

*Full Length Research Paper*

# The international trade prospective of agriculture sector in South African

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The objective of this paper is to analyse the international trade performance of the South African agricultural industry in aggregate and by product group categories. A useful tool in this regard is the Gini and intra-industrial trade coefficient (IIT), which is used to examine the international trade balance of South Africa. Moreover, Ordinary Least Squares (OLS) is also used to identify factors that may be necessary to achieve high IIT. The IIT coefficient, after 1994, achieved more than 85 percent, which is a record level even for industrialised countries. This high IIT performance reveals trade liberalisation between the Southern Africa Customs Union (SACU) and the European Union (EU), opening South Africa's market to the world. It also reveals that South Africa is able to increase its specialisation and flexibility to gain market access, and has shown a greater ability to compete in a changing trade environment. The results of the econometric analysis of IIT determinants give a greater magnitude to the coefficients export to Gross Domestic Product (GDP) and export -to -import ratios. These results imply that if South Africa's industries take measures to increase trade liberalisation, diversity, and the level of industrial specialisation, the IIT level would be higher, and significant economic gain might be achieved by minimising costs.

**Key word:** Gini and intra-industrial trade coefficient, the international trade performance.

## INTRODUCTION

During the past year and a half, the global financial environment has remained generally accommodative and world economy has expanded, recording a growth rate of some 5 percent in 2004, with a projected growth of between 4 and 4½ percent in 2005. While global economic growth has moderated somewhat in the second half of 2004 and in the first half of 2005, real income has still advanced at a rapid pace. The stronger world economy and high international commodity prices have contributed to the acceleration in growth on the African continent to a rate which has also amounted to around 5 percent in 2004 – the highest in eight years (South African Reserve Bank (SARB), 2004). The sharp increase in international commodity prices, especially oil prices, has contributed

to a moderate increase in inflation in most countries since the beginning of 2004. Crude oil prices have more than doubled from the beginning of 2004 to August 2005, in the face of strong global demand, geopolitical tensions and concerns regarding possible disruptions of oil production in some countries. While the prices of many other international commodities have receded somewhat from their upper turning points in early 2004, prices have remained high. Nevertheless, global consumer price inflation has picked up very little. In Africa, the average consumer price inflation has receded from more than 10 percent in 2003, to a single-digit level in 2004 (SARB, 2004). The performance of the South African economy in recent times seems to be more solid and consistent than previously. In fact, the business cycle has been in an upward phase for 71 months since September 1999, making this the longest upswing in the recorded economic history of South Africa. The Real Gross Domestic Product (GDP) registered twenty-three

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quarters of uninterrupted increase, on an average annualised rate of 3½ percent over this recovery, signifying an appreciable increase in real production per capita. The growth momentum over the past year-and-a-half has been sustained by strong domestic expenditure, alongside stronger world economy and generally favourable terms of trade (SARB, 2004). There has been a rise in merchandise export earnings from 2% in 2001, to 2% in 2002 and drastically to 23% in 2003 (Agrimark (AMT), 2004).

South Africa is ranked 38th amongst the leading exporters and 35th amongst the leading importers in world merchandise trade in 2003. Total exports amounted to \$36.5b and imports to \$41.1b. The total exports and imports from 1997 to 2004 in nominal terms have increased. Exports of agricultural products have nearly doubled, while imports have increased marginally (Agrimark, 2004). In an effort to understand better the international trade performance of agriculture by South Africa, a starting point would be to examine South Africa's current trade. Thus, the objective of this paper is to analyse the international trade performance of the South African agricultural industry in aggregate.

## THEORETICAL FRAMEWORK

Many developing countries have taken steps toward trade liberalisation and have undergone important policy changes. As a result, trade exports in particular, have expanded considerably. With this expansion Guzin and Haluk (2003) have observed a significant increase in the Intra-Industry trade (IIT) coefficient in most African economies; that is, the simultaneous buying and selling of the same or similar commodities. Openness to trade has long been seen as an important element of sound economic policy—in the alleviation of poverty and in promoting trade success. There is a preponderance of cross-country evidence that trade liberalisation and openness to trade increases the growth rate of income and output (Hoekman, Michalopoulos, Schiff and Tarr, 2002: 1; Jooste and Van Schalkwyk, 1998: 1). This, in turn, is linked directly and indirectly, to the level of income of people.

Since the pioneering work done of by Grubel and Lloyd in the mid-70s, much empirical work has been undertaken to examine IIT determinants. The cross-country model of intra- industry trade has long been studied to explain the level of sophistication of the trade structure and the level of development of countries (Alan, 2002). Grubel and Lloyd (1975) showed that the bulk of trade in industrial countries was intra -industry trade, with some qualification. They stated that it should be clear that IIT is a result, or the effect, of increased specialisation, not a cause. The underlying a determinants of a country's preparedness to compete internationally, and to adapt to changing circumstances are fiscal and monetary policy,

the factor market, investment, international trade, and restrictions such as tariffs and quotas. It should be noted that trade liberalisation has significant advantages for specialisation. This conclusion remains valid as shown in recent studies such as Globerman and Dean (1990 in Oleh and Peter, 1997). The notion that the degree of specialisation in IIT or high Gini coefficient's, correlating with the stage of development has led to a large body of literature and empirical studies (Alen, 2002; Guzin and Haluk, 2003).

One needs to be cautions when interpreting the IIT as an indicator of preparedness. On the another hand, a high IIT is broadly indicative of a greater flexibility to compete internationally and thus to be better prepared for trade liberalisation. On the other hand, a reverse causation could be argued that liberalisation, even only vis-à-vis the European Union (EU), can stimulate investment and efficiency improvements, which in turn, would be reflected in an increased IIT index. The proposition that trade liberalisation generates increased IIT is posited in the literature, though it remains, in fact, unresolved. Globerman and Dean (1990 in Oleh and Peter, 1997), argue against this proposition by analysing the Canada-US Free Trade Agreement.

Oleh and Peter (1997), present the results of a survey of Canadian firms which concludes that these firms do not plan to specialise further. The study also indicates that there appears to be a "topping out" or even reversal of increasing IIT levels, suggesting that product specialisation is not an expected outcome of the FTA between the US and Canada. Similarly, Steven (2003) examines whether a change in the level of protection has consequences for the IIT level in Australia and New Zealand. He has found no support for this hypothesis. One must however, be cautious about inferences regarding these studies, as they analyse the effect of liberalisation or protectionism on IIT for industrialised countries, where the notion of topping out may be more applicable. Nevertheless, most studies agree that the impact of trade liberalisation on IIT is inconclusive.

