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THE EFFECT OF INTERNATIONALISATION ON THE BEEF AND MAIZE SUB-SECTORS: THE RELEVANCE OF REVEALED COMPARATIVE ADVANTAGE MEASURES

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Abstract

According to the RCA and RCA# the beef sub-sector in South Africa has shown a revealed comparative disadvantage for 17 out of the 22 years to 2002, while the maize sub-sector showed a revealed comparative advantage for 18 out of the same 22 years. However, this article argues that these results do not show the real state of competitiveness that exists in these sub-sectors, mainly because RCA measures should not be used to make definitive conclusions whether an industry, sector or sub-sector is competitive, nor whether it uses scarce resources efficiently. RCA measures explain in more accurate ways, relative to a simple analysis of export trends, how a country features in the context of world trade. Hence, one possible application of RCA measures is to deduce the impact of changes in trade policies on an industry, sector or sub-sector. Cognisance should also be taken that the RCA measures fail to distinguish between a region's factor endowments. Finally, it appears as if both the beef and maize sub-sectors have adjusted favourably since the implementation of the Marrakech agreement and subsequent deregulation of the domestic market. Favourably in this context means that both sub-sectors appear to have discounted the changing trade and regulatory environments into their respective supply chains. The question of how competitive these sub-sectors are relative to their international counterparts however remains unanswered, and will require a more in-depth analysis of the complete chains for these sub-sectors.

1. INTRODUCTION

There is much confusion between the use of the terms comparative advantage and competitiveness in economics. The concepts are related, but are often mistakenly exchanged for one another. Comparative advantage and competitiveness would be the same in a world of perfect competition, in which there are homogeneous products, perfect information and an absence of market failure (Cordon, 1974).

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From a trade point of view Worley (1996) provides more clarity. He states that comparative advantage elucidates how trade benefits nations through more efficient use of their resource base when trade is totally unrestricted, while competitive advantage explains trading patterns as they exist in the real world, including all the barriers to free trade ignored by comparative advantage.

Understanding the aforementioned is vitally important when one endeavours to use the various different measures that are available to quantify policy options and trade. With this in mind this paper is divided into several sections. Firstly, it provides a brief overview of the basic theoretical concept underlying of trade theory. Secondly, arguments are built why comparative advantage and competitive advantage are different from each other. Thirdly, different methodologies pertaining to comparative advantage is explored. Fourthly, the revealed comparative advantage of the beef and maize sub-sectors are analysed. From this important conclusions are drawn that provides insight into the adjustments these sectors have undergone in recent years from a policy and trade perspective.

2. ABSOLUTE ADVANTAGE, COMPARATIVE ADVANTAGE AND COMPETITIVENESS

While the mercantilists believed that one nation could gain only at the expense of another nation and advocated strict government control of all economic activity and trade, Adam Smith and other classical economists believed that all nations would gain from free trade and strongly advocated a policy of as little as possible government interference with the economic system.

According to the theory of Adam Smith, trade between two nations is based on absolute advantage. When one nation is more efficient than (or has an absolute advantage over) another in the production of one commodity but is less efficient than (or has an absolute disadvantage with respect to) the other nation in producing a second commodity, then both nations can gain by each specializing in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage (Salvatore, 2001). By this process, resources are utilized in the most efficient way and the output of both commodities will rise. This increase in the output of both commodities measures the gains from specialization in production available to be divided between the two nations through trade.

David Ricardo's law of comparative advantage, on the other hand state that, even if one nation is less efficient than the other nation in the production of both commodities, there is still room for mutually beneficial trade. The first nation should specialize in the production of and export the commodity in which its absolute advantage is smaller and import the commodity in which its absolute disadvantage is greater. Salvatore (2001) argues that there are exceptions to Ricardo's law of comparative advantage, since it may happen that the absolute disadvantage that one nation has with respect to another nation is the same in both commodities. This, therefore, requires a slight modification of the law of comparative advantage that read as follows - *Even if one nation has an absolute disadvantage with respect to the other nation in the production of both commodities, there is still a basis for mutually beneficial trade, unless the absolute advantage is in the same proportion for the two commodities.*

Two important questions were left largely unanswered by Smith and Ricardo. These are associated with the basis of comparative advantage and analyzing the effect that international trade has on the earnings of factors of production in the two trading nations. The Heckscher-Ohlin model provides answers to these two important questions. The Heckscher-Ohlin model explains comparative advantage rather than assuming it, as was the case for classical economists. That is, the Heckscher-Ohlin model postulates that the difference in relative factor abundance and prices is the cause of the pre-trade difference in relative commodity prices between two nations. This difference in relative factor and relative commodity prices is then translated into a difference in absolute factor and commodity prices between the two nations; it is this difference in absolute commodity prices in the two nations that is the immediate cause of trade.

