Growing the Sugar Industry in South Africa

Document 2: Comparative analysis of the different regions of the South African sugarcane industry.

September 2011

The reporting on the outcome of the study consists of a number of reports as listed below. This Report corresponds to the report **Document 2** below:

Management Report: Lessons, Justifications and Challenges – Guidelines for Decision Making.
Document 1: Overview of the Sugar Industry: Contribution to Social and Economic Development and Contentious Issues.
Document 2: Comparative Advantage Analysis of the Sugar Industry.
Document 3: Legislative Environment of the Sugar Industry.
Document 4: Evaluation of the Viability of the Sugar Industry: A Cost Benefit Analysis and Macroeconomic Impact analysis.
Document 5: Investigation and Evaluation of Alternative Uses and Products: A Cost Benefit and Macro-economic Impact Analysis.

National Agricultural Marketing Council
Strategic positioning of South African Agriculture in dynamic global markets

Block A, 4th Floor
Meintjiesplein Building

536 Schoeman Street, Arcadia

Pretoria 0002

Private Bag, X935, Pretoria 0001

Tel: 012 341 1115

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Comparative analysis of the different regions of the South African sugarcane industry

Abstract

South Africa shows a very strong comparative advantage when producing sugarcane in an undistorted world market. The result of this study shows that the South African sugarcane industry needs protection and protection, as long as the world market is distorted. The paper evaluates the comparative economic advantage (CEA) of four agro-ecological zones of sugarcane production in South Africa namely: Northern irrigated, Coastal, Midland and Zululand region. The effect of policy on the industry is highlighted on a regional basis.

Current policy measures do not provide sufficient protection to the South African sugarcane industry against a distorted world market. This situation is amplified by domestic policy/regulatory measures pertaining to inputs (e.g. taxes on fuel, regulated prices in the electricity sector). Given the potential of this industry the current protection the industry attracts must be reviewed, as well as measures to soften the impact of especially regulated prices.

1. Introduction

The purpose of this study is to achieve the following specific objectives:

- to evaluate if the South Africa sugarcane industry have a comparative advantage per region to produce sugarcane.
- to analyse the potential impacts of removing the existing price and institutional intervention, to enhance the economic efficiency of alternative productive use of resources
- to identify points of policy, technology and institutional intervention which may enhance the economic efficiency of alternative uses of resources.

This analysis will provide insight into the sugarcane industry with a proper understanding of the forces that drive profitability, sustainability and competitiveness in the industry. It will also help to determine the key success factors and constraints impacting on the comparativeness of the industry.

The importance of the sugarcane industry is reflected in its annual gross production value of R4.42 billion (2008/09), which represents 3,38 % of the total value of production for all agricultural commodities and ranks the sugarcane industry the tenth largest in the agricultural field (DAFF, 2010). The average growth rate for the last 10 years, in terms of value of production, at nominal terms for the industry, was 7.16 % and the real growth rate was 0 %. Hectares planted decreased by 7.82 % and production decreased by 1.12 % over the same period. The export quantity decreased from 1.7 million tons in 2000 to 0.9 million tons in 2009 (DAFF, 2009).

The contribution of the sugarcane industry to the rural community cannot be underestimated. The long history of state intervention left South African agriculture with a host of laws, ordinances, statutes and regulations which, in many cases, still affect all aspects of agriculture, including volatility of input prices (fertilizer, fuel and packaging material). Administered prices have increased significant and the impact of changes in the economic policy environment pose critical threats to the changes in production and trade patterns of the sugarcane industry.

Comparative economic advantage (CEA) is the most common criteria used to evaluate the economic efficiency of alternative productive uses of scarce land, labour, capital and water resources, within a particular country or region (Hassan and Faki (1993); Jooste and van Zyl (1999)). The CEA methodology is used to understand the different ecological zones. The paper discusses each production region and measures it in terms of CEA methodology. The paper also looks into 'what if' scenarios in terms of the global and international market.

2. Comparative advantage versus competitive advantage

To understand the basis of the analysis it is important to understand the meaning of both comparative and competitive advantage. Comparative advantage is an economic concept that a country should specialize in producing and exporting only those goods and services which it can

produce more efficiently (at lower opportunity cost) than other goods and services (which it should import). Comparative advantage results from different endowments of the factors of production (capital, land, labour), entrepreneurial skill, power resources, technology, etc. It therefore follows that free trade is beneficial to all countries, because each can gain if it specializes according to its comparative advantage. A basic concept of international trade theory, it is founded on the work of the British economist, David Ricardo (1772-1823), on comparative cost (Internet source, 2011). Gupta (2004) emphasized that the literature on international trade and policy contains a number of reasons why one country may have a comparative advantage in exporting a commodity to another country. For convenience, most of these reasons may be classified into (1) technological superiority, (2) resource endowments, (3) demand patterns and (4) commercial policies.