The purpose of this study is to examine the agricultural position of South Africa in a global comparison to Gini and IIT and to draw inferences about trade flexibilities. Ingco and Townsend (Jooste and Van Schalkwyk, 1998: 6) argued that had developing countries been at the negotiating table for the right reasons, that is finding ways and means to take advantage of the liberalisation process, they would, in any case, have received differential treatment. By resisting liberalisation and the opportunity to anchor domestic reform in an international framework, a region such as Sub-Saharan Africa (SSA) has foregone the opportunity to reap substantial gains from the Uruguay Round. This is reinforced by a study conducted on the possible impact of the Uruguay Round on developing countries by Brain and Jeans (2005). They indicated that larger gains would have been realised if developing countries chose to participate wholeheartedly

in the world trading system by undertaking (trade) reforms of their own (Jooste and Van Schalkwyk, 1998: 7).

**METHODOLOGY AND DATA**

In an effort to gain a better understanding of the impact of trade liberalisation on the agricultural industry in South Africa, a starting point would be to examine South Africa's current trade. Useful tools in this regard are the Gini-coefficient, used to examine the degree of concentration for both export and import capability, and the IIT.

**The gini coefficient**

The extent of concentration is determined by various factors, such as consumer preferences that result in different trade streams; trade barriers prohibiting or restricting trade between different regions and certain products or product types; trade agreements and trade incentives; infrastructure; political stability or instability in a country; and the ability to pay, which is a function of income (Lubbe, 1992). The Gini coefficient is defined graphically as a ratio of two surfaces involving the summation of all vertical deviations between the Lorenz curve and the perfect equality line. The Gini coefficient was developed to measure the degree of concentration (inequality) of a variable in a distribution of its elements. It compares the Lorenz curve of a ranked empirical distribution with the line of perfect equality. This line assumes that each element has the same contribution to the total summation of the values of a variable. The Gini coefficient ranges between 0, where there is no concentration (perfect equality), and 1, representing total concentration (perfect inequality). The closer the coefficient is to 1, the more unequal the distribution (Brian and Jean, 2005). According to Hanson and Simmons (1995), a Gini coefficient is a relatively precise measurement of market concentration. The Gini coefficient is formulated by the following equation:

$$G_i = 1 - \sum_{k=0}^{k=n-1} (X_{k+1} - X_k)(Y_{k+1} + Y_k)$$

Where:  $G_i$  = Gini coefficient,  $X$  = Cumulated proportion of the variable being investigated,  $Y$  = Cumulated proportion of the export value

**The intra-industrial trade coefficient**

The second analytical tool used was an IIT coefficient with its key determinants. To determine attributes that contribute to high IIT an Ordinary Least Square (OLS) econometrical model was used. This tool is useful for measuring the level of concentration and patterns in trade. As Lubbe (1992) states, in order to evaluate countries' international trade performance, concentration indices may be used as proxies for determining specialisation and the market power of a country. This study will explore the South African level of specialisation and/or diversification in agricultural trade.

In trade literature, the amount of intra-industry trade, or trade in similar goods, is often taken as a measure of the diversity, degree of specialisation and the degree of technical sophistication of a country's industrial sector. This can be used to infer a country's ability to compete in a changing environment (Oleh and Peter, 1997). Grubel and Lloyd (1971) define the IIT index ( $GLit$ ) as follows:

$$GL_{it} = 1 - \frac{|X_{it} - M_{it}|}{X_{it} + M_{it}}$$

Where:  $X_{it}$  = Exports of industry  $i$  in period  $t$

$M_{it}$  = Imports of industry  $i$  in period  $t$ .

The value of  $GL_{it}$  lies between 0 and 1; zero indicates a low trade balance, while a value closer to 1 indicates a high rate of importing and exporting of the same or similar products by an industry. The key determinant of the IIT model is drawn from the theoretical and empirical literature. The model follows the general modelling of IIT determinants as developed by Oleh and Peter (1997), and is specified for aggregate agriculture IIT of South African agricultural trade over the period of 1965 to 2005. The expected signs of the independent variables are shown below:

$$IIT_j = F(EXGDP_j, TIMB_j, EXP\_IMP_j, RDEBT_j, RER_j, D1) \quad (1)$$

(+)            (-)            (-)            (-)            (-)            (+)

Where:  $EXGDP_j$  = Ratio of total export to agricultural GDP,  $TIMB_j$  = Trade imbalance,  $REXP\_IMP_j$  = Ratio of total export to total import,  $RDEBT_j$  = Ratio of total agricultural debt to agricultural GDP,  $RER_j$  = real exchange rate,  $D1$  = South Africa trade liberalisation after year 1998 take one, otherwise zero.

Since IIT is a multidimensional issue, it is important to indicate and justify the model specification, and the expected sign in relation to the index.

1. The effect of export to GDP ratio ( $EXGDP$ ), is an indication of the growth of the economy and the success of international trade. A higher GDP would most likely affect the IIT coefficient positively (Oleh and Peter, 1997). Therefore, the expected sign would be positive.
2. IIT is biased by the degree of trade imbalance. As Verbeke, et al. (2000) indicated,  $TIMB$ , as a variable controls the biasness in the estimation defined as:

$$TIMB_j = |X_j - M_j| / (X_j + M_j)$$

Where  $X_j$  is defined as the total export of country  $j$ , and  $M_j$  is defined as the total import of country  $j$ . Thus, the variable represents net trade as a share of the total trade, and will take the value of zero at the lower extreme. Where there is no imbalance and value of one, there are either no exports from, or imports to, a country (that is complete imbalance) (Oleh and Peter, 1997). The expected sign should be negative.

3. The balanced effect ratio of total commodity export to total commodity import shows there is higher specialisation in the country. The higher  $EXP\_IMP$  reveals that the country focuses on exports. Scale effects would likely decrease the coefficient of IIT. Then the expected sign of  $EXP\_IMP$  is negative (Alan, 2002).
4. Exchange rate and debt is expected to have a negative sign.
5. The expected sign for the dummy variable of trade liberalisation is positive. It is hypothesised that trade liberalisation and regional integration schemes should be positively related with IIT reflecting the increased possibility of IIT.

