

Identifying the comparative advantage of products and industries of South Africa's Mpumalanga province

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ABSTRACT

Knowledge of a region's comparative advantage may dictate its industrial development agenda and realistic export opportunities. Through the effective targeting of specific sectors and industries within the South African provinces, provincial government entities can determine which sector or industry could gain the most from effective targeting for industrial development, development planning and export promotion. This study determined the comparative advantage of South Africa's Mpumalanga province by estimating the Revealed Comparative Advantage Index (RCA). The study revealed that the products with the highest comparative advantage (RCA) and realistic export opportunities (REO) are manganese products, salted meat (beef), frozen fish, chewing gum, tomatoes, soups and broths. In addition, the results of the RCA analysis were matched to the export opportunities identified by the decision support model (TRADE-DSM) to determine which of the comparative advantage products have realistic export opportunities. Eight of the top 15 comparative advantage products were found to have realistic export opportunities according to the TRADE-DSM.

Key words: competitiveness, Decision Support Model (DSM), export, Revealed Comparative Advantage (RCA), Mpumalanga province, trade, South Africa

This study determines the comparative advantage of products for South Africa's Mpumalanga province. A scientific means of identifying potential products and sectors is important for enhancing the industrial sector as part of the developing plan of the country, as well as subsidising exports to the rest of the world (Cuyvers & Viviers 2012). In recent times, economic development efforts have become more

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focused on regional economic development policies. Regional development policies aim to improve regional production systems; enhance firm, regional and national competitiveness; and achieve growth and development (NGA 2002; Shields, Barkley & Emery 2010).

The effectiveness of regional development policies is dependent on the identification of a region's comparative advantage (Shields et al. 2010). A region's growth and development efforts are likely to succeed if the strategies are targeted in sectors with regional comparative advantage (Shields et al. 2010). Comparative advantage can be based on the characteristics of the labour force, local endowments, quality and availability of private and public infrastructure, and proximity to input and product markets (Rosenfeld 1992).

The identification of a region's comparative advantage is important and ensures the design of effective industrial development and promotion programmes (Fertő & Hubbard 2002). Comparative advantage analysis reveals the structure of production, highlighting the sectors, sub-sectors, products or services and locality in which the province has a more comparative production function relative to other sectors (Meintjes 2001). This is an essential step in developing effective strategies to boost a region's competitiveness.

In addition to specialising in sectors where a region's comparative advantage lies, firms can maintain their competitiveness through internationalisation. Awuah (2009) found that firms in less developed countries can cope with the challenges of globalisation and take advantage of the opportunities it presents by adopting a strategy of internationalisation. The micro- and macro-economic benefits of internationalisation are well documented in the literature. Internationalisation ensures that firms are able to serve many markets from existing manufacturing bases without having to establish production plants in other markets (Czinkota & Ronkainen 2003; Doole & Lowe 2004). Van Laere and Heene (2003) suggest that firms, particularly small and medium-sized firms, can survive and remain competitive in the global business environment of increasing global integration and competition by enhancing three firm capabilities, namely innovation, learning and internationalisation.

The continuously changing international environment necessitates governments to provide effective industrial development and export promotion to ensure international competitiveness (Cuyvers & Viviers 2012). Ideally, development efforts should be holistic, implying that no product, industry or region is excluded. In reality, however, governments have limited resources that must be used efficiently in order to achieve results. One of the main challenges for all governments is to identify and justify which products, sectors, industries or regions to promote.

Against this background, this study aimed to reveal the underlying comparative advantage of South Africa's Mpumalanga province from observable trade patterns. Kathuria (2013) concludes that an economy will become most efficient and its welfare highest when production and the trade of goods and services are consistent with its comparative advantage.

In order to determine Mpumalanga's comparative advantage products, this study estimated the Revealed Comparative Advantage (RCA) scores using HS 6-digit product-level data at postal code level. The Harmonised Commodity Description and Coding System (HS System [HS]) classification is an international numerical product nomenclature that was developed by the World Customs Organisation (WCO), which organises products in a logical and legal structure for the collection of customs duty and international trade statistics (WCO 2008).

By calculating and examining the RCA scores for Mpumalanga at local (postal code) level, this study provides some direction for the cultivation of new industries to drive the provincial economic development. This study also compared the province's RCA products with the province's current export products to determine whether the province is exporting products in which it has a comparative advantage. The study utilised the TRADE-Decision Support Model (TRADE-DSM). TRADE is an acronym for the Trade and Development research entity in the Faculty of Economic and Management Sciences at the North-West University (Potchefstroom campus) in South Africa. The TRADE-DSM is a scientific tool enabling decision-makers to identify smaller sub-sets of products with realistic export opportunities (REOs) that can be promoted and can achieve export success. The TRADE-DSM identifies products and services in which the country has a comparative advantage and for which realistic opportunities exist in the rest of the world. It prioritises the specific products, services and countries where specific opportunities exist. The study ultimately compares the products with the highest comparative advantage to the results of the TRADE-DSM to determine whether any of these products have realistic export opportunities (REO) according to the TRADE-DSM. The rest of this study is organised as follows: the next section provides the literature background, which gives insight into the theory of revealed comparative advantage, the determinants of exports and the role of government in export promotion. An economic overview of Mpumalanga province is then provided, followed by a discussion of the research methods used in this study. The results are then discussed, followed by the conclusion.

