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The Determinants of Agricultural Export Growth in South Africa

By

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# The Determinants of Agricultural Export Growth in South Africa

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*Abstract:*

*South Africa has relatively not been affected that significantly by the global food and economic crises. Although, the exports of South Africa's traditional agricultural exports showed a moderate dip over the last two years. However, the country's agricultural export base that earns valuable foreign currency is quite shallow. Against this background the study identified ten agricultural export products which showed a significant increase in exports over the last years. These emerging agricultural exports form the basis for the analysis of the determinants of export growth. The identified determinants will provide a guideline for future trade diversification.*

*An augmented gravity model was applied to investigate factors such as transaction cost, market size, the stage of economic development, exchange rate fluctuations and the impact of trade agreements on the export flows of the selected products. Various factors were found to have a significant impact on trade flows amongst which: economic market size, supply capacity and physical market size.*

**Keywords:** agricultural exports, diversification, South Africa, augmented gravity model, determinants of trade

## **1. Introduction**

South Africa is well-known for its production of high-quality wine and various fruits like apples, mango's and oranges. The surplus of these commodities has found well-established and lucrative markets in the Northern-Hemisphere; earning large amounts of foreign currency and enhancing economic development. South Africa agricultural exports have shown strong growth over the last years with an average annual increase of almost 16 percent in the period 2004 to 2009 to a total value of 34.9 billion ZAR in 2009. Although South Africa produces a very wide range of agricultural products, of total production only a fairly small percentage is exported. Furthermore, the variety of products that contribute to total agricultural exports is also fairly narrow. The top five exports contributed more than 50 percent to total agricultural exports, where the top 20 exports products contributed 86 percent (DTI. 2010). Looking at the international markets to which South Africa supplies its agricultural products the situation looks better, 41 percent of all

agricultural exports was sold on the top five export markets in 2009 and seven of the ten top destination were advanced economies. This indicates that the markets for agricultural exports are more diversified than its products, further emphasized by the fact that South Africa supplied 180 international markets with its agricultural products. Taking the product diversification in consideration, South Africa is still fairly vulnerable to fluctuations in world prices and economic stability in its export markets even though demand for food products is in general more price-inelastic, especially in advanced markets. Therefore, export diversification can be a strategy to decrease the vulnerability of the agricultural sector to domestic and international economic shocks.

Agricultural exports are drivers of broad-based rural economic growth as, apart from earning valuable foreign currency; it creates sustainable jobs, increases the adaption of advanced technologies and production practices as well as the enhancement of overall competitiveness of the agricultural sector. Therefore, the focus on export diversification, hence exporting new products to new and existing markets, can also be essential in achieving accelerated rural economic growth.

Against the background of the recent global food security concerns, one should also ask whether more food exports are desirable from a local food security perspective. South Africa is a net food exporter for years, once again reflected by a positive agricultural trade balance ratio of 1.5<sup>2</sup> in 2009 (AMT, 2010). This indicates, inter alia, that there exists a situation of food security, further stipulated by the fact that the country is self-sufficient in all staple food (except for rice). From this stems the rationale that opportunities for the expansion of agricultural & food export exists currently without compromising domestic food security. Furthermore, surplus agricultural production in South Africa could enhance food security situations in other parts of the world, especially Africa.

South Africa has shown some significant expansion in the exports of various agricultural commodities over the last years. Since these emerging exports provide a good indication of trade

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<sup>2</sup> Indicates that agricultural & food exports are 1.5 larger than agricultural & food imports.

diversification in agriculture it is important to investigate the factors influencing these exports. Notwithstanding the importance of supply side factors like production cost and climatic conditions, the marketing factors of these commodities internationally may provide guidelines for future diversification strategies. This study therefore attempts to investigate the determinants of South Africa's emerging agricultural exports in order to gain knowledge on the factors that influence export diversification. The gravity model will be applied using panel data of the ten agricultural export products that have shown the most promising expansion since 2004, e.g. the so-called "champions". Earlier studies have applied the gravity model to investigate the trade flows and trade potential of South Africa (see: Sichei et. al., 2005; Cassim, 2000; Steenkamp, 1999; Gouws, 2005) However, most of these studies are more aggregate in nature and none of these studies have particularly looked at emerging agricultural exports.