The model follows the general modelling of Grubel and Lloyd's (1971) IIT index as previously defined. In this case, the IIT determinant of OLS is refined and estimated in log linear form as follows:

$$\ln IIT = \ln EXGP_j + \ln TIMB_j + \ln EXP\_IMP_j + \ln RDEBT_j + \ln RER_j + \ln D1 + C \dots (2)$$

To apply the above -mentioned method, secondary data were used from sources such as the South Africa Reserve Bank, Statistics South Africa, the International Trade Centre (ITC), and the Food Agricultural Organisation (FAO).

## RESULTS AND DISCUSSION

In this section, results on the IIT and the determinants attributed to high IIT will be reported. The section has three subsections. The first subsection deals with the international trade performance of Southern Africa Customs Union (SADC) (Gini and Lorenz curve approach), and the last two subsections with IIT index analysis different product groups and agricultural commodities in aggregate (attributed to high IIT econometric analysis will be given), respectively.

### The international trade performance for SADC agricultural commodities: Gini and Lorenz curve approach

The total agriculture export by SADC in 2005 was about R26.2 million. Figure 1 shows that the biggest trade was to EU countries, accounting for about 24 percent; SADC followed (about 16%); then the UK (about 13.5 percent). Imports by other countries together, accounted for less than 30 percent. In terms of SADC import origins (Figure 1), Latin America (Brazil and Argentina) was the biggest exporter to the SADC region, accounting for 25%, Asia (Malaysia, Indonesia, India, China and Thailand) was the second exporter (21.4%) and the EU and the USA were in third and fourth places, respectively (at 13.2 percent and 10.5%). Oceania and UK imports accounted for less than 6%. Figures 2 and 3 show that the Lorenz curves for SADC exports and imports of agricultural commodities to/from 21 countries in 2005, respectively. The x-axis reflects the countries that imported (exported) agricultural products from/to SADC, ranked from lowest to highest. The y-axis shows the cumulative percentages of exports/imports by SADC. As indicated (in Figure 2), the cumulative percentage of exports to 16 countries is less than 3 percent. This indicates that agricultural export by SADC is highly concentrated in a few countries. The Gini coefficient of export was calculated as 0.6108.

A similar explanation can be given for import from (Figure 3). The cumulative percentage of import to 16 countries is around 3%, and the calculated Gini coefficient was 0.7077. As stated earlier, the main export destinations are the EU and SADC. The trend of concentration appears to have remained the same. If we assume that the biggest share of exports and imports of SADC were from South Africa, we can conclude that the regional trade and the bilateral trade agreements created

market opportunities to South Africa, to increase the export and import share. As Assarson (2005) indicated, South Africa has comparative advantages for the European Union in terms of natural resources, textiles, agricultural products, wine, and a labour force. Trade with Africa, America, and Asia also constitute an important part of the South African market. During 1999 and 2003 the total imports by South Africa increased by 54 percent and the total exports by 37%. In the same period, the European Union increased its total imports and exports by 29 and 30%, respectively. These figures imply that South Africa has benefited from trade liberalisation and trade agreements. This may be taken as proof that trade creation has been realised.

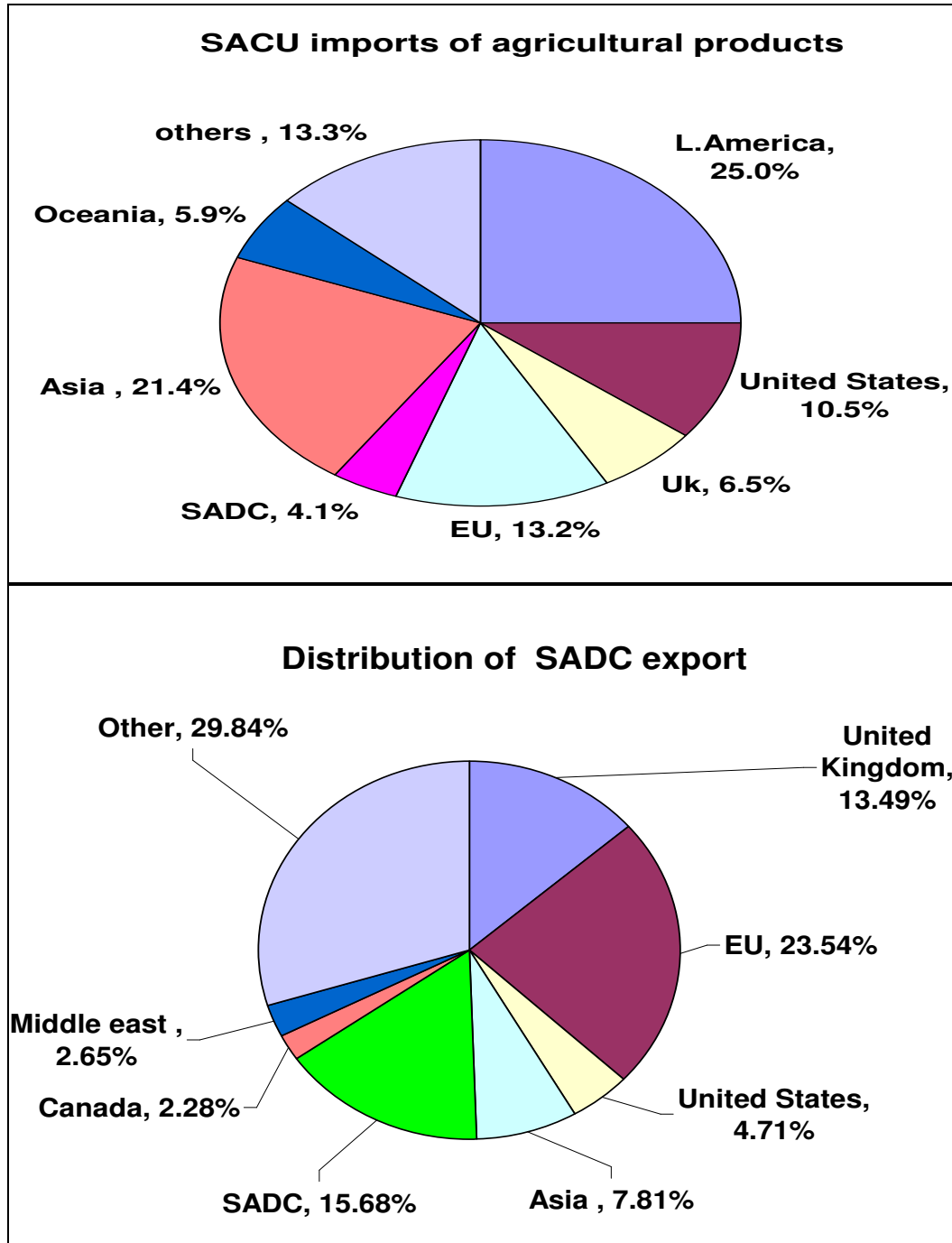
Moreover, the Organisation for Economic Co-Operation and Development (OECD) (2006) report shows that, trade liberalisation (or the opening of the agricultural sector to the world), placed South Africa among the world's leading exporters of agro-food products, especially wine, fresh fruit and sugar. The beginning of the current decade witnessed particularly strong agricultural export growth (Figure 4). South Africa's agricultural export revenues reached almost 9 percent of the total value of national exports. Europe is by far the largest destination, absorbing almost one-half of the country's agricultural exports. Agricultural imports are also growing, but less rapidly than exports accounting for 5 - 6 percent of the total annual imports since 2000 (OECD, 2006).