Moreover, according to Chacholiades (1990), the gist of the Heckscher-Ohlin model can be summarised in four theorems, namely the Heckscher-Ohlin theorem, the factor-price equalisation theorem, the Stolper-Samuelson theorem and the Rybczynski theorem. He summarises these as follows:

- **Heckscher-Ohlin theorem:** A country has a comparative advantage in the commodity which uses intensively the country's abundant factor.
- **Factor-Price Equalization theorem:** Free trade equalizes factor rewards (real rentals) between countries and thus serves as a substitute for external factor mobility.
- **Stolper-Samuelson theorem:** An increase in the relative price of a commodity raises, in terms of both commodities, the real reward of the

factor used intensively in production of the commodity and reduces, in terms of both commodities, the real reward of the other factor.

- **Rybcynski theorem:** When the coefficients of production are given and factor supplies are fully employed, an expansion in the endowment of one factor of production raises the output of the commodity that uses the expanded factor intensively and reduces the output of the other commodity.

According to Porter (1990), and more recently Reed (2001), traditional trade theories fail to explain the reasons for why countries trade with each other in its entirety in the modern world of globalization, i.e. why some countries have a competitive advantage and other not. The traditional trade theories nevertheless provide the premise on which arguments could be based to explain “modern” trade.

According to Khemani (1997), **comparative** advantage can be the basis on which to build **competitive** advantage. Many deviations in policy and marketing practices, that violate conditions necessary for trade, are solely based on comparative advantage. Worley (1996) states that competitive advantage encompasses these factors and, when all these additional factors are considered, better describes trade patterns. He further affirms that competitive advantage characterizes trade patterns resulting from comparative advantage together with policy effects, product quality differences and industry marketing skills. It is hence clear that one needs a proper understanding of comparative advantage before one attempt to explain competitive advantage. It is for this reason that the next section will investigate the measurement of comparative advantage more closely.

3. MEASURING COMPARATIVE ADVANTAGE

Net social profitability (NSP), Domestic Resource Cost (DRC), and Resource Cost Ratio (RCR) and the Revealed Comparative Advantage (RCA) are all measurements of economic efficiency (Mucavele, 2000).

NSP refers to the profit of producing a commodity by efficiently utilizing all foreign and domestic resources. It can be estimated by subtracting all input costs from the sum of their opportunity costs plus any externalities (Tuan and Tingjun, 2000). NSP measures can only be used to contrast similar types of activities, such as alternative agricultural product projects competing for given fixed resources (Mucavale, 2000).

The DRC methodology compares the economic value of land, labour and capital to the value-added measured in world prices (Salinger, 1999), i.e. the concept of DRC relates to a measure of real opportunity cost in terms of total domestic resources of producing (or saving) a net marginal unit of foreign exchange (Bruno, 1967). It is used as an *ex ante* measure of comparative advantage to determine which among a set of alternative production activities is relatively efficient for a country or region in terms of contribution to national income (Bruno, 1967). However, the DRC method measures only static efficiency and fails to account for the dynamics of price and quantity changes in input-output relations (Ul Haque, 1991).

An alternative measure of economic efficiency that is easier to interpret is the RCR. Resource cost ratios provide an explicit indication of the efficiency with which production alternatives uses domestic resources to generate or save foreign exchange (Morris, 1990), thus serving as a relative indicator of the degree of efficiency. According to Morris (1990), the RCR's also lend itself more readily to cross-country comparison.

Another measure of changes in comparative advantage is the RCA. It provides a measurement of comparative advantage based on countries trade patterns. It is this measure that forms the basis of this chapter. It is, however, necessary to clearly define the use and interpretation of the RCA to prevent wrong interpretations of its meaning in an analytical context. This will be highlighted in the next section.

4. REVEALED COMPARATIVE ADVANTAGE

4.1 What do we actually learn from RCA?

Bender and Li (2002) state RCA faces a measurement problem, as it is defined in terms of autarkic price relationships that are not observable. Trade statistics reflect only post-trade situations. They further state that this approach, pioneered by Balassa (1965, 1977, 1979), assume that the true pattern of comparative advantage can be observed from post-trade data. The availability of data at different levels of aggregation and the data bias caused by government policy distortions (e.g. non-trade barriers and export subsidies) caused immeasurable damage to the "true" pattern of comparative advantage.