## **2. An overview of South Africa's emerging agricultural exports**

Total agricultural & food trade grew with almost 95 percent in the period 2004 to 2008. A number of agricultural products performed relatively extremely well in terms of export growth and these will form the basis of the analysis in this study. The selection of these top-ten performing agricultural export products, "champions", was based on the following criteria:

- Agricultural products used for human consumption or similar uses, excluding fish products.
- A total export value of more than 750 thousand USD (= 6.2 million ZAR) in 2008.
- Largest percentage growth in export quantity in the period between 2004 and 2008, per annum.
- Self-sufficiency ratio of more than 60 percent (e.g. total imports are less than 40 percent of total exports).
- Exports to more than four markets

The products were selected on the growth in export quantity rather than export value, since the latter is influenced by fluctuations in exchange rates resulting from dynamics outside the agricultural sector. An overview of the products that were selected based on these criteria is given in Table 1. The second columns gives the selected products ranked in order of largest

export growth in the relevant period, the per annum growth in value is also give in brackets. In six cases the growth in value is larger than the growth in quantity exported.

**Table 1: Overview of South Africa's emerging agricultural exports**

HS Code	Product	Growth 2004 – 2008 Quantity {Value} (% p.a.)	Value exported in 2008* (Mill ZAR)	Share of trade balance in total exports**	Total # of markets (2004-2008)	Main export markets (2004-2008)	GROWTH IN TOTAL WORLD imports between 2004 – 2008 (% p.a.)
100110	Durum wheat	809% {716%}	47.2	99.9%	16	Zimbabwe, Zambia, Bosnia, Malawi	23%
120600	Sunflower seed	171% {109%}	496.3	97.3%	52	Portugal, Turkey, Sudan, Uganda	16%
110320	Cereal pellets	167% {194%}	11.6	100%	28	Angola, Mozambique, Zimbabwe, Ghana	27%
080250	Pistachio nuts	158% {179%}	7.7	80.3%	27	Israel, The Netherlands, Turkey, USA	19%
060410	Mosses and lichens	127% {242%}	6.3	99.7%	47	The Netherlands, UK, Canada, Germany	4%
121020	Hop cones (grounded, lupulin)	123% {120%}	108.7	61.2%	13	Czech Rep., Zimbabwe, Angola, Mozambique	35%
0101420	Live goats	58% {65%}	15.9	96.7%	19	Malaysia, Mauritius, Singapore, Uganda	34%
140190	Vegetable material for plaiting	55% {42%}	6.8	92.8%	40	Spain, USA, United Arab Emirates. UK	-7%
120810	Soybean flour	51% {54%}	47.3	93.1%	29	Zambia. Sweden, Mozambique, Zambia	23%
081020	Raspberries, mul- berries, blackberries	50% {65%}	15.1	100%	28	UK, The Netherlands, Russian Federation, UAR	31%

Notes: \* Trade data for 2008 was used since 2009 data for some export destinations was not yet available in the Trademaps database

\*\* Proxy for self-sufficiency

Source: Trademaps & own calculations, 2010

The fifth column indicates the degree of self-sufficiency per product, in other words how dependant is the export supply on domestic production. South Africa is nearly self-sufficient for most products, from a food security perspective this is especially important for staple food such as wheat and cereal pellets. Only for hop cones and pistachio nuts the country relies on imports to a larger extend. The sixth column in Table 1 indicated the number of markets that the product was exported to during the period between 2004 and 2008. It becomes evident that all of the emerging agricultural export products are exported to a wide range of markets. The seventh column shows the four largest export market per product for the period 2004 to 2008 listed in order of significance. The last column gives an indication of the trend in world trade for the specific product. All, except for one product, are exported in a growing world market.