Furthermore, the OECD (2006) report shows that, in the broader context, South Africa has benefited from trade liberalisation, and the expected welfare gains are largely due to reform in the manufacturing industry. The benefit from reform in agriculture is important, accounting for one-third of the total of South Africa's welfare gains. Within South Africa, black and coloured communities have become better off as a result of reform, while white households showed a decline in welfare. From the regional perspective, the less developed inland provinces' gains were much better, while the majority of coastal provinces lost, marginally.

### The South African international trade performance analysis

#### *Intra industrial trade analysis for different product categories*

Table 1 shows the calculated IIT indices of different products grouped by product code. The data were divided into four sub-periods (that is from 1980 to 1987, 1988 to 1993, 1994 to 1997 and 1998 to 2002, respectively). The IIT index is calculated based on the average imports and exports during the sub-periods. During the third period (1994 -1997), there was good progress in all products, except animal and vegetable oils. In the fourth period (1998 to 2002), the SITC



**Figure 1.** Percentage distribution of imports and exports of agricultural products. Source: Abstract of agricultural statistics (2006).

category codes 0, 1 and 6 showed a slight decline, while the performance of other category codes showed a significant improvement (Table 1).

Moreover, Table 1 shows that the highest level of IIT index was recorded in the first period (1980 -1987) in animal and vegetable oils (SITC category 4) at 62%, followed by chemical products and basic manufactures

(both at 61% index). In the second period (1988 to 1993), beverages and tobacco (SITC category 1) recorded first place (69%), animal and vegetable oils in the second (62%), followed by basic manufactures (with 60%). In the third period (1994 -1998), product groups of food and live animals, beverage and tobacco, chemical products and basic manufactured goods-achieved more

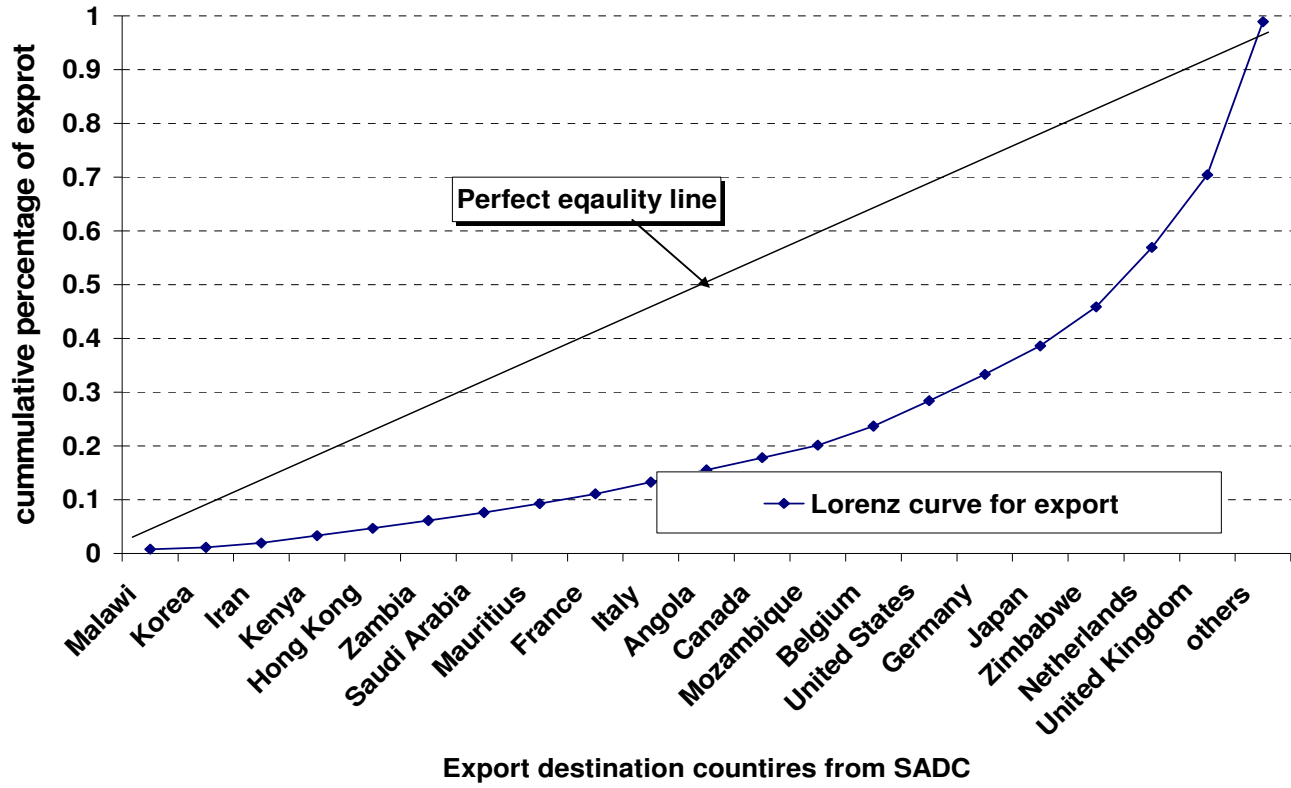


Figure 2. Lorenz curve for SADC agricultural export in 2005. Source: Author calculation.