Gutha (2009) argues that competitive advantage is an advantage over competitors gained by offering consumers greater value, either by means of lower prices or by providing greater benefits and services that justify higher prices (Internet source, 2011). He also mentioned the following:

> *"Porter (1985) emphasised competitiveness, at the level of a firm, in terms of competitive strategies, such as low cost and/or product differentiation. However, his description of competitiveness did not entail a formal conceptual definition. As noted by Cho (1998), 'Despite all discussions on competitiveness however, no clear definition or model has yet been developed. There is even ongoing debate about the "entity" of competitiveness.' Hoffman (2000) developed a definition of sustainable competitive advantage (SCA) based on Barney (1991), together with dictionary meanings of each term as 'An SCA is a prolonged benefit of implementing some unique value-creating strategy, not simultaneously implemented by any current or potential competitors, along with the inability to duplicate the benefits of this strategy.' Obviously, this definition emphasises competitive advantage of a firm based on firm-specific factors and thus ignores macro aspects of comparative advantage."*

3. Methodology

Comparative economic advantage (CEA) analysis, evaluates the economic efficiency of alternative productive uses of scarce land, labour, capital and water resources within a particular country or region (Jooste and van Zyl, 1999). Hasan and Faki (1993) state that for any product to attract different resources, such as research, capital, etc, it must show a comparative advantage over alternative products that are available. Consequently, principles of CEA ought to guide economic policy reforms, to direct resources to their most productive use (Jooste and van Zyl, 1999). Appendix 1 provides a more detailed explanation on the methodology of the CEA analysis.

4. Empirical formulation and data collection

Due to market failure and government intervention, market prices often do not reflect the scarcity value of goods and services. It is therefore necessary to compile an enterprise budget for farm-gate prices, which are also referred to as market prices. This budget is divided into

income, tradable expenditure and non-tradable expenditure. It is further necessary to calculate the economic price (shadow price) of income, goods and services. Hence, market prices are those prices that prevail in a market, where market failure and government intervention influence prices. In order to calculate different economic prices, commercial enterprise budgets, obtained from various sources, were used as basis. Appendix 2 provides a detailed explanation of the empirical formulation of the CEA analysis.

4.1. Market income

Market income for each different region is calculated as Yield (tons) x Recoverable Value (RV price). These prices were provided by the South African Sugar Association (SASA) and are 56 % of the calculated notional prices weighted (80:20) between white and brown. The 56 % weight is used to calculate the shadow recoverable value for of sugarcane.

4.2. Market value tradable expenditure.

As mentioned, a detailed enterprise budget is necessary to determine the market tradable expenditure. The total market value of tradable expenditure for the Northern Irrigated Region is R6 549; R4 437 for the Midlands Area; R4 829 for the Coastal Region and R5258 for the Zululand Area. A summary of the market value of tradable expenditure is illustrated in Table 1.

Table 1: Summary of market value of tradables expenditure

	Northern Irrigation	Midlands	Coastal	Zululand
Fertilizer	2885.76	1452.00	2440.80	2533.50
Repairs (Machinery)-harvesting	1541.20	1430.51	935.82	1164.73
Pesticides	787.59	357.80	482.98	465.69
Seed	380.00	380.00	380.00	380.00
Depreciation	331.91	271.62	200.60	253.11
Diesel	277.56	227.84	165.59	210.60
Harvesting	233.55	211.33	135.84	158.65
Other	112.00	105.91	86.00	92.29
Total tradables	**R6 549.57**	**R4 437.02**	**R4 920.34**	**R5 258.56**

Source: South Africa Canegrowers and own calculation, 2011

4.3. Market value of Non-Tradable/Domestic Expenditure

The market value of non-tradable expenditure is typically derived from expenditure that cannot be traded across borders namely: capital, land, labour etc. Every tradable item also has a domestic factor or non tradable part. Table 2 illustrates a summary of the value of non-tradable/domestic part of tradables expenditure.

Table 2: Summary of the values of non-tradables/domestic part of tradable expenditure

	Northern Irrigation	Midlands	Coastal	Zululand
Fertilizer	721.44	363.00	633.38	633.38
Pesticides	196.90	89.45	120.75	116.42
Seed	40.00	40.00	40.00	40.00
Other	152.98	139.03	110.55	124.22
Total tradables	**R257.46**	**R221.44**	**R156.76**	**R222.87**

Source: South Africa Canegrowers and own calculation, 2011

Table 3 is a summary of the values of non tradable/ domestic factors at market level.