For some products the listed in Table 1 the uses may be somewhat unclear, therefore here a short explanation. Durum wheat is used in the production of pasta. Cereal pellets are used in the milling industry. Mosses and lichens are used as ornamental foliage in the floral industry. Hop cones are used in the beer brewing industry or in the herbal medicine industry. Vegetable material for plaiting may comprise of cereal straw or reeds.

### **3. Methodology and data**

One of the most successful and widespread methodologies used for estimating the determinants of trade is the gravity model. The gravity model is an ex-post analysis approach that uses historical data to conduct an econometric study of trade. Tinbergen (1962) and Poyhonen (1963) first applied the gravity model to analyse international trade flows. The traditional model explains the flow of trade between countries by the proportion of their economic mass and by the inversely proportion of the physical distance between them.

As the gravity model was already applied since the early 60's the theoretical foundations are of more recent origin. Trade theorists found that the model is consistent with trade theories based upon models of imperfect competition and with the Heckscher-Ohlin (H-O) model. Frankel (1997) gives recognition to Helpman & Krugman (1985) for the standard gravity model. They



provide a rationale for the relationship between trade flows and country size but they do not include a role for distance. The inclusion of the latter in the gravity model stems from different motivations, such as:

- Distance is a proxy for transport cost
- Distance is proxy for transaction cost
- Distance is a proxy for shipping times (especially important for the exports perishable products)
- Distance a proxy for synchronisation cost (especially important for the exports of inputs or intermediates)
- Distance is proxy for cultural differences (cultural differences may impede trade due to differences in preferences, values, language, negotiating styles etc.)

Bergstrand (1985) included a role for shipping cost in his version of the imperfect substitution model. Deardoff (1995) derived the gravity model from two cases of the H-O theory. The first case, frictionless trade, where all obstacles to trade of a homogeneous product are considered to be indifferent amongst trading partners. In this case the correlations in the gravity model may resolve this indifferent randomly expected trade flows. In the second case, different countries produce distinct goods, as specified in the H-O model of complete specialisation, other estimation techniques are required (e.g. Cobb-Douglas function with Consumer Excess Demand preferences). In our case of generally more homogeneous agricultural products the estimation of a gravity model will be sufficient.

Apart from the traditional variables, income and distance, many models have included other variables to control for differences in geographical factors, trade policy and economic facts. It must be noted that the gravity models do not make provisions for third party effects between country A and B. Furthermore, another important shortcoming of the model is the neglect of supply side constraints which are especially evident for agricultural production (e.g. weather patterns, pests). This study also applies an augmented gravity model which will be specified in the next paragraph.

As mentioned, this study aims to estimate the factors determining South Africa's emerging agricultural exports, thus not South Africa's total trade. The departure point of this study is the basic gravity model that can be specified as follows:

$$\log EXP_{nt} = \alpha + \beta_1 \log(GDP_{nt}) + \beta_2 \log(GDP_{it}) + \beta_3 \log(GNIE_{nt}) + \beta_4 \log(GNIE_{it}) + \beta_5 \log(D_{nt}) + \varepsilon \quad (1)$$

Where  $t$  is a specific year,  $n$  is South Africa and  $i$  a trading partner (see also Table 2).

To account for other factors that are expected to influence agricultural trade levels, some variables have been added to Equation 1. This study will therefore use the following augmented gravity model:

$$\begin{aligned} \log Exp_{nt,t} = & \alpha + \beta_1 \log(GDP_{nt}) + \beta_2 \log(GDP_{it}) + \beta_3 \log(GNIE_{nt}) + \beta_4 \log(GNIE_{it}) \\ & + \beta_5 EconDist_{nt,t} + \beta_6 \log(IMP_{nt-n}) + \beta_7 \log(ER_{nt,t}) + \beta_8 \log(Pop_{it}) \\ & + \beta_9 \log(Dist_{nt,t}) + \beta_{10} Com_{nt,t} + \beta_{11} SADC_t + \beta_{12} TDCA_t + \varepsilon \end{aligned} \quad (2)$$

The dependant and independent variables of Equation 2 are explained in Table 2.