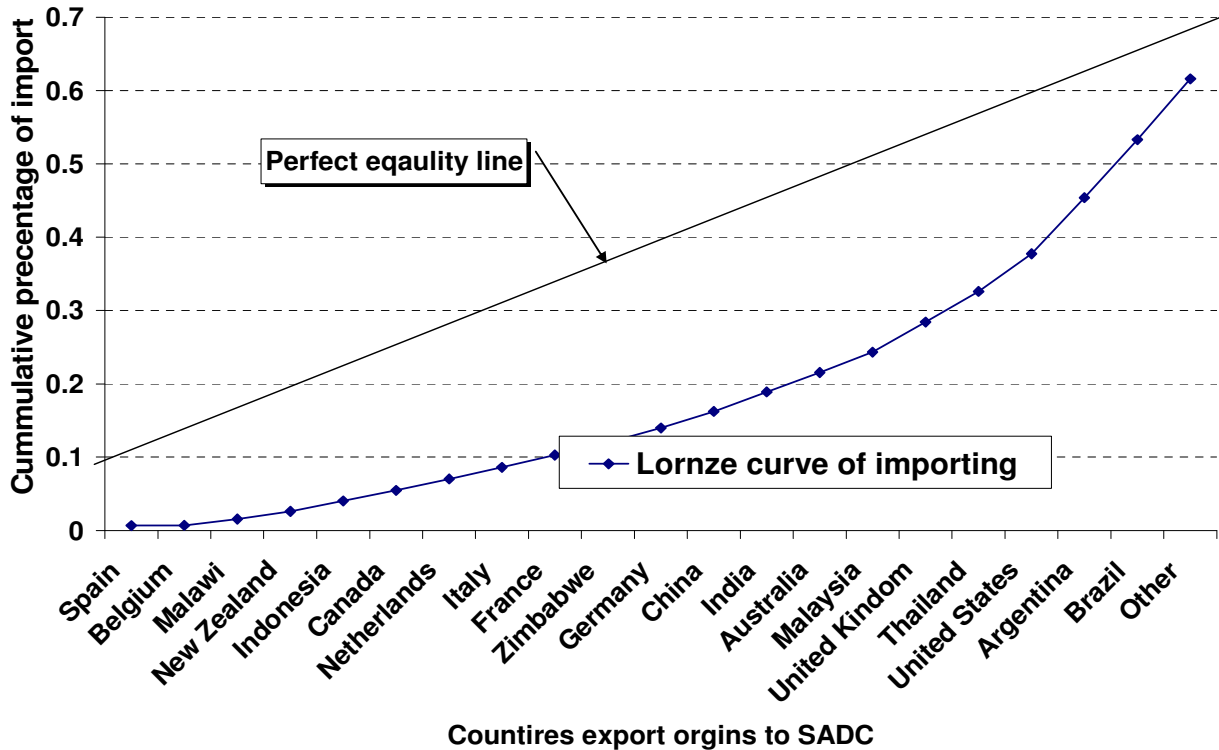


Figure 3. Lorenz curve for SADC agricultural import in 2005. Source: Author calculation.

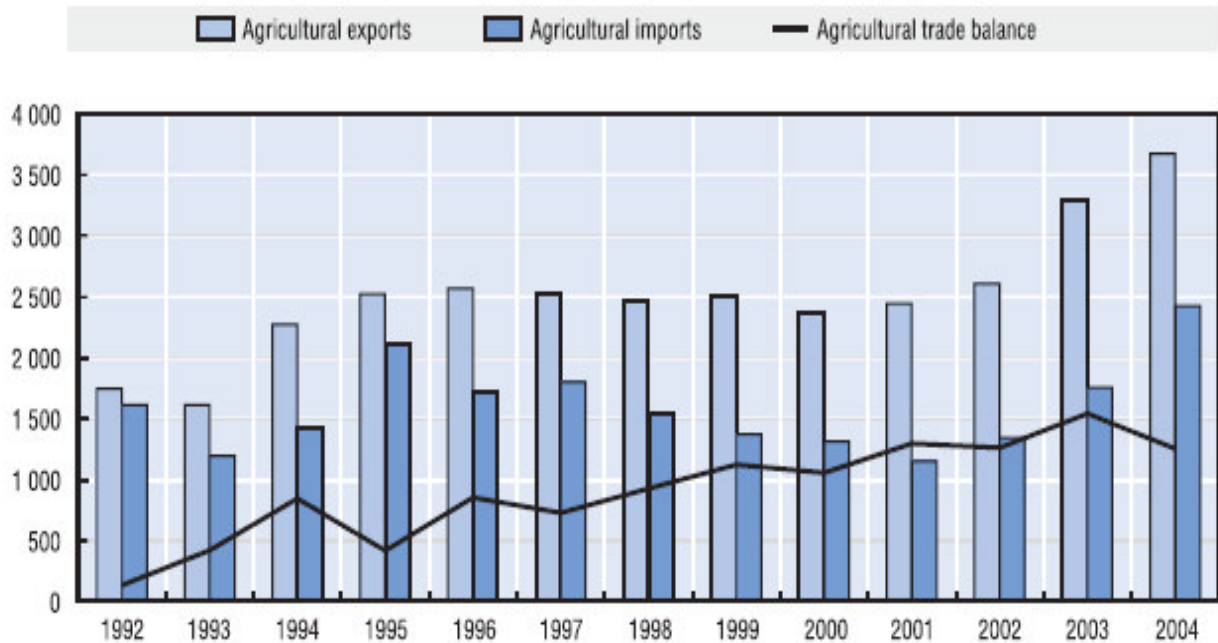


Figure 4. South African agricultural exports and imports, in 1992 – 2004 US\$ million. Source: OECD (2006).

Table 1. Intra-industry trade by product group.

Sitc code	Product group	Average 1980-1987	Average 1988-1993	Average 1994-1997	Average 1998-2002
0	Food and live animals	0.50	0.53	0.75	0.68
1	Beverages and tobacco	0.57	0.69	0.84	0.68
2	Crude materials, inedible, except fuels	0.38	0.26	0.42	0.43
3	Mineral fuels, lubricants and related materials	0.33	0.13	0.62	0.88
4	Animal and vegetable oils, fats and waxes	0.62	0.62	0.29	0.38
5	Chemicals and related products, n.e.s.	0.61	0.59	0.80	0.88
6	Manufactured goods classified chiefly by material	0.61	0.60	0.73	0.52
7	Machinery and transport equipment	0.12	0.19	0.39	0.62
8	Miscellaneous manufactured articles	0.26	0.38	0.53	0.72
9	Commodities and transactions not elsewhere classified.	0.02	0.05	0.22	0.65
10	All commodities	0.77	0.77	0.98	0.97

Source: author calculation.

more than a 70% index.