Table 3: Market value of non-tradable expenditure

	Northern Irrigation	Midlands	Coastal	Zululand
Licences & insurance	613.69	556.03	353.38	423.29
Maintenance	1721.93	334.48	309.89	410.41
Electricity	3500.00	173.10	203.58	376.10
Water	333.47	33.87	20.00	111.65
Contract	62.39	62.39	73.11	69.13
Administration	950.03	635.89	714.33	943.08
Levies, rent and leases	400.56	628.08	460.98	448.15
Interest	563.92	592.19	709.28	948.33
Labour	4264.29	3382.59	3180.22	3565.36
Land	2700.00	1400.00	1200.00	1300.00
Total non-tradables	**R15 110.28**	**R7 798.62**	**R7 224.77**	**R8 595.51**

Source: South Africa Canegrowers and own calculation, 2011

4.4. Economic income

The South African Sugar Association exports surplus sugar to various destinations across the globe. Therefore, an export value for sugarcane needs to be derived. The basis of the calculation is as follows:

$$\text{Economic value of sugarcane (ton)} = \frac{\text{V Price}}{\text{Notional Price}} \times \text{Export parity prices}$$

The economic value for sugarcane for the 2010 season is R1 817.81/ton

4.5. Economic value of tradable expenditure

Economic value is seen as values in an undistorted market. Reasons for distortions are tariffs and taxes on inputs. The economic values of tradable expenditure are illustrated in Table 4.

Table 4: Economic value of tradable expenditure

	Northern Irrigation	Midlands	Coastal Region	Zululand
Fertilizer	2531.37	1273.68	2222.37	2222.37
Repairs & Maintenance	1476.09	1372.10	898.82	1118.13
Pesticides	690.87	313.86	423.67	408.50
Seed	333.33	333.33	333.33	333.33
Depreciation	242.62	198.56	146.64	185.02
Diesel	188.74	154.93	112.60	143.21
Harvesting	204.87	185.38	119.16	139.16
Other	98.24	92.90	75.44	80.96
Total tradables	**R5 766.13**	**R3 924.75**	**R4 332.03**	**R4 630.68**

Source: South Africa Canegrowers and own calculation, 2011

4.6. Economic value of non-tradable expenditure

As previously mentioned every tradable item has a domestic factor or non tradable part. Table 5 is a summary of the economic value of the non tradable parts of tradable items.

Table 5: Summary of non-tradables of tradable expenditure

	Northern Irrigation	Midlands	Coastal Region	Zululand
Fertilizer	632.84	318.42	555.59	555.59
Pesticides	172.72	78.47	105.92	102.12
Seed	35.09	35.09	35.09	35.09
Other	125.96	115.28	91.94	102.80
Total tradables	**R966.60**	**R547.25**	**R788.54**	**R795.61**

Source: South Africa Canegrowers and own calculation, 2011

Table 6 provides a summary of domestic/non tradable factors at economic level.

Table 6: Summary of the economic value of non-tradable expenditure

	Northern Irrigation	Midlands	Coastal Region	Zululand
Licences & insurance	613.69	556.03	353.38	423.29
Maintenance	1721.93	334.48	309.89	410.41
Electricity	6250.00	309.11	363.54	671.61
Water	333.47	33.87	20.00	111.65
Contract	62.39	62.39	73.11	69.13
Administration	950.03	635.89	714.33	943.08
Levies, rent and leases	400.56	628.08	460.98	448.15

Interest	518.70	544.39	651.52	871.05
Labour	2553.47	2025.50	1904.32	2134.95
Land	2700.00	1400.00	1200.00	1300.00
Total non-tradables	**R16 104.23**	**R6 529.74**	**R6 051.08**	**R7 383.32**

Source: South Africa Canegrowers and own calculation, 2011

5. Discussion of results

As mentioned, the study focuses on three different scenarios namely:

Base Scenario: The base scenario can be seen as an '*as is*' scenario. This scenario takes all the current factors and drivers into account when determining the outcome of the analysis. Current scenario, where a skewed world market exists and a US$358/ton dollar based reference is applicable..

Scenario 1: This scenario illustrates the effects of an undistorted world market.