**Table 2: Variables of the augmented gravity model**

Variable	Description	Proxy	Expected sign	Data source
$Exp_{mi}$	Exports from South Africa to importer $i$ of commodity $j$ in year $t$ (USD)	Depended variable		<i>UN Comtrade</i>
$GDP_m$	Gross Domestic Product of South Africa in year $t$	Supply capacity of South Africa	+	<i>The World Bank</i>
$GDP_{ti}$	Gross Domestic Product of importer $i$ in year $t$	Economic market size of importer	+	<i>The World Bank</i>
$GNIc_m$	Per capita Gross National Income of South Africa in year $t$	Stage of development of supplying country	+	<i>IMF</i>
$GNIc_{ti}$	Per capita Gross National Income of importer $i$ in year $t$	Stage of development of importing country , income of consumers	+	<i>IMF</i>
$EconDist_{mi}$	Economic distance: the difference between South Africa's GNI per capita and the per capita GNI of importer $i$	Difference in economic development	-	<i>Own calculation</i>
$IMP_{ti-n}$	Total imports of the relevant product group by importer $i$ in year $t$ , excluding imports from Namibia	Size of the relevant export market for a specific product group in a specific country	+	<i>UN Comtrade</i>
$ER_{mi}$	The exchange rate of the national currency of importer $i$ and the South African Rand in year $t$	The impact of bilateral currency devaluation	-	<i>IMF, EuroStat, Oanda.com</i>
$Pop_{ti}$	The total population of importer $i$ in year $t$	Total market size	+	<i>The World Bank</i>
$Dist_{ni}$	The physical distance in kilometres from Pretoria to the capital of importer $i$ (crow's flight)	Transportation cost, transaction cost, shipping time, synchronisation cost, cultural differences	-	<i>www.mapcrow.info</i>
$Com_{ni}$	Dummy variable for a common border between South Africa and importer $i$ (value of 1 for a shared border line and 0 if this is not the case)	Natural links between trading partners	+	<i>CIA World Fact Book</i>

$SADC_{ni}$	Dummy variable for a shared membership of SADC by South Africa and importer $i$ . ( <i>value of 1 for a shared membership and a 0 of this is not the case</i> )	Effect of this Regional Trade Agreement on exports	+	<i>SADC</i>
$TDCA_{ni}$	Dummy variable for a shared membership of the Trade and Development Cooperation (TDCA) by South Africa and importer $i$ . ( <i>value of 1 for a shared membership and a 0 of this is not the case</i> )	Effect of this multilateral Free Trade Agreement on exports	+	<i>European Commission</i>

Note: All scale variables are transformed to their natural log in order to make the model linear.

The augmented gravity model will be estimated using panel data for the period 2002 to 2009. Furthermore, the out-of-sample method will be used, implying that all relevant global export flows are considered in the model. The trade partners considered for the model will comprise of virtually all trade and for which data on the independent variables was available.). As this augmented gravity model specifically focuses on emerging agricultural export products it will be estimated at disaggregated level (HS6 nomenclature).

There are three models that can be used for estimating a gravity model with panel data, these are: pooled, fixed effects and random effects regression. Since all the countries are treated as homogenous, the individual country effects are excluded from the model as they fall outside the scope of the analysis; thus a simple restricted pooled regression will be used. The intercept variable, that reflects the individual country effects, will be restricted in the estimation procedure. The estimators will be tested for heteroskedasticity, heterogeneity and autocorrelation as these are common problems with panel data. Significant estimators will be identified at a 90%, 95% and 99% significance level, as factors determining exports.

#### 4. Empirical results

The estimation results of the gravity model for the ten emerging agricultural export products are depicted in Table 3. Only the significant estimators at a confidence level of 90% or more are shown per product. The T-statistic per estimator is given in brackets and the goodness of fit, reflected by the adjusted R-square, as well as the total number of observations are given in the final rows.