Bender and Li (2002) is, however, also of the opinion that RCA measures are still acceptable since the impact of changes in trade policies can be deducted from movements of RCA, even though it fails to distinguish between a

region's factor endowments. It is within this context that the RCA is used in this study.

4.2 Formulation of RCA

The positive impact of trade liberalization and expansion thereof can indirectly be measured by calculating the RCA of a product. According to Cassim, Onyango and Van Seventer (2002), RCA is based on observed trade patterns; it measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries.

For this study two RCA measures are used. One is the original RCA index, formulated by Balassa (1965) that compares the export share of a given sector in a country with the export share of that sector in the world market. The other is an improved version constructed by Vollarath (1991), and is denoted as RCA#. According to Bender and Li (2002), Vollarath's RCA# is considered to be the more appropriate measure, because a group of countries is expected to have a much greater impact at the world level than an individual economy. RCA# considers the significance of a country's exports in a given sector and at the world level and purges any double counting problem in the world trade. For any export of sector "i", the RCA and RCA# are defined, respectively, as:

$$RCA_i = \left[\frac{\left(\frac{X_{ij}}{\sum_i X_{ij}} \right)}{\sum_j X_{ij} / \sum_j \sum_i X_{ij}} \right] \quad (1)$$

$$RCA\#_i = \frac{\left\{ \frac{X_{ij}}{\left(\sum_i X_{ij} \right) - X_{ij}} \right\}}{\left\{ \frac{\left(\sum_j X_{ij} \right) - X_{ij}}{\left(\left(\sum_j \sum_i X_{ij} \right) - \left(\sum_j X_{ij} \right) \right) - \left(\left(\sum_i X_{ij} \right) - X_{ij} \right)} \right\}} \quad (2)$$

Where:

X_{ij} = the exports of sector “ i ” of country “ j ”;

$\sum_i X_{ij}$ = the total exports of country “ j ”;

$\sum_j X_{ij}$ = the world exports of sector “ i ”; and

$\sum_j \sum_i X_{ij}$ = the total “world” exports.

A value greater than 1 signal that the country has a revealed comparative advantage in that product, whereas a value smaller than 1 signal a revealed comparative disadvantage.

Cognisance should be taken of the fact that more than one variation exist for equations 1 and 2 shown above. Edwards and Schoer (2001), however, found a high degree of correlation between these measures, i.e. in general the correlation coefficient exceeds 0.8. Therefore, for this particular study, the Balassa (RCA) and the Vollarath (RCA#) methods are applied to determine the revealed comparative advantages of the South African beef and maize industries.

4.3 Evidence from other studies

Bender and Li (2002) who investigated the performance of manufacture exports in a number of Asian and Latin American economies over the period 1981-1997 argues that although the RCA measurement may not distinguish between the factor endowment effects a trade policy may have, the RCA measures provide an indication of the movement in a regions comparative advantage. Their evidence strongly suggests that, despite the strong export performance experienced by East Asian economies, they are losing their comparative advantage to the lower-tier economies in Southeast Asia and Latin America.

In a study by Cassim *et al* (2002), they showed that South Africa has a revealed comparative advantage for the production of agriculture, mining and manufacturing products relating to these sectors. These results appear consistent with those of Nordas (1996) and suggest that South Africa is relatively competitive in the production of mineral and agricultural resource intensive products. Edwards and Schoer (2001) showed that South Africa has a revealed comparative disadvantage in the production of the more high-technology products such as electrical machinery, apparatus and appliances.

4.4 RCA's for the beef and maize sub-sectors in South Africa

In this section the results of applying equation 1 and 2 described in Section 4.2 on the beef and maize sub-sectors are discussed. Data was sourced in terms of total world exports, as well as exports of beef and maize by South Africa and the world.

In line with Edwards and Schoer (2001), the hypothesis is tested that there is no significant difference between the calculated RCA and RCA#. This is demonstrated with the RCA and RCA# that was calculated for beef. Table 1 show that there is no significant difference between these two measures as measured by the F-test. In addition, a correlation test found a correlation coefficient of 0.9998.

Table 1: F-test for RCA and RCA# values

Indicators	RCA	RCA#
Mean	0.799976	0.800613
Variance	0.307271	0.314376
Observations	22	22
Df	21	21
F	0.9774 ($p < 0.05$)	

4.4.1 Beef

Figure 1 depicts the RCA and RCA# calculated for beef. According to the definition of RCA and RCA# South Africa only showed a revealed comparative advantage for beef during 1985, 1991, 1996, 2000 and 2001. Thus, South Africa had a revealed comparative disadvantage for 17 out of the 22 years since 1980.