Literature review and theoretical basis

Factors influencing the decision for firms to export

Various factors or determinants act as stimuli for firms to export. Over time, these determinants have been analysed in various theories. Firms enter export markets in pursuit of business opportunities (Jeannet & Hennessey 1998: 239). These opportunities may include existing customers that move to foreign markets (unsolicited orders), the need to expand market share beyond the domestic market, the potential to enhance profit by increasing market share, higher growth rates in foreign markets, and the opportunity to exploit dissimilar stages in the product lifecycle in different markets (Leonidou et al. 2007: 736; Jeannet & Hennessey 1998: 239). The specific properties of products, such as how long the product has been in the domestic markets, and unique characteristics of the product enable a firm to seek new markets abroad and are also important factors influencing exports (Cavusgil & Zou 1994: 5).

Neoclassical trade theories point out factors such as factor input endowment and technology, which determine the supply capacity of a country, as significant determinants of trade (Carbaugh 1985: 47; Samuelson & Nordhaus 1998). The Heckscher-Ohlin (H-O) theory of factor endowments is regarded as the traditional core trade theory (Greenaway & Kneller 2004: 101). Empirical evidence from Indonesia supports the assumptions of the H-O theory. The Indonesian study found that firms' exports consisted mainly of goods and services requiring little skilled labour, given the abundance of unskilled labour in Indonesia (Ramstetter 1999: 60).

The modern trade theories of the 1980s predominantly focused on loosening some of the assumptions of the neoclassical theories, such as the H-O theory of factor endowments. Newer theories incorporate the existence of imperfect competition and economies of scale as determinants of trade (Dosi, Pavitt & Soete 1990). Strides in modern trade theories offer realistic hypotheses that incorporate monopolistic and oligopolistic competition. Modern trade theories also incorporate individual firms so that the decision to export is determined at a micro-economic level. The neoclassical trade theories assume the existence of identical firms. Bernard, Redding and Schott (2007: 4) relaxed this assumption and analysed firm heterogeneity, as well as its effect on a firm's decision to export. In terms of firm heterogeneity, firms produce differentiated products in the same industry, unlike in the H-O theorem (Bernard, Eaton & Kortum 2003; Bernard et al. 2007: 32). Although modern trade theories relax some of the assumptions of the neoclassical trade theories, they maintain some of the underlying assumptions of the latter theories. The firm heterogeneity theory assumes that countries possess a comparative advantage based on factor endowments (as in the H-O theory) and that industries utilise different factor proportions and intensities (Bernard et al. 2007: 32).

Firms are heterogeneous in factors such as the level of productivity, the number of workers employed and the level of wages and capital intensity (Bernard & Jensen 2001; Melitz 2003: 1696; Bernard et al. 2007: 32). The firm heterogeneity theorem hypothesises that the most productive firms in each industry have larger market shares and earn higher profits. As a result, these firms will 'self-select' into exporting with exposure to trade. The most productive firms have characteristics that enable them to successfully enter or self-select into foreign markets with exposure to trade. These characteristics include higher levels of productivity, higher capital intensity, and more productive workers (Kleynhans & Swart 2012: 3700). The most productive firms are therefore able to cover the entry costs associated with exporting, such as product adaptation and information collection (Trofimenko 2007: 2). The least productive firms, however, will lose both market share and profit and will consequently be forced out of business when exposed to trade (Melitz 2003: 1696). The firm heterogeneity theorem and the self-selection hypothesis are important stylised facts of firm-level determinants of exports and have been found to be dominant phenomena in several countries, such the United States of America, Germany, Columbia and Mexico (Edwards, Rankin & Schoer 2008: 30).

The role of government in export promotion

The quantity and direction of trade flows can also be influenced by the implementation of commercial and trade policies that promote trade by either domestic or foreign governments. Such policies include export assistance programmes, the reduction of tariffs and trade liberalisation (Tybout 2001: 13; Leonidou et al. 2007: 748; DTI 2014: 5). Governments may seek to enhance exports in a bid to meet other economic goals, such as enhancing economic activity, increasing domestic employment and generating foreign currency (Leonidou et al. 2007: 747). General equilibrium models suggest that trade liberalisation brings about scale efficiencies ranging between 1% and 5% of gross domestic product (Tybout & Westbrook 1995). This means that when trade is liberalised, firms will be able to produce larger volumes of output at a lower cost. These policies reduce exporters' risks and associated trade costs, and enhance potential export profits. Consequently, commercial and trade policies are seen as a strong stimulant of exporting activities (Simpson & Kujawa 1974; Kaynak, Ghauri & Olofsson-Bredenlow 1987).

