



Volume and Issues Obtainable at Center for Sustainability Research and Consultancy

Review of Economics and Development Studies

ISSN:2519-9692 ISSN (E): 2519-9706

Volume 1: Issue 1 June 2015

Journal homepage: www.publishing.globalcsrc.org/reads**Inter-Industry Comparative Advantage of Sudan**¹Macleans Mzumara¹Bindura University of Science Education, Bindura Zimbabwe. macmzumara@yahoo.com**ARTICLEDETAILS****History***Revised format: May 2015**Available online: June 2015***Keywords***Comparative advantage in international trade**Exports**Sudan***JEL Classification**

P23, Z21, N67

ABSTRACT

The Author has investigated inter-industry comparative advantage of Sudan. Inter-industry comparative advantage in Sudan is lacking. Industries have insignificant number of product codes in which they have comparative advantage. Exports earnings are not linked to the number of product codes in which comparative advantage exists. Sudan mainly exports crude oil without value addition. It is recommended that Sudan diversifies its economy. It is further recommended that it adds value to its oil by refining it. There is a need of investing in exploration of new endowments to boost comparative advantage. Sudan should work towards attracting foreign direct investment so it can be able to expand its narrow base of comparative advantage

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Corresponding author's email address: macmzumara@yahoo.com**Recommended citation:** Mzumara, M. (2015). Inter-Industry Comparative Advantage of Sudan. *Review of Economics and Development Studies*, 1 (1) 11-19**DOI:** <https://doi.org/10.26710/reads.v1i1.112>**1. Introduction**

Generally the studies on Sudan have concentrated on comparative advantage at product level. An example of such studies is Damiyano and Mzumara (2013). In that study the authors identified products in which Sudan has comparative advantage. However, their analysis did not reveal the industries in which the products belong. The objective of this paper is to investigate inter-industry comparative advantage of Sudan.

This paper relies on the theory of comparative advantage. The Theory of Comparative Advantage was first proposed by David Ricardo as the determinant of international trade. In his famous proposition, Ricardo gave an example of Portugal producing wine and Britain producing cloth in a 2×2 model. This theory has been accepted as the global law of economics (Goldin, 1990). According to Bender and Li (2000) the classical theory of comparative advantage explains that the gains from external trade improve welfare and that trade exhibits no barriers to promote prosperity of the global economy.

In the neo-classical theory, production for the global economy is determined by costs. In the global

economy, prices and costs are used interchangeably in this process exchange is determined by comparative advantage. It is therefore a given fact that the factors of production namely labour, land and capital especially in developing nations do not account their opportunity costs due to distortions inherent in the market (Goldin, 1990).

Comparative advantage specifically involves countries exporting goods which they are in a position to produce at their best giving them an advantage over other producers in the world. This implies that, a nation should channel its endowment to production of a particular good (Serin and Civan, 2008). Comparative advantage is attributed to various sources depending on a particular theory used. The Ricardian theory attributes comparative advantage for costs and technological advantages of nations over others. The Neo-Factor-Proportion theory attributes comparative advantage from factor productivity among countries. The Heckscher-Ohlin-Samuelson theory attributes comparative advantage from differences in factor endowments. The technological gap and product cycle theory attributes comparative advantage from the technological innovations for example soft technological changes. Some authors such as Medovic (1994) attributes comparative advantage from government actions such as policies, administrative capacity and how the process of intervention in the economy is carried out. Historical and political dynamics also influence comparative advantage (Krugman, 1989; Barry and Hannan, 2001).

Widgren (2005) has said that Heckscher-Ohlin theorem factor endowments in nations determine comparative advantage. These views are almost the same as Mzumara (2006) who attributes comparative advantage from differences in factor endowment. According to Mzumara (2006), a nation with an abundant factor will use this factor most intensively to produce the good that it will export to other countries. It will then import a good that uses its scarce factor less intensively. The result of this process is that specialization will emerge. Nations will therefore specialize in the products in which they have abundant endowment and give up the products in which they are not gifted through factor abundance. Khatibi (2008) emphasizes on factor scarcity as the major determinant of comparative disadvantage.

In order to measure comparative advantage, a revealed comparative advantage (RCA) is used. The index is helpful in demonstrating a country's capabilities to produce. The RCA technique utilizes observable trade balance to conclude the relative industrial advantage. A particular industry has comparative advantage when it is able to produce at lower costs. The RCA is basically a ratio of ratio that shows trade shares (Ferto and Habbard, 2000; Richardson and Zhang, 2001). The RCA measure utilizes the trend of trade balances to show relative industrial comparative advantage end up producing for the external markets whereas industries which lack comparative advantage end up importing. RCA is definitely an acceptable technique that is not influenced by limitations of assumptions that lack validity in practice (Mutambatsere, 2007).