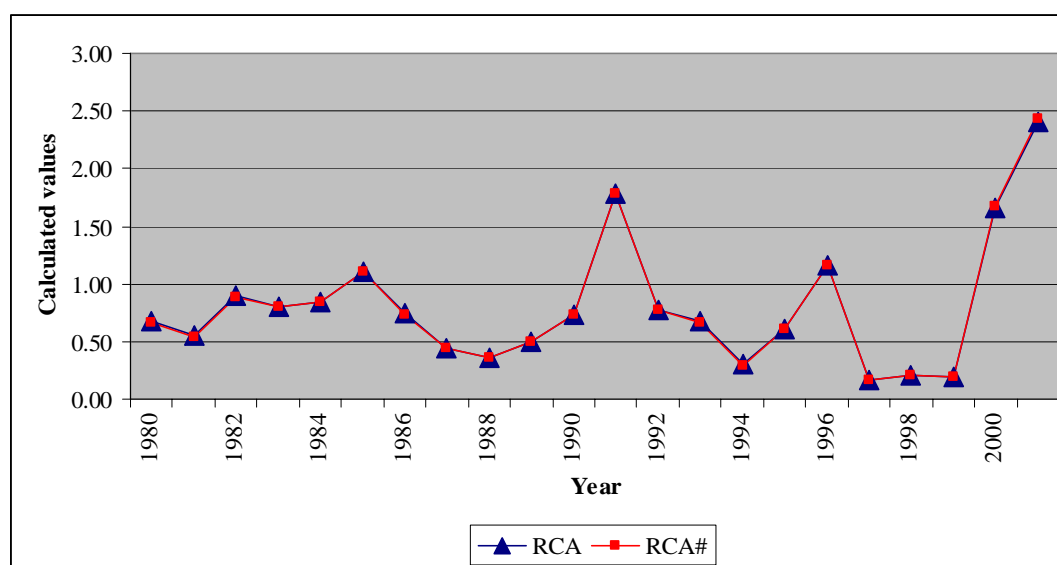


Figure 1: Revealed comparative advantage for beef

Two questions arise, (i) are the results indicating that the South African beef sub-sector indeed has a comparative disadvantage, and (ii) do the RCA measures for 2000 and 2001 indicate that the beef sub-sector is becoming more export orientated. In order to answer these questions several issues have to be considered. They are:

- South Africa is a net importer of beef, i.e. imports exceed exports because local production does not meet local demand for beef. This situation has not changed since 1980.
- South Africa was isolated by the rest of the world for most of the 1980s, effectively restricting exports of most products.
- The period prior to 1995 was characterized high levels of protection of beef industries worldwide. It was only after the Marrakesh Agreement that more liberal trade and domestic policies were implemented (Jooste, 2001).
- The period prior to 1997 was characterized by a high level of domestic regulation, even though major changes in the level of regulation took effect already in 1994.
- Due, in large to the previous three events, the South African beef industry is not export orientated. For example, only a select few companies are exporting beef and beef products. This state of affairs can largely be attributed to the fact many countries restrict the imports of carcasses and beef (frozen, chilled or fresh) from South Africa due to its animal disease status. In addition, compliance cost to strict international standards is high (Jooste *et al*, 2003).

Given the aforementioned, it is clear that one can not merely conclude from the RCA results that the beef sub-sector has a comparative disadvantage. Moreover, Siegfried (2002) state that the RCA is primarily based on relative export shares that could be biased due to distortions from various trade and non-trade barriers; which is indeed the case for beef. Also, Jooste and Van Zyl (1999) showed that the beef industry in South Africa is actually taxed. They also used the RCR measure of comparative advantage to show that the beef industry does have a comparative advantage, i.e. the beef industry does make effective use of the scarce natural resources used to produce beef.

Lastly, it appears as if the beef sub-sector has started to re-orientate itself to a more open trade regime and that niche export opportunities exist if one looks at the trend in the RCA measures since 1997. That is, the RCA measures remained more or less stable from 1997 to 1999 (a period that one can

postulate that the industry adjusted itself to a globalised environment) and increased to above the threshold value since 2001. The reason for the latter trend could be that firms have sufficiently discounted international factors that affect global meat markets into their operational and business environments to market beef internationally.