Governments provide export promotion because of the possible benefits that the country will enjoy from firms' exports. Some of the major reasons and possible benefits of export assistance include an increase in domestic economic activity, industrial development, encouragement of employment, collection of additional

tax revenues and increased foreign currency generation (Cavusgil & Yeoh 1994). Exports enhance the accumulation of technology, the development of technological capabilities and capacity building for a country (Bell & Pavitt 1993). These aspects, once acquired, yield product and process improvement, all of which yield production efficiency (Romijn 1995: 359).

Expanding exports lead to higher economic growth, as they generate higher levels of production and services. More labour is required to facilitate these higher levels of economic activity, thus leading to the creation of jobs. This in turn leads to more people receiving wages, earning an income and becoming self-reliant, which alleviates poverty and raises the standard of living. This implies that the trade advantages caused by the improvement of a region's competitive position have a considerable socio-economic impact, justifying the promotion of exports by governments.

The South African government, through the Department of Trade and Industry (DTI), has taken steps to achieve international competitiveness through export success. The DTI incorporates the results of scientific models into the national export strategy to prioritise export sectors (DTI 2014). These models include the gravity model and the TRADE-DSM. This stance by the DTI is an effort to increase the probability of success for exporting firms, maximise the efficiency of government's export-promotion programmes and enhance South Africa's international trade position. The gravity model is renowned and widely applied in the international trade literature. It has been applied in several research papers and published articles covering all areas of trade. The gravity model estimates the trade impacts of various trade-related policies, from traditional tariffs to new 'behind-the-border' measures. In particular, the gravity model is typically applied to provide information on the determinants of trade, help explain trade patterns and inform policy-impact analysis on these topics. The TRADE-DSM is an international selection method that identifies and prioritises specific target export markets and products. Steenkamp (2011) and Cuyvers and Viviers (2012) provide a detailed overview and comparison of the TRADE-DSM with the gravity model as well as other international market selection methods such as the Trade Opportunity Matrix (TOM) of Canada, the multiple criteria method and the shift share model, among others.

The TRADE-DSM is a tool that decision-makers can use to identify smaller subsets of products with realistic export opportunities (REOs) that can be promoted and can achieve export success. The DSM was first developed and applied to identify export opportunities for Belgium and Thailand. The South African TRADE-DSM was adapted from the Belgian and Thai DSMs (Cuyvers, De Pelsmacker, Rayp & Roozen 1995; Cuyvers 2004) to suit the characteristics and data for South Africa (Cuyvers & Viviers 2012; Steenkamp 2011). The TRADE-DSM can be computed

annually if the data are available. The South African TRADE-DSM has been applied to 2007, 2010 and 2014 data. This study uses the 2010 TRADE-DSM results in order to correspond with the 2010 SARS export data used to calculate the RCA scores for Mpumalanga. The TRADE-DSM involves a sequential filtering process with four filters that identify products and markets with the most REOs for export success (Jacobs, Viviers & Steenkamp 2014). The TRADE-DSM can therefore be used to justify the allocation of public resources to promote products with the highest export potential (Cuyvers & Viviers 2012).

An economic overview of Mpumalanga province

Mpumalanga province is located in the north-eastern part of South Africa, bordering Mozambique, Zimbabwe, Swaziland and northern KwaZulu-Natal. The provincial capital of Mpumalanga is Mbombela. The province covers a total area of 76 495km² (accounting for 6.3% of South Africa’s land area), making it the eighth largest province (Stats SA 2013). Table 1 shows the total (all industries) gross value added (GVA) for nine provinces in South Africa in 2013. Mpumalanga contributes 7% of national output in South Africa. In terms of contributions to national output, Mpumalanga is not very competitive; it ranks as the sixth largest contributor to national output (GVA).

Table 1: Provincial contributions to South African GVA in 2013

Province	Gross value added (current prices; R million)	Share of total GVA (%)	Ranking in national GVA
Western Cape	431 295.5577	14.2	3
Eastern Cape	228 662.108	7.5	4
Northern Cape	68 655.94653	2.3	9
Free State	160 744.8706	5.3	8
KwaZulu-Natal	480 381.7959	15.9	2
North West	196 830.0668	6.5	7
Gauteng	1 035 237.984	34.2	1
Mpumalanga	213 242.7748	7.0	6
Limpopo	215 211.9959	7.1	5
Total: South Africa	3 030 263.1	100	

Source: Quantec Easy Data (2014)

Table 2 shows South Africa’s exports by province in 2013. Gauteng is the country’s trade centre, as 67% of South African exports of all products originate from Gauteng. The Free State province contributed the smallest share of exports of all products. Mpumalanga contributed 1.8% of national exports in 2013 and ranked as the seventh largest exporter relative to other provinces.