After having discussed the theory of comparative advantage and the measurement used to determine comparative advantage, the question is whether empirical evidence exists? A number of studies have been done which show empirical evidence in support of the theory. In a study done by Mirzaei et al (2001) the objective was to investigate whether Iran's chicken meat which is exported to the Middle East possess comparative advantage. The study concluded that Iran lacked comparative advantage. The implication of this lack of comparative advantage is that Iran should in fact be importing the chickens itself instead of producing them and that should channel its resources elsewhere where it possess comparative advantage. The other implication of the results is that the Middle East countries are importing from a less efficient producer instead of importing from efficient producer with comparative advantage.

Khatibi (2008) investigated whether Kazakhstan's exports to the European Union possess comparative advantage. The study revealed that Kazakhstan has comparative advantage and it is evident in all sectors. Krugell and Matthee (2009) investigated the performance of South African regions. They were able to identify the regions which have comparative advantage and demonstrate export capabilities. Shinyekwa and Otieno (2011) investigated whether Uganda has comparative advantage. Their findings revealed that Uganda has comparative advantage in limited products. The results are similar to Chingarande et al (2013) in which they investigated the comparative advantage of the East African Community (EAC) member states. In respect for Uganda, they found that it has comparative advantage although in limited products. They also found Kenya to have comparative advantage and various levels of comparative advantage in Tanzania Burundi and Rwanda. However, one shocking finding was that they specialized or have comparative advantage in similar primary products such as coffee making the prospect of trade amongst themselves slim.

Mzumara (2011a) investigated whether Zimbabwe had competitive advantage between 2000-2009. The study concluded that Zimbabwe had comparative advantage. Mzumara (2011b) also investigated the performance of Mozambique and concluded that Mozambique has comparative advantage. Mzumara et al (2012) investigated whether the members of the North America Free Trade Agreement (NAFTA) have comparative advantage. The study concluded that the United States, Canada and Mexico have comparative advantage.

2. Methodology

The technique used here is Balassa (1965) index, the revealed comparative advantage (RCA). According to Wu and Chen (2004) a higher RCA is evidence that a nation possesses a greater revealed comparative advantage and competitiveness in the production of the product. Krugell and Matthee used Balassa (1965) technique in comparing the export capabilities of the South African regions.

Balassa (1965) formula is as follows;

$$RCA = \left(\frac{X_{i,j}}{X_{w,j}} \right) / \left(\frac{X_{i,tot}}{X_{w,tot}} \right)$$

Where:

$X_{i,j}$ denoting country i 's exports of product j ;

$X_{i,tot}$ denoting country i 's total exports;

$X_{w,j}$ denoting the world's (all countries) export of product j ; and

$X_{w,tot}$ denoting total exports in the world.

An $RCA \geq 1$ demonstrates that a nation has revealed comparative advantage in the production of the same product. An $RCA < 1$ shows that a country has no revealed comparative advantage in the production of the same product.

The author obtained data from the International Trade Centre's Trademap. Both Sudan's export data and the world export data was secured on 6-digit level. This is the product classification accepted globally as the most disaggregative. Separate computation of RCAs was done for 2008, 2009 and 2010 and then the average RCA was obtained.

3. Results Discussion

Table 1 shows the results for each industry.

Table 1: Results for each industry

Rank	Industry code	Industry description	Number of products in the industry with $RCA \geq 1$
1	06-15	Vegetable products	11
1	41-43	Raw hides, skins, leather and furs	11
2	01-05	Animal and animal products	8
3	16-24	Foodstuffs	6
3	25-27	Mineral products	6
3	72-83	Metals	6
4	84-85	Machinery/Electric	3
5	28-38	Chemicals and allied industries	2
5	90-97	Miscellaneous	2
6	44-49	Wood and wood products	1
6	50-63	Textiles	1
6	68-71	Stone/glass	1
7	39-40	Plastic/rubber	0
7	64-67	Foot wear /head gear	0
8	86-89	Transportation	0

Source: From the results.