4.4.2 Maize

Figure 2 shows the RCA and RCA# that were calculated for maize. According to the definitions of the aforementioned measures South Africa enjoyed a revealed comparative advantage for maize. However, South Africa showed a revealed comparative disadvantage during the years 1984, 1985, 1988 and 1993. Thus, South Africa had a revealed comparative advantage for 18 out of the 22 years since 1980. The years in which South Africa has a revealed comparative disadvantage coincides with droughts, and hence delivery of maize was lower than usual.

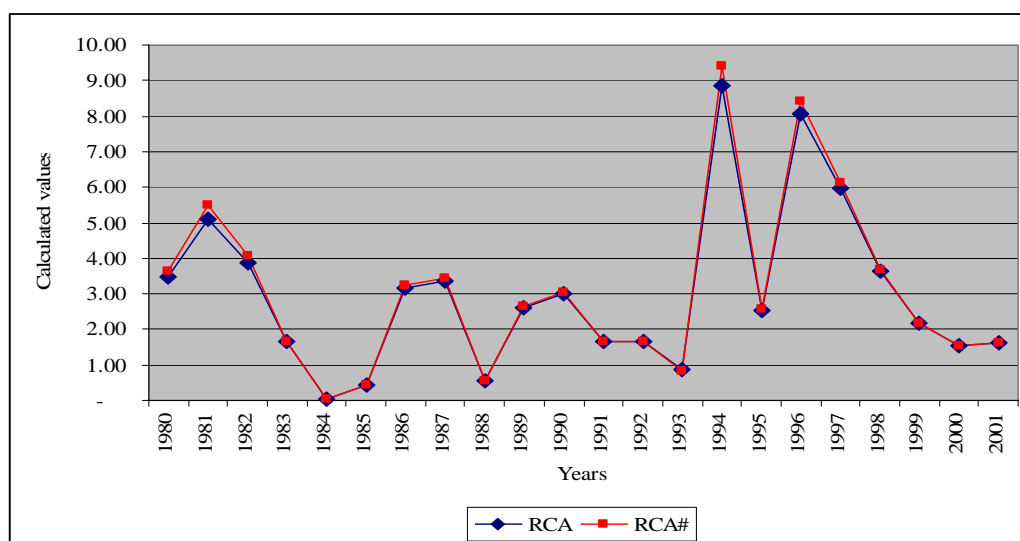


Figure 2: Revealed comparative advantage for maize

The result obtained above is not surprising since South Africa is a net exporter of maize. What is, however, surprising is the downward trend in both RCA measures since 1996. This is the period that coincides with the implementation of the Marrakesh Agreement (i.e. more liberal trade regimes) and the deregulation of the agricultural sector, including the maize sub-sector, in South Africa. Although it is probably too early to make a definite conclusion, it appears as if the downward trend in the RCA measures levelled out in 2000. This may be indicative that the sector has more or less adjusted to the new trading and regulatory environment, i.e. production has stabilized at the level where South Africa maintains its relative export share as net exporter of maize.

5. CONCLUSIONS

The content of this paper serves multiple purposes. Firstly, it provides a brief overview of the theoretical basis of trade theory. Secondly, arguments are built why comparative advantage and competitive advantage are different from each other. Thirdly, different methodologies pertaining to comparative advantage is explored. Fourthly, the revealed comparative advantage of the beef and maize sub-sectors are analysed.

According to the RCA and RCA# the beef sub-sector in South Africa showed a revealed comparative disadvantage for 17 out of the 22 years since 1980. The maize sub-sector, on the other hand, showed a revealed comparative advantage for 18 out of the 22 years since 1980. It is however argued that the results do not show the real state of comparative advantage that exists in these industries. According to Cassim *et al* (2002), the RCA measures explains in more accurate ways, relative to a simple analysis of export trends, how a country features in the context of world trade. Hence, one possible application of RCA measures is to deduct the impact of changes in trade policies on an industry, sector or sub-sector. Cognisance should also be taken that the RCA measures fail to distinguish between a region's factor endowments (Siegfried, 2002).

Finally, it appears as if both the beef and maize sub-sectors have adjusted favourably since the implementation of the Marrakesh Agreement and subsequent deregulation of the domestic market. Favourably in this context means that both sub-sectors appear to have discounted the changing trade and regulatory environments into their respective supply chains. The question of how competitive these sub-sectors are relative to their international counterparts however remains unanswered, and will require a much more in depth analysis of the complete value chains for these sub-sectors.

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