Table 2: South Africa's exports by province in 2013

Province	Export value of all commodities in 2013 (R million)	Share of total national exports (%)	Ranking in national exports
Western Cape	74 873.93	9.5	3
Eastern Cape	33 222.35	4.2	4
Northern Cape	1 698.74	0.2	9
Free State	4 616.41	0.6	8
KwaZulu-Natal	91 999.81	11.7	2
North West	20 832.56	2.6	5
Gauteng	531 112.36	67.4	1
Mpumalanga	11 966.22	1.5	7
Limpopo	18 062.65	2.3	6
Total: South Africa	788 385.05	100.0	

Source: Quantec Easy Data (2014)

Tables 1 and 2 show that Mpumalanga is not competitive in terms of output and exports relative to other provinces in South Africa.

Research method

Data

The provincial export data used in this study are supplied by the South African Revenue Service (SARS) at HS 6 digit level and categorised according to the postal codes for Mpumalanga. The full sample of data of Mpumalanga exports used in this study covers 2 671 products at HS 6 digit level. The postal codes are given by the location of the district post office in each district municipality (Lombaard 2005). The SARS data used in this study assign export values according to the origin of the exports. Each area is assigned a four-digit code, ranging between 0001 and 9999. The ranges are divided into post box and street codes, and these codes correspond

with place names, sorting centres and provinces. A disadvantage of the data is that the South African provincial boundaries and post office distribution areas do not always match perfectly (Lombaard 2005: 1). Another disadvantage is that the data are available for only one year (i.e. 2010). The disadvantage of using data for a single year is that the comparative advantage determined for the province may not be the underlying comparative advantage of the province based on factor endowment. This is because data for a single year may be subject to fluctuations in the trade data caused by a number of factors, such as the impact of government policies or currency volatility.

Despite these data limitations, this study makes an important contribution by revealing the province's comparative advantage at postal code level. It is important to calculate the RCA scores using postal code data, because the headquarters of some firms are not in the province in which production plants are located. As a result, the origins of those firms' exports are incorrectly recorded as the headquarters' locations. This would then under-state the exports of the regions where production takes place, and over-state those in which the headquarters are located, providing an inaccurate indication of the locality of comparative advantage in the region. The estimates of this study provide important insights into the comparative advantage of Mpumalanga taking into account the origins of the exports under analysis.

Revealed Comparative Advantage index (RCA)

The concept of comparative advantage stems from Ricardo's factor proportions and Heckscher-Ohlin (H-O) theories. According to these theories, the differences in opportunity cost of a particular good result in countries having comparative advantages in the production of specific goods (Thornhill 1988; Kathuria 2013). The H-O model states that, in autarky, in a two-commodities, two-production factors and two-countries model, a country will export the commodity that uses most intensively the inputs with which it is relatively well endowed, and will import the commodity that uses inputs most intensively in its production process, with which it is relatively poorly endowed (Thornhill 1988).

This comparative advantage is related to autarkic prices, which are not observable in the real world. Balassa (1965) proposed an index known as the revealed comparative advantage index (RCA), which infers comparative advantage using past trade prices (Vixathep 2013). The RCA score reveals the relative export performance of a country in a particular commodity trade. This assumption implies that trade patterns reveal relative costs and differences in non-price factors and the comparative advantage of countries (Vixathep 2013).

The RCA reveals the underlying comparative advantage from observable trade patterns (Vavryshchuk 2007). It evaluates comparative advantage on the basis of a country's specialisation in exports relative to the rest of the world. It can be calculated periodically, for example quarterly or annually, to establish trends in competitiveness in different sectors or commodities. The RCA, originally known as the Balassa index, can be determined using the equation:

$$B = \left(\frac{X_{ij}}{X_{it}} \right) / \left(\frac{X_{nj}}{X_{nt}} \right) \quad (\text{eq. 1})$$

where 'B' represents trade patterns, indicating comparative advantage, 'x' represents exports, 'i' a country, 'j' commodity, 't' the set of commodities, and 'n' the set of countries.

An RCA larger than 1 implies that a country has a comparative advantage in that product or industry. When the RCA is less than 1, the country has a comparative disadvantage. An RCA equal to 1 represents comparative neutrality. RCA typically uses data on factor costs per sector; however, export data may be used instead to reveal the comparative advantage of a country or region (Balassa 1965). This is because the pattern of commodity exports reflects the relative costs and the non-price factor differences of the structure of exports (Akhtar et al. 2013).