Contrary to these figures, the fourth period (1998 - 2002), except for product categories codes 2 and 4, all product groups showed more than a 50% record. This high IIT reveals that trade liberalisation and trade agreements with SADC and the EU could be contributors to the higher IIT index (Table 1). Furthermore, this high IIT performance reveals that South Africa was able to increase specialisation and flexibility to gain market access. Furthermore, this high IIT reveals that South Africa has the ability to compete in a changing trade

environment.

#### ***Intra industrial trade analysis for agricultural commodities in aggregate***

The calculated IIT indices for the agricultural industry are given in Figure 3. It is interesting to note that the IIT indices performance after 1994 fluctuated between 64 percent and 96%. While prior to the structural adjustment shows lower than that of the highest of 95% in 1985 and

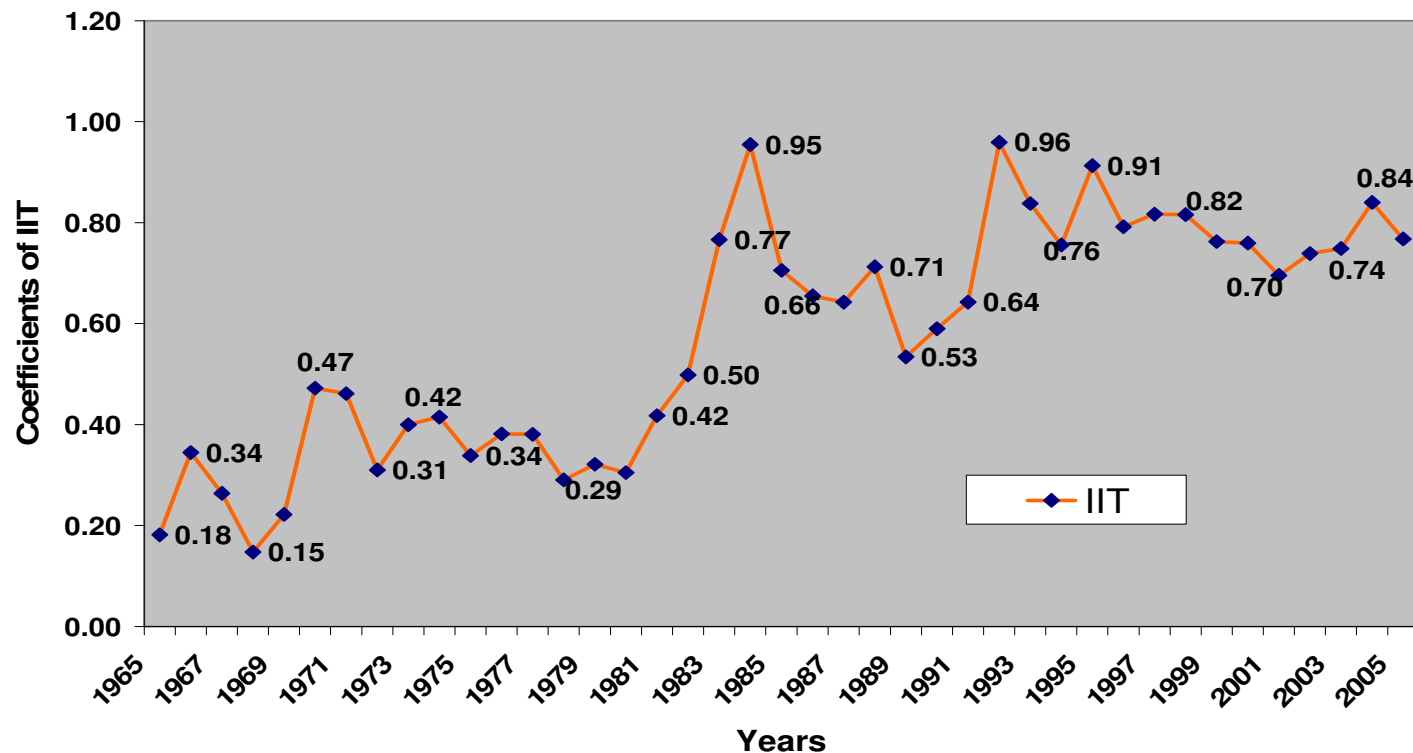


Figure 5. IIT coefficient for agricultural industries (from 1965 to 2006). Source: author calculations.

the lowest of 18% in year 1965.

From Figure 5, the high value of the IIT record during the period prior to 1985 may be attributed to the fact that the values of imports and exports moved in equal proportions (Figure 6). Since 1994 the value of imports and exports started to rise, resulting in a moderate IIT. After 1995, the value of exports increased substantially, while imports also increased marginally. From 1998 the value of imports and exports increased proportionally which resulted in higher IIT; this high IIT is a good indicator that South Africa has increased in specialisation and competitiveness. This may be due to (i) South Africa's being accepted back into the world community, (ii) gradual momentum gained after the deregulation of the agricultural industry, resulting in a freer domestic market and (iii) the process of complying with the Agreement of Agriculture (AoA) that resulted in a greater number of more open markets, both domestically and internationally.

#### Model estimation for determinants of IIT

In this section, the necessary statistical test and the long-term relationship among the variables are estimated; the section has three subsections. The first two subsections deal with stationary and integration tests, while the third section deals with the model estimation.

#### Stationarity test (unit root tests)

Previous studies indicate that time series data, be it monthly, quarterly or annual, are likely to be nonstationary (see for example Saghaian et al., 2005; Cho et al., 2004). In this study, the Augmented Dickey-Fuller (ADF) unit root test, with and without a linear trend, is performed to test for the stationarity of the variables considered. The ADF test with a linear trend checks if the variables are trend stationary. Following the above technique the standard practice of unit root tests literature, both the level and first difference of each data series were tested; the results are presented in Table 2.

In this study, the ADF unit root test, with and without a linear trend is performed. The ADF test with a linear trend checks for the trend stationary of the variables. The results are presented in Table 2. Since the ADF test is sensitive to the choice of order of the lag, the starting point was the over-specification ADF test where the order of the lag was relatively larger and that corresponds to the highest (absolute value) Akaike Information Criterion (AIC).