**Table 3: Estimation results**

	Products									
Variables	Durum wheat	Sunflower seed	Cereal pellets	Pistachio nuts	Mosses and liches	Hop cones	Live goats	Vegetable material for plating	Soybean flour	Raspberries, mulberries, blackberries
$GDP_{ti}$	-16.15** (-2.39)	-1.65** (-2.48)	-16.26** (-2.34)		1.14*** (1.76)	16993** (2.31)				
$GDP_{in}$	10.76*** (1.93)	7.89* (2.84)	13.46** (2.54)	10.14*** (1.87)				11.47* (1.04)		
$GNIC_{ti}$						-16990** (-2.31)				
$GNIC_{in}$		-8.16** (-2.32)								
$EconDist_{mi}$	12.87 (1.88)	1.64** (2.54)	16.72** (2.29)							
$IMP_{ti-n}$		0.28* (4.89)		0.49* (3.23)				0.28** (2.34)		
$ER_{mi}$						0.50** (2.04)				
$Pop_{ti}$	14.80** (2.09)	1.985* (2.81)	16.31** (2.24)			-16944** (-2.31)	-0.375** (-2.12)			0.59** (2.57)
$Dist_{ni}$			-2.78** (-2.15)					-2.43* (2.71)	0.67* (2.78)	0.35* (2.87)

$Com_{ni}$									2.20** (2.10)	
$SADC_{ni}$					2.27*** (1.87)			-3.69* (-4.43)	2.36* (2.82)	1.27*** (1.70)
$TDCA_{ni}$		-1.57** (-2.21)		-2.81** (-2.60)				-2.22* (-3.81)		2.87* (3.15)
Adj. R-square	0.76	0.91	0.87	0.92	0.93	0.97	0.98	0.94	0.90	0.91
Obss	39	190	70	64	96	42	57	139	84	79

Notes: \* indicates significant at 1%, \*\* indicates significant at 5%, \*\*\* indicates significant at 10%

T-statistics are in parentheses

As evident from the model specification in the previous chapter, natural logs were used for:  $GDP_{tn}$ ,  $GDP_{ti}$ ,  $GNIc_{tn}$ ,  $GNIc_{ti}$ ,  $IMP_{ti-n}$ ,  $Pop_{ti}$ ,  $Dist_{ni}$ .

Looking at the overall goodness of fit of all the ten estimations of the gravity model it can be concluded that the specified models explain the variety in export flows to a sufficient extend. In five of the estimations the coefficient of the trading partners' GDP was found to be significant. However the sign of this variable in the three estimations for durum wheat, cereal pellets and sunflower seeds are negative in contrary with the expectation. This indicates that the export of these grain crops is significantly determined by the smaller economies. The market size of the trading partner's economy is not of significant importance to the exports of pistachio's, live goats, mosses, soybean flour and raspberries.

The GDP of South Africa was also significant in the determination of exports of five of the agricultural commodities. The significant coefficient all had the expected positive sign indicating that the domestic supply capacity positively impacts on the exports of durum wheat, sunflower seed, cereal pellets, pistachio nuts and vegetable material for plaiting.

The GNI per capita of the trading partner was only found to be significant in the estimation for hop cones exports. The sign of this estimation was negative, contrary to the expectation. The results imply that the stage of development of the trading partner and income of the consumers does not significantly impact the exports of emerging agricultural products. Similar results for the GNI per capita of South Africa; only one of the ten estimations shows a significant coefficient for this variable. This indicates that the exports are not impacted by the stage of development in the supplying country.

The economic distance was found to be positively significant, as expected, in three estimations. The results imply that grain crops tend to be exported to countries that differ to a larger extent in economic development from South Africa.

The total size of the specific export market for the relevant product group was positively significant for three products, namely sunflower seeds, pistachio nuts and vegetable material for plaiting. This entails that these products are exported to countries which rely more heavily on imports for the supply of the relevant product (and product group). For the other seven products the reliance on imports of the trading partner is not of significant importance for their export flows.