Numerous empirical studies have calculated an RCA index to identify a country or a region's most competitive sectors (Bojnec 2001; Havrila & Gunawardana 2003; Yue 2001; Edwards & Schoer 2002; Widgrén 2005; Batra & Khan 2005; Kilduff & Chi 2006; Gao 2007; Török 2008; Yu, Cai, & Leung 2009; Kathuria 2013). The advantages and disadvantages of this index are still widely debated, however (Serin & Civan 2008). Batra and Khan (2005: 5–6) pointed out that an advantage of this method is that the factor endowments and productivity of an economy are consistent with the intrinsic advantage of specific exportable products. The disadvantage of this index, however, is that it is complicated to determine when endowments change. To apply suitable trade policies to a country is then unclear (Batra & Khan 2005: 5–6). Another shortcoming of the RCA is that relying only on the absolute terms of the RCA index might lead to the misinterpretation of a country's comparative advantage. A single commodity group cannot significantly increase its existing export share if it already enjoys a large proportion of the country's exports. Moreover, when a country's range of exports becomes more diversified, it becomes increasingly difficult for a commodity group to increase its market share (Lee 1995). Despite these shortcomings, the RCA is an important indicator of comparative advantage.

According to Utkulu and Seymen (2004: 8), the concept of RCA refers to the relative trade performances of individual regions or countries in particular commodities. On

the assumption that the commodity pattern of trade reflects a country's differences in relative costs, as well as in non-price factors, it is assumed to reveal the comparative advantage of trading countries (Balassa 1977: 327). The RCA definition has been modified to such an extent that multiple measures of the RCA now exist (Utkulu & Seymen 2004: 8).

In the current study, the RCA index is calculated using equation 1, and is converted to measure the exports of Mpumalanga province relative to South Africa, as illustrated in equation 2:

$$RCA = \left(\frac{X_{MPj}}{X_{SAj}} \right) / \left(\frac{X_{MPtot}}{X_{SAtot}} \right) \quad (\text{eq. 2})$$

where 'RCA' represents the Revealed Comparative Advantage,

X_{MPj} represents Mpumalanga's exports of product j ,

X_{MPtot} represents Mpumalanga's total exports of all products,

X_{SAj} represents South Africa's exports of product j and

X_{SAtot} represents South Africa's total exports of all products.

The RCA index measures a region's exports of a commodity relative to its total exports and to the corresponding export performance of the country; if the RCA score is greater than 1, then a comparative advantage is revealed. Therefore, an RCA score greater than 1 will indicate that Mpumalanga is relatively specialised in a specific product. This then implies that Mpumalanga will have a revealed comparative advantage in that specific product (Batra & Khan 2005: 5). In contrast, Mpumalanga will have a comparative disadvantage when the RCA is smaller than 1 (Faustino 2008: 7). The results were then matched to the Decision Support Model.

Decision Support Model (TRADE-DSM)

The TRADE-DSM is a computerised information-based model that can be used as an export market-selection tool. It makes use of a sophisticated filtering process to sift through an extensive range of product-, service- and country-related data to reveal those product-service-country combinations that offer the most realistic and sustainable export opportunities (Viviers et al. 2014: 1). It provides exporters with information on foreign business opportunities that will lead to realistic export success for their products and will increase a firm's export profitability and export volumes (Pearson 2007: 37–38). The TRADE-DSM has been identified as a superior method of identifying export opportunities for a country relative to other methods. This is

because the TRADE-DSM provides a national export-promotion agency, that has limited financial and human resources, with a list of realistic export opportunities (products and markets) on which they can focus their export-promotion activities while at the same time maintaining their ability to answer additional ad hoc practical questions as they arise from their clients – without the need to conduct complex and time-consuming analysis themselves. For a detailed comparison of the TRADE-DSM with other international market-selection methods, see Steenkamp (2011) and Cuyvers and Viviers (2012).

The TRADE-DSM model consists of a sequential screening process with four major consecutive filters that are appropriate for the simultaneous identification of market opportunities. Filter 1 of the model analyses the commercial and political risk of doing business with various countries, as well as the general macro-economic indicators of all countries in the world in order to determine general potential (Cuyvers, Steenkamp & Viviers 2012: 347). Filter 2 assesses the market potential of the various product groups for the remaining countries, considering the growth rates of imports (growth rate of imports of a given product group by a given country) and import market size (the value of imports of a given product group by a given country) (Cuyvers 2004: 3). Product–market combinations were rejected for further screening if they exceeded a certain threshold value. Filter 3 analyses the accessibility of each market by assessing all kinds of barriers to entry that show a likelihood of dominant bilateral trade patterns that are difficult to enter – measured by the Herfindahl-Hirschman index. After the completion of Filter 3, a list of probable export opportunities is obtained, showing product–market combinations with enough potential to be exploited profitably. Filter 4 categorises export product–market combinations based on the country’s relative market size and medium- to long-term growth prospects (Jacobs et al. 2014: 23).

The TRADE-DSM therefore identifies products and services in which the country has a comparative advantage and for which realistic opportunities exist in the rest of the world. It prioritises the specific products, services and countries where specific opportunities exist. The current study focused only on exports from Mpumalanga; the next section reports on an empirical investigation and the RCA results found, which may effectively enhance the international trade and competitiveness of Mpumalanga. Finally, these results are matched to the findings of the TRADE-DSM.