From Table 2 the absolute values of the ADF test in level shows that it is statistically lower than the 95% critical value. This suggests that the null hypothesis of the unit root is not rejected and none of these variables are (trend) stationary in levels at a 5% significance level. Each series was differenced and the ADF test performed.



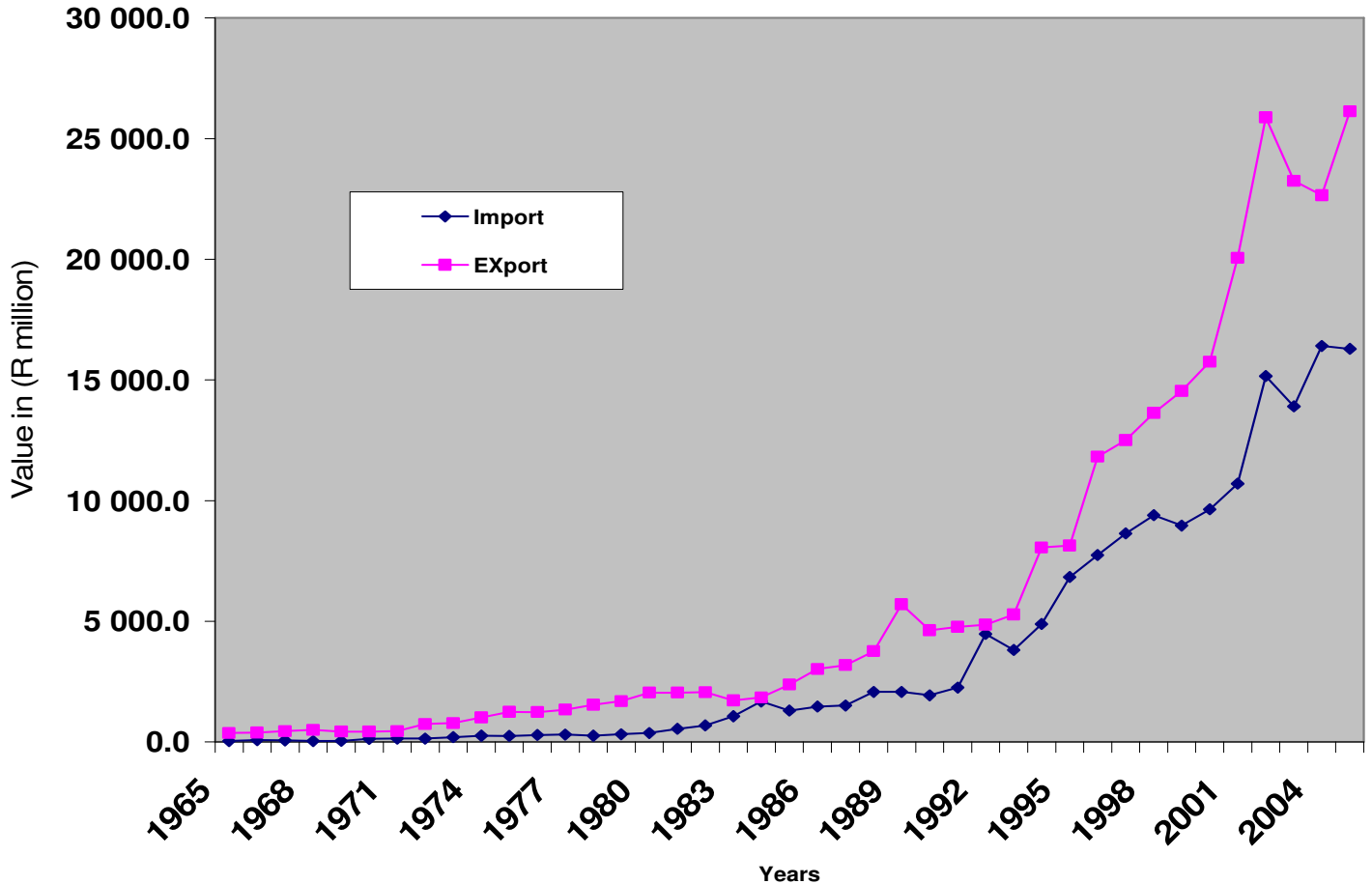


Figure 6. Trends in South African total value of agricultural exports and imports. Sources: Abstract of agricultural statistics (2006).

Table 2. ADF test results – with and without trend.

Variables	Specification	In levels			Differenced once		
		Lags	Critical value	Test statistics	Lags	Critical value	Test statistics
IIT	Constant only	2	-2.9446	-2.1795	1	-2.9472	-6.625
	Constant with trend	4	-3.5386	-3.1902	1	-3.5426	-6.4207
EXGDP	Constant only	4	-2.9446	-1.6157	1	-2.9472	-5.9033
	Constant with trend	4	-3.5386	-1.4265	1	-3.5426	-6.0356
TIMB	Constant only	4	-2.9446	-1.7205	1	-2.9472	-6.4992
	Constant with trend	4	-3.5386	-2.7265	1	-3.5426	-6.4071
REXPIMP	Constant only	4	-2.9446	-1.9953	2	-2.9472	-4.4159
	Constant with trend	3	-3.5386	-2.4604	2	-3.5426	-4.3039
RDBTG	Constant only	1	-2.9446	-1.9866	1	-2.9472	-4.7362
	Constant with trend	1	-3.5386	-2.5522	1	-3.5426	-4.6365
RER	Constant only	1	-2.9446	-0.51014	1	-2.9472	-4.4985
	Constant with trend	1	-3.5386	-2.789	1	-3.5426	-4.4448
D1	Constant only	1	-3.5386	-0.44949	1	-2.9472	-4.1833
	Constant with trend	1	-3.5386	-1.6089	1	-3.5426	-4.3263

95% critical value for the augmented Dickey-Fuller statistic, Source: author calculations.

**Table 3.** Co-integration analysis.

<b>Test assumption: No deterministic trend in the data</b>				
<b>Series: IIT EXGDP TIMB REXPIMP RDBTG RER D1</b>				
<b>Lags interval: 1 to 1</b>				
	<b>Likelihood</b>	<b>5%</b>	<b>1%</b>	<b>Hypothesised</b>
<b>Eigenvalue</b>	<b>Ratio</b>	<b>Critical value</b>	<b>Critical value</b>	<b>No. of CE(s)</b>
0.611439	100.7148	109.99	119.80	None
0.527315	63.84783	82.49	90.45	At most 1
0.315780	34.62409	59.46	66.52	At most 2
0.221367	19.82453	39.89	45.58	At most 3
0.154922	10.06612	24.31	29.75	At most 4
0.071994	3.501372	12.53	16.31	At most 5
0.014949	0.587420	3.84	6.51	At most 6

\*(\*\*) denotes rejection of the hypothesis at 5 and 1% significance level, LR rejects any co-integration at 5% significance level  
Source: author calculations.