Column 1 in table 1 is the rank of the industry. Column 2 is the industry code. It is derived from the first two digits of the product code. Column 3 is the industry description and column 4 is the number of the product codes with $RCA \geq 1$. Sudan demonstrates that it has insignificant inter-industry comparative advantage. Vegetable products industry has 11 product codes. It is ranked number 1. The same rank is shared by raw hides, skins, leather and fur industry. Although the two industries are ranked number 1 in this analysis, the number of products in them is very insignificant. Wood and wood products, textiles and stone/glass all have a single product code each. Plastic/rubber, foot wear/head gear and transportation industries all do not have a product code in them. Sudan relies so much on oil that it has not managed to diversify its economy. So at industry level in terms of the number of products, Sudan inter-industry comparative advantage is insignificant. Table 2 shows top 3 product codes in the vegetable products industry in which Sudan has comparative advantage.

Table 2: Top 3 product codes in the vegetable products industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	130120	Gum Arabic	348.7649	204.233	243.4348	265.4776
2	120740	Sesamum seeds	177.2951	124.9577	137.4088	146.5539
3	121299	Vegetable products for human consumption	55.66296	39.77092	25.26885	40.23424

Source: From the results

Gum Arabic in table 2 in the vegetable products industry has the highest RCA in this industry with an index of 265.5. Sesamum seeds are ranked the second with an index of 146.6. Vegetable products for human consumption are ranked the third with an index of 40. Table 2 shows top 3 product codes in the raw hides, skins, leather and furs industry in which Sudan has comparative advantage.

Table 3: Top 3 product codes in the raw hides, skins, leather and furs industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	410510	Tanned/crust skins of sheep/lambs, without wool on in the wet state	77.29592	68.51966	49.78037	65.19865
2	410621	Tanned/crust hides and skins of goats/kids, without wool/hair on, in the wet state	43.32304	12.29105	38.14735	31.25401
3	410229	Sheep or lamb skins, raw except pickled, no wool	1.715847	11.09164	0.715471	4.50765

Source: From the results.

Tanned/crust skins of sheep/lambs, without wool on in the wet state in table 3 in the raw hides, skins, leather and furs industry have the highest RCA index in this industry with an index of 65.2. Tanned/crust hides and skins of goats/kids, without wool/hair on, in the wet state are ranked second with an index of 31.3. Sheep or lamb skins, raw except pickled, no wool are in the third rank with an index of 4.5. Table 4 shows top 3 product codes in the animal and animal products industry in which Sudan has comparative advantage.

Table 4: Top 3 product codes in the raw animal and animal products industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	010410	Sheep, live	80.2322	290.7259	386.0372	252.3318
2	010420	Goats, live	3.61723	37.92994	222.1886	87.91193
3	010690	Live animals	104.9739	82.63462	0.116349	62.57495

Source: From the results.

Sheep, live in table 4 in the animal and animal products industry has the highest RCA in this industry with an index of 252. Goats, live are ranked second with an index of 88. Live animals rank third with an index of 62.6. Table 5 shows top 3 product codes in the foodstuffs industry in which Sudan has comparative advantage.

Table 5: Top 3 product codes in the foodstuffs industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	170310	Cane molasses	13.41597	3.553057	11.83281	9.600612
2	220710	Undenatured ethyl alcohol >80% by volume	0	0	5.414471	1.804824
3	230230	Wheat bran, sharps, other residues	2.385099	0	2.713473	1.699524

Source: From the results.

Cane molasses in table 5 in the foodstuffs industry have the highest RCA in this industry with an index of 9.6. Undenatured ethyl alcohol >80% by volume is ranked second with an index of 1.7. Wheat bran, sharps, other residues are ranked the third with an index of 1.7. Table 6 shows top 3 product codes in the

mineral products industry in which Sudan has comparative advantage.

Table 6: Top 3 product codes in the mineral products industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	270900	Petroleum oil, oil from bituminous minerals, crude	9.782954	10.67944	12.22897	10.89712
2	261000	Chromium ores and concentrates	4.587556	3.270766	10.9646	6.274309
3	271311	Petroleum coke, not calcined	0	0	10.47092	3.490307

Source: From the results.

Petroleum oil, oil from bituminous minerals, crude in table 6 in mineral products industry has the highest RCA in this industry with an index of 10.9. Chromium ores and concentrates are in the second rank with an index of 6.3. Petroleum coke, not calcined in the third rank with an index of 3.5. This is the industry that brings in most of the revenue of Sudan. However, Sudan exports crude oil without value addition. It is therefore deprived revenue by exporting crude oil. Table 7 shows top 3 product codes in the metals industry in which Sudan has comparative advantage.