Empirical results

Mpumalanga’s revealed comparative advantage

The estimates of this study provide important insights into the comparative advantage of Mpumalanga province taking into account the origins of the exports

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under analysis. Table 3 shows the classification of Mpumalanga's exports at the HS 6-digit level on the basis of comparative advantage. These results highlight the comparative advantage position of Mpumalanga and the products in which the province has a comparative advantage. The highest comparative advantage product for Mpumalanga is in the mineral-processing sector, in the product HS 811100: Articles of manganese and scrap metal manganese. Mpumalanga's comparative advantage is also pronounced in the following products: bovine meat, salted, dried or smoked (HS 021020); and tomatoes, fresh or chilled (HS 070200). High levels of specialisation are also observable in the following products: citrus fruits, otherwise prepared or preserved (HS 200830); and mackerel and other fish, frozen, whole (HS 030374). It is important to note that five of the top six comparative advantage products for Mpumalanga are in the food-processing sector.

Table 3: Products for which Mpumalanga holds comparative advantage on the basis of RCA index scores

HS 6 code	Tariff heading and description	RCA score
811100	Manganese, articles thereof, waste or scrap	72.31
021020	Bovine meat, salted, dried or smoked	61.10
070200	Tomatoes, fresh or chilled	60.20
200830	Citrus fruits, otherwise prepared or preserved	53.50
030374	Mackerel and other fish, frozen, whole	53.43
440710	Lumber, coniferous (softwood) thick s < 6 mm	37.55
170410	Chewing gum containing sugar, except medicinal	36.00
210410	Soups and broths and preparations thereof	35.05
282090	Manganese oxides other than manganese dioxide	28.60
330690	Oral and dental hygiene preparations, except dentifrice	25.76
391731	Plastic tube, pipe or hose, flexible, mbp > 27.6 MPa	25.15
700800	Multiple-walled insulating units of glass	25.06
230400	Soybean, oil-cake and other solid residues	24.60
440310	Poles, treated or painted with preservatives	24.31
720837	Flat rolled prod/coils < 4.75	24.14

Source: Author's own calculations

The analysis of the data shows that Mpumalanga also specialises in lumber, coniferous (softwood) thick s < 6 mm (HS 440710); chewing gum containing

sugar, except medicinal (HS 170410); and soups and broths and preparations thereof (HS 210410). Table 3 illustrates the top 15 comparative advantage products for the province. It is noteworthy that these top products have RCA scores greater than 20. Mpumalanga has comparative advantage in these particular products because its exports of these commodities are greater than the province's total exports of all products and the corresponding export performance of South Africa in these commodities.

Comparison of Mpumalanga's exports and its products with comparative advantage

Table 4 shows Mpumalanga's top 20 export products in 2013. These top 20 export products accounted for 76.92% of Mpumalanga's R11.96 billion exports in 2013. This indicates that these products are significant contributors to the province's total exports, as they account for more than 75% of the total export value. The leading export product was bituminous coal, not agglomerated (HS 270112), which accounted for 24.72% of Mpumalanga's exports. Other leading export products and the respective shares of Mpumalanga's total exports were manganese, articles thereof, waste or scrap (HS 811100) (10.86%); refined sugar, in solid form, nes, pure sucrose (HS 170199) (8.19%); ferro-vanadium (HS: 720292) (5.95 %); macadamia nut, in shell (HS: 080261) (4.48%); and wood in chips, non-coniferous (HS: 440122) (4.11%). A significant amount of Mpumalanga's top 20 export products shown in Table 4 accounted for less than 1% of the province's total exports. This indicates that the province's exports are concentrated in a few products.

Table 5 shows Mpumalanga's top export products based on export value in 2013 as well as its comparative advantage products as determined in this study. From the table, it is evident that the top 20 export products, regardless of the RCAs, are not necessarily the products in which the province's comparative advantage lies. Only one product from the comparative advantage products – i.e. manganese, articles thereof, waste or scrap (HS 811100) – is currently exported in Mpumalanga. This indicates that the products with the largest export values are not those in which the province has the highest comparative advantage. This is an indication of under-utilisation of the province's comparative advantage, and an indication of latent production and export opportunities for producers from Mpumalanga.