The result shows that the unit root null hypothesis is rejected at a 5% significance level (Table 2). The results show that all the series tested are not stationary in (log) levels, but stationary at a 5% significance level after being differenced once, fulfilling a necessary condition for a co-integration test.

### **Co-integration test**

To test co-integration, Johansen (1990) has proposed two statistics which can be used to evaluate the rank of the coefficient matrix, or the number of co-integrating relationships. The one used here is the likelihood ratio test of the null hypothesis, that the number of co-integrating vectors is  $r$  versus the alternative  $r+1$  vector. In this case, the null hypothesis is the number of co-integrating vectors equals 0. Table 3 shows that Likelihood Ratio (LR) statistics are below their corresponding coefficients of the critical value thus, co-integration between the variables pairs is unlikely. The Johansen tests reject the hypothesis at 5 percent (1 percent) significance level LR (Table 3). The result shows clearly that there is no long-term co-integrating vector among the variables. Table 3 shows that co-integration tests were conducted with the assumption no deterministic trend in the data had been preformed, proving that there is no long-term relationship; the necessary condition to use OLS regression was done.

### **Estimation of the model**

In this section, results for the determinant of IIT are reported. The overall explanatory power is quite high at 95%. Except for RER (not significant and not reported; (Table 4) all other variables were found to be statistically

significant at the specified level of significance. The hypotheses put forth regarding determinants of IIT were confirmed in all the results. The positive coefficient of ratio of export to GDP indicates that scale effects dominate proximity effects, resulting in a positive coefficient and significance. The 5% significance level of the variable implies there was a strong effect of GDP on the level of intra -industry trade. That shows that an increase of 10% in the share of export to GDP, leads to the increase of IIT by 0.5% (Table 4).

From Table 4 the net share of South African trade (TIMB) was found to be positive and significant at 1%. This implies that the South African agricultural trade is somewhat imbalanced. This implies that either exports or imports are weighted, which results in a decreased IIT index. This also implies that South Africa needs to increase specialisation to balance trade. Similarly, the interpretation can be made as a previous explanation for exports to imports ratio share (REXP\_IMP) variable. This implies that on average, exports from South Africa are more than the imports.

On the other hand, it is interesting to note the result of debt (DEBT) was found to be negative and significant (at a 1% significance level). This implies that by further increasing debt by 10%, led to a decline of IIT by 0.5%, which is a good indicator that South African agricultural industries were suffering from the debt crisis that affected international trade performance. Moreover, this is a good indicator that South African agricultural industries need to reconsider how to decrease their level of debt. Furthermore, the agricultural industries are in need of expert assistance in how to manage debt effectively and efficiently, so that farmers will be able to reap the highest benefit from credit access.

The dummy variable for trade liberalisation was found to be significant at 10% significance level, with a positively estimated coefficient of 0.005 (Table 4). The

**Table 4.** Log-linear estimates of IIT data, using ordinary least square (data from 1965-2005).

Independent variable	Estimated coefficient	"t" - value
DEXGDP <sub>j</sub>	0.054	2.52**
DTIMB <sub>j</sub>	-0.079	15.13*
DREXP_IMP <sub>j</sub>	-0.880	-80.12*
DRDBET <sub>j</sub>	-0.056	-2.88*
DRER <sub>j</sub>	0.005	0.28
DD1 <sub>j</sub>	0.005	0.31***
Intercept	-0.0028	
DW-statistic	2.5	
R <sup>2</sup>	0.97	
Adjusted R <sup>2</sup>	0.95	

\*, \*\*, and \*\*\* denote significant at the 1, 5, and 10% levels, respectively. Source: author calculations.

small estimated coefficient implies that the effect of trade liberalisation may be observable over a longer period of observation. Generally the finding of this study indicates that South Africa needs to reinforce the position of the bilateral agreement with the regional or even multilateral trade liberalisation agreement.

## Conclusion

This chapter investigated the trade performance of South Africa. The analytical tools used were the Gini coefficient and the Intra-Industrial Trade coefficient with its economic determinates that contribute to achieving a higher IIT. This tool is useful for measuring the level of concentration and patterns in trade. The cumulative percentage of exports/imports to 16 countries is less than 3 percent, respectively. This indicates that agricultural export by SADC is highly concentrated in a few countries. The Gini coefficient of exports and imports were calculated as 0.6108 and 0.7077, respectively. The main export destinations and origins were EU and SADC. The trend of concentration appears to have remained the same. This implies that the regional trade and the bilateral trade agreements created market opportunities for South Africa to increase its export and import share. The study shows, on the disaggregate IIT calculation for the product group, for the second period (that is after structural adjustment from 1998 - 2002), that there was an increase, with effective competition lying in chemical and mineral related product groups. However, except for crude related materials, and animal and vegetable oils, all product group categories have also achieved a considerably high level of specialisation, comparable to advanced countries.

Whereas on aggregate, agricultural IIT calculations after 1994, show a record of more than average, during this period South Africa exported products of approximately the same value as that of imported ones (this shows an ability to maintain the capacity of balanced trade), possibly implying that South African industries are

highly advanced. Additionally, trade liberalisation and trade agreements open up market opportunities to increase exportable surpluses, probably as a result of increased specialisation and competitiveness. The higher level of IIT after 1998 reveals the ability of South African industries to adjust to a more competitive environment, thus reinforcing the position that a bilateral agreement should be accompanied by regional or even multilateral liberalisation. The finding of the econometric analysis of IIT determinants gives magnified effect to the coefficients of export to import ratios and the TIMB (trade balance). These results imply that if South African industries implement measures to increase trade liberalisation and diversify the level of industrial specialisation, the IIT level would maintain high, and significant economic gain might be achieved from minimising costs.

The negative and significance (at 1%) level for the debt (DEBT) variable, implies that South African agricultural industries suffered from a debt crisis, which affected the international trade performance, negatively. This is a good indicator that South African industries need to reconsider how to decrease the level of debt. Moreover, the agricultural industries are in need of expert assistance on how to manage debt effectively and efficiently, so that farmers will be able to reap the highest benefit from credit access.

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