The exchange rate was only positively significant, in contrary to expectation, in the estimation of exports of hop cones. This indicates that the large the relevant exchange rate to more exports of hop cones which is not in line with any theoretical principle. For the other agricultural exports the exchange rate is not of significant impact to the amount of exports. This may be explained by the fact that most agricultural and food products are relatively more price inelastic by nature.

The total market size reflected by the total population of the trading partner was found to be significant in six estimations. The sign of the coefficient in the models for durum wheat, sunflower seed, cereal pellets and raspberries was positive as expected. This implies that the export of these commodities is positively related to the physical market size of the trading partner. The opposite is the case with the exports of hop cones and live goats.

Regarded as an important estimator of trade flows; distance was found to be of significance in four estimations. The sign of the coefficient for distance was negative, as expected, for the exports of cereal pellets and vegetable material for plaiting. Thus for the exports of these commodities transaction and transportation cost is of significant importance. The opposite is the case for soybean flour and raspberries, which exports are significantly positively impacted by distance (e.g. markets that are further away). For the other six commodities, distance does not play a significant role in the determination of export flows.

Having a common border with South Africa only significantly determines the trade of soybean flour. The export flows of the other emerging agricultural export products are not impacted by the existence of a common border with South Africa.

Being a member of the Southern African Development Community (SADC) was of positive significance for the exports of raspberries, mosses and soybean flour. This implies that a regional trade agreement is a significant determinant of the export flows of these commodities. The export flows of vegetable materials for plaiting is negatively affected by SADC membership. Membership of the Trade and Development Cooperation Agreement (TDCA), a FTA between South Africa and the EU, is of significant positive importance to the export flows of raspberries. This implies that the EU is a noteworthy export market for raspberries. This trade agreements has a negative impact on the export flows of cereal pellets, pistachio nuts and vegetable material for plaiting, indicating that these export flows are destined for markets outside the EU.

## **5. Conclusions**

The objective of his paper was to estimate the determinants of South Africa's upcoming agricultural exports by applying the gravity model. The aim of this exercise is to gain knowledge on agricultural trade diversification and export growth to ultimately provide guidelines for future export opportunities.

The results from the gravity model are not one-sided, as a variety of the investigated factors were found significant, although differing per product. One of the main findings was that the specified models do explain the variation in the export flows of the "champions" to a large extend. Thus exogenous factors will have a limited effect on the export of these products. The three factors that were found to be most significant in all the gravity models are population (physical market size), GDP of the trading partner (economic market size) and GDP of South Africa (supply capacity). Of less importance are: having a common border (natural links between trading partners), GNI per capita (stage of economic development) of the trading partner and South Africa and exchange rate (financial risk & currency devaluation). The total size of the specific export market for the relevant product group is also of lesser importance to the flows of emerging agricultural exports.



The implication of these outcomes is that the focus of future South Africa's agricultural trade diversification should be strategized along the following guidelines from a marketing perspective:

- The enhancement of food security in the rest of Africa by focussing on the exports of grains to large populated countries
- Economic and physical market size does play an important role in agricultural export growth, so those markets should be targeted first whether it's a bulk or niche product.
- Economic growth in South Africa spurs growth in agricultural exports, and growth in agricultural exports stimulates economic development. Thus a synergetic relationship between the two exists, possibly rationalised by an increase in investor's confidence.
- South Africa's neighbouring markets are small and are not able to absorb large amount of agricultural exports.
- The stage of development of an export market is not of trivial importance to agricultural export growth. Thus export diversification should focus on markets in all stages of economic development: developing, emerging and developed.
- Exchange rate is subject to various endogenous and exogenous factors which are outside the control of the exporter; which has to bear the risk. However, fluctuation in exchange rates is not of significance to the export flows of the selected agricultural products.
- The focus of trade diversification should not solely be on traditional large import markets, as this is not necessary were the growth can be achieved.
- All South Africa's trading partner's propensity to import must be taken into account sufficiently and adequately when trade policy is formulated

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