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Table 4: Top 20 export products for Mpumalanga based on export value

HS 6 code and description	Mpumalanga export value in 2013 (R million)	Share of Mpumalanga's exports (%)
H0: Total: All commodities	11 966.22	
270112: Bituminous coal, not agglomerated	2 958.07	24.72
811100: Manganese, articles thereof, waste or scrap	1 299.23	10.86
170199: Refined sugar, in solid form, nes, pure sucrose	979.93	8.19
720292: Ferro-vanadium	712.13	5.95
080261: Macadamia nut: In shell	535.71	4.48
440122: Wood in chips, non-coniferous	492.36	4.11
282010: Manganese dioxide	391.31	3.27
080262: Macadamia nuts: Shelled	375.58	3.14
282530: Vanadium oxides and hydroxides	259.66	2.17
080510: Oranges, fresh or dried	196.15	1.64
080540: Grapefruit, fresh or dried	127.27	1.06
721632: Sections, I, i/nas, nfw hot-roll/drawn/extruded > 80mm	121.76	1.02
270820: Pitch coke	116.12	0.97
720230: Ferro-silico-manganese	103.57	0.87
080440: Avocados, fresh or dried	100.11	0.84
284920: Silicon carbide	94.41	0.79
720851: Flat rld prod n/coils<10	92.41	0.77
020714: Fowls, cuts & offal, frozen	87.40	0.73
110313: Maize (corn) groats or meal	82.60	0.69
270400: Coke, semi-coke of coal, lignite, peat & retort carbon	78.88	0.66

Source: Quantec Easy Data (2014)

Table 5: Comparison of Mpumalanga's top export products and comparative advantage products

Mpumalanga's export products in 2013	Mpumalanga's comparative advantage products
270112: Bituminous coal, not agglomerated	811100: Manganese, articles thereof, waste or scrap
811100: Manganese, articles thereof, waste or scrap	021020: Bovine meat, salted, dried or smoked
170199: Refined sugar, in solid form, nes, pure sucrose	070200: Tomatoes, fresh or chilled
720292: Ferro-vanadium	200830: Citrus fruits, otherwise prepared or preserved
080261: Macadamia nut: In shell	030374: Mackerel, frozen, whole
440122: Wood in chips, non-coniferous	440710: Lumber, coniferous (softwood) thick s < 6 mm
282010: Manganese dioxide	170410: Chewing gum containing sugar, except medicinal
080262: Macadamia nuts: Shelled	210410: Soups and broths and preparations thereof
282530: Vanadium oxides and hydroxides	282090: Manganese oxides other than manganese dioxide
080510: Oranges, fresh or dried	330690: Oral & dental hygiene preparations, except dentifrice
080540: Grapefruit, fresh or dried	391731: Plastic tube, pipe or hose, flexible, mbp > 27.6 MPa
721632: Sections, l, i/nas, nfw hot-roll/drawn/extruded > 80mm	700800: Multiple-walled insulating units of glass
270820: Pitch coke	230400: Soybean, oil-cake and other solid residues
720230: Ferro-silico-manganese	440310: Poles, treated or painted with preservatives
080440: Avocados, fresh or dried	720837: Flat rolled prod/coils<4.75

Source: Authors' own estimates from Quantec Easy Data (2014) and TRADE-DSM results

Realistic export opportunities for products with comparative advantage

Table 6 shows the comparison of the TRADE-DSM results and Mpumalanga's comparative advantage products. The table shows the top three markets of comparative advantage products that have REOs according to the TRADE-DSM. Eight of the 15 comparative advantage products have REOs according to the TRADE-DSM. Manganese, articles thereof, waste or scrap (HS 811100) has REOs

to Austria, France and Canada with regard to potential export value. The potential export values for each REO provide an indication of the potential market size of the export opportunities relative to one another. These REOs, however, do not rank high relative to all other REOs for South Africa. This indicates that this product has a small potential market size compared to other products that were identified as having REOs by the TRADE-DSM. Processed mackerel and other fish, frozen, whole (HS 030374) has export potential to the following markets and respective potential market values: China \$26.9 million, Thailand \$18.5 million and Ghana \$15.6 million. The following comparative advantage products did not match REOs according to the TRADE-DSM:

- Bovine meat, salted, dried or smoked: HS 021020;
- Tomatoes, fresh or chilled: HS 070200;
- Citrus fruits, otherwise prepared or preserved: HS 200830;
- Lumber, coniferous (softwood) thick $s < 6$ mm: HS 440710;
- Multiple-walled insulating units of glass: HS 700800;
- Soybean, oil-cake and other solid residues: HS 230400; and
- Flat rolled prod/coils < 4.75 : HS 720837.

Discussion and conclusion

This study investigated the comparative advantage of products and sectors of South Africa's Mpumalanga province. Revealed Comparative Advantage indices (RCA) were calculated using provincial HS 6-digit level export data at the postal code level. The results revealed that the province's comparative advantage lies in the production of articles of manganese and scrap metal manganese; bovine meat, salted, dried or smoked; and tomatoes, fresh or chilled. High levels of specialisation are also observable in the following products: citrus fruits, otherwise prepared or preserved; and processed mackerel and other fish, frozen, whole; lumber, coniferous (softwood < 6 mm); chewing gum containing sugar, except medicinal; and soups and broths and preparations thereof.