Table 7: Top 3 product code in the metals industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	780200	Lead waste or scrap	4.480923	5.183406	2.316308	3.993545
2	720430	Waste or scrap, of tinned iron steel	7.764182	0.57313	0.689301	3.008873
3	720410	Waste or scrap, of cast iron	2.517828	0.262217	0.39117	1.057072

Source: From the results.

Lead waste or scrap in table 7 in the metals industry has the highest RCA in this industry with an index of 4. Waste or scrap, of tinned iron steel is in the second rank with an index of 3. Waste or scrap, of cast iron is in the third rank with an index of 1. Table 8 shows top 3 product codes in the machinery/electric industry in which Sudan has comparative advantage.

Table 8: Top 3 product codes in the machinery/electric industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	850690	Parts of primary cells and primary batteries	17.48173	2.451331	0	6.644354
2	854810	Waste and scrap of primary cell	0	0.163476	14.14031	4.767929
3	842630	Portal or pedestal jib cranes	5.127741	0	0.378311	1.835351

Source: From the results.

Parts of primary cells and primary batteries in table 8 in the machinery/electric industry have the highest RCA in this industry of 6.6. Waste and scrap of primary cell is in the second rank with an index of 4.8. Portal or pedestal jib cranes are in the third rank with an index of 1.8. Table 9 shows 2 product codes in the chemicals and allied industries in which Sudan has comparative advantage.

Table 9: 2 product codes in the chemicals and allied industries in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	284450	Spent fuel elements of nuclear reactors	5.625838	0	0	1.875279
2	291250	Cyclic polymers of aldehydes	4.881612	0	0	1.627204

Source: From the results.

Spent fuel elements of nuclear reactors in table 9 in chemicals and allied industries have the highest RCA in this industry with an index of 1.9. Cyclic polymers of aldehydes are in the second rank with an index of 1.6. Table 10 shows 2 product codes in the miscellaneous industry in which Sudan has comparative advantage.

Table 10: 2 product codes in the miscellaneous industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	930610	Cartridges for rivet etc tools, humane	3.185844	4070.336	212.2929	1364.917
2	950310	Electric trains, train sets	2.951097	75.36659	13.3459	30.55786

Source: From the results

Cartridges for rivet etc tools, humane in table 10 in miscellaneous industry have the highest RCA in this industry with an index of 1365. Electric trains, train sets are in the second rank with an index of 30.6. Table 10 shows 1 product code in the wood and wood products industry in which Sudan has comparative advantage.

Table 11: 1 product code in the wood and wood products industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	440349	Logs, tropical woods	0	0	10.65446	3.551487

Source: From the results.

Logs, tropical woods in table 10 in the wood and wood products industry is the only product code in this industry with $RCA \geq 1$. Table 11 shows 1 product code in the textiles industry in which Sudan has comparative advantage.

Table 12: 1 product code in the textiles industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	520100	Cotton, not carded or combed	8.936779	6.663224	4.352662	6.798862

Source: From the results.

Cotton, not carded or combed in table 11 in the textile industry is the only product code in this industry

with $RCA \geq 1$. Table 12 shows 1 product code in the stone/glass industry in which Sudan has comparative advantage.

Table 13: 1 product code in the stone/glass industry in which Sudan has comparative advantage

Rank	Product code	Product description	2008 RCA	2009 RCA	2010 RCA	Average RCA
1	710812	Gold in unwrought forms non-monetary	0	11.63722	1.42077	4.352662

Source: From the results.

Gold in unwrought forms non-monetary in table 12 in the stone/glass industry is the only product code with an $RCA \geq 1$.

Although Sudan shows no real evidence of inter-industry comparative advantage, the mineral products industry provides relatively sufficient earnings for Sudan. Sudan which has only comparative advantage in only 60 product codes has a higher earnings from its exports than some other African countries which some of them have even more than 400 product codes in which they have comparative advantage in.

4. Conclusions and Recommendations

Inter-industry comparative advantage in Sudan is lacking. Industries have insignificant number of product codes in which they have comparative advantage. Exports earnings are not linked to the number of product codes in which comparative advantage exists. Sudan mainly exports crude oil without value addition.

It is recommended that Sudan diversifies its economy. It is further recommended that it adds value to its oil by refining it. There is a need of investing in exploration of new endowments to boost comparative advantage. Sudan should work towards attracting foreign direct investment so it can be able to expand its narrow base of comparative advantage.

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