This study then compared the province's comparative advantage sectors to its current exports. Only one comparative advantage product – i.e. articles of manganese and scrap metal manganese – is currently being exported by the province. This indicates that the products with the largest export values are not those in which the province has the highest comparative advantage. This is an indication of the under-utilisation of the province's comparative advantage and an indication of latent production and export opportunities. Mpumalanga's top export products did not

Table 6: Highest potential markets according to the 2010 results of the TRADE-DSM per comparative advantage product for Mpumalanga

HS 6 code and description	Countries	Potential export value (US\$'000)	Product ranking according to potential export values (US\$'000)
811100: Manganese, articles thereof, waste or scrap	Austria	29 642	1 279
	France	10 887	2 927
	Canada	9 941	3 122
021020: Bovine meat, salted, dried or smoked	N/A		
070200: Tomatoes, fresh or chilled	N/A		
200830: Citrus fruits, otherwise prepared or preserved	N/A		
030374: Mackerel, frozen, whole	China	26 934	1 401
	Thailand	18 507	1 933
	Ghana	15 636	2 224
440710: Lumber, coniferous (softwood) thick s < 6 mm	N/A		
170410: Chewing gum containing sugar, except medicinal	United Kingdom	6 316	4 219
	Slovakia	2 956	6 472
	United Arab Emirates	2 434	7 131
210410: Soups and broths and preparations thereof	United States	44 111	893
	Germany	39 369	985
	Japan	13 787	2 475
282090: Manganese oxides other than manganese dioxide	Belgium	2 405	7 162
	Japan	2 003	7 763
	United Kingdom	1 448	8 794
330690: Oral & dental hygiene preparations, except dentifrice	United States	27 537	1 368
	Japan	18 034	1 975
	Germany	15 610	2 226
391731: Plastic tube, pipe or hose, flexible, mbp > 27.6 MPa	United States	10 557	3 006
	China	10 018	3 102
	Hong Kong	9 098	3 325
700800: Multiple-walled insulating units of glass	N/A		
230400: Soybean, oil-cake and other solid residues	N/A		
440310: Poles, treated or painted with preservatives	Oman	3 974	5 525
	Qatar	2 457	7 096
	Vietnam	1 781	8 119
720837: Flat rolled prod/coils < 4.75	N/A		

Source: Authors' own estimates from Quantec Easy Data (2014) and TRADE-DSM results

match the products according to their RCAs. Siggel (2007) concluded that a sector may have potential comparative advantage that is not presently realised as a result of either skills shortages or infrastructure deficiencies making the sector non-competitive. A lack of information and knowledge may also be a factor. From the foregoing scenario, provincial-level industrial policies should be implemented to remove such obstacles for the comparative advantage sector. Efforts should be put in place to enhance the activities that have been identified as comparative advantage sectors.

Finally, this study investigated whether any of the comparative advantage products have Realistic Export Opportunities (REOs) according to the Decision Support Model (TRADE-DSM). The following products were found to have REOs according to the TRADE-DSM:

- Manganese, articles thereof, waste or scrap: HS 811100;
- Mackerel and other fish, frozen, whole: HS 030374;
- Chewing gum containing sugar, except medicinal: HS 170410;
- Soups and broths and preparations thereof: HS 210410;
- Manganese oxides other than manganese dioxide: HS 282090;
- Oral & dental hygiene preparations, except dentifrice: HS 330690;
- Plastic tube, pipe or hose, flexible, mbp > 27.6 MPa: HS 391731;
- Multiple-walled insulating units of glass: HS 700800; and
- Poles, treated or painted with preservatives: HS 440310.

The results of this study confirm the findings of other researchers in the existing literature. Yeats (1990) pointed out that the products in which developing countries' RCAs are highly concentrated are labour intensive, and this provides verification of the factor proportions theory. The RCAs of Mpumalanga province and South Africa are highly labour intensive, with particular socio-economic advantages. In addition, Edwards and Schoer (2002) found that South Africa's comparative advantage lies in natural resource-based products. This is true of Mpumalanga, as some of its comparative advantage products are natural resource-based products.

Several studies have investigated changes in comparative advantage over time. The rationale is that long-term patterns of specialisation broadly reflect expectations of the factor proportions theory and industry evolution models. It is therefore recommended that this study be repeated in further research with time series data so as to test the changes in comparative advantage for Mpumalanga over time. Mpumalanga needs to build a solid base for industrialisation, including physical and institutional infrastructure to support the development of the comparative advantage sectors. If guided by the appropriate development and promotion strategies, these products could become the most important exports of Mpumalanga.

Furthermore, it is recommended that future studies should extend this analysis to other provinces in South Africa. In addition, future studies should explore the socio-economic impact of such a trade advantage for Mpumalanga province and for South Africa. Such a study could provide valuable insights into the number of companies that export the comparative advantage products and the implications for job creation and ultimately skills transfer and the improvement of the quality of life of people who live within the province.

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