5.1. Results: Base Scenario

Table 6 shows the market and economic profitability, as well as policy measures for irrigation and dry land, in the different sugarcane production regions. Profitability is calculated by subtracting revenue, tradable inputs, and non-tradable factors. The table show that economic profits are considerably lower than market profits. The analysis reveals the variation in profitability, both private and social, across the regions. Obviously, different soil types, climatic conditions and production costs are the reasons for the variation. The overall market profits show fairly good private profitability. The Northern Irrigated Region has the highest profits, of R4 056/ha in 2010. With regard to the economic profits, which are an efficiency measure or comparative advantage of the related regions, they are negative in three regions, which indicate that the regions are not efficient users of scarce resources. The size of the margin between market and economic profits is highly dependent on the economic price used for the output.

Table 6: Market and economic profitability and policy measures in the regions

	With market distortion (Current situation)			
	Northern Irrigation	**Midlands**	**Coastal Region**	**Zululand**
Income (Market)	R 26 827	R 15 690	R 14 095	R 15 906
Income (Economic)	R 18 960	R 11 089	R 9 962	R 11 241
Tradables (Market)	R 6 550	R 4 437	R 4 920	R 5 259
Tradables (Economic)	R 5 766	R 3 925	R 4 332	R 4 631
Non-Tradables (Market)	R 16 222	R 8 431	R 8 130	R 9 510
Non-Tradables (Economic)	R 17 071	R 7 077	R 6 840	R 8 179
Profit (Market)	R 4 056	R 2 822	R 1 045	R 1 138

Profit (Economic)	R -3 877	R 87	R -1 210	R -1 568
Effect of divergences & efficient policy (Revenue)	**R 7 868**	**R 4 601**	**R 4 134**	**R 4 665**

Source: Own calculation, 2011

5.1.1. Market profitability

The private profitability calculations show the competitiveness of the agricultural system, given current technologies, output values, input cost, and policy transfers as previously mentioned. Profitability results are residuals and might have come from systems using very different levels of inputs to produce outputs with widely varying prices.

The problem is circumvented by the construction of a private cost ratio (PCR) – the ratio of the market non-tradable expenditure to value added in private prices (Market Income – Market Tradable Expenditure); that is, PCR = Market Non-Tradable Expenditure/(Market Income – Market Tradable Expenditure). Value added is the difference between the value of output and the costs of tradable inputs; it shows how much the system can afford to pay domestic factors (including a normal return on capital) and still remain competitive – that is, break even after earning normal profits, where (Market Income – Market Tradable Expenditure – Market Non-Tradable Cost) = Market Profit = 0. The entrepreneurs in the system prefer to earn excess profits, and they can achieve this result if their non-tradable expenditure is less than their value added in private prices. Thus, they try to minimize the private cost ratio by holding down non-tradable and tradable expenditure, in order to maximize excess profits (Monke and Pearson, 1989:26).

The profitability is positive for every region. The difference varies between R1 045 for the Coastal Region, R1 138 for Zululand, R2 822 for Midlands and R4 056 for the Northern Irrigation Region as illustrated in figure 1.

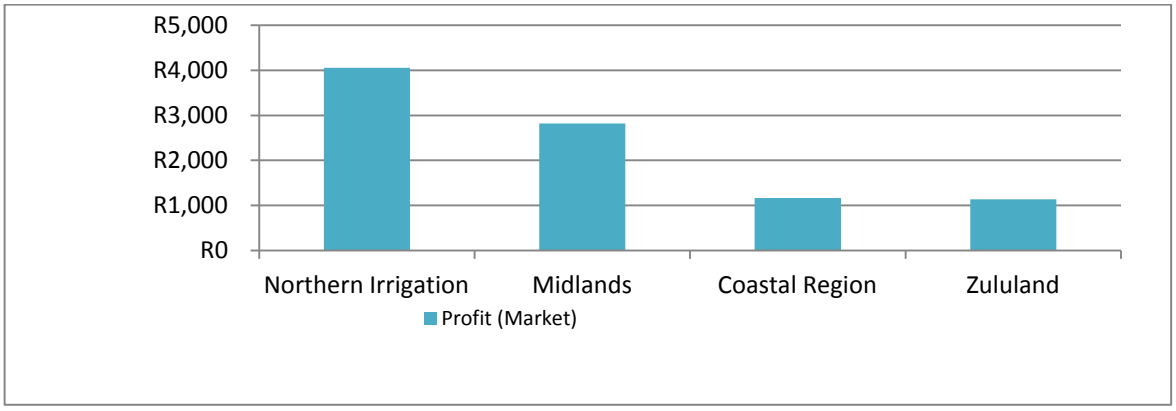

Figure 1: Market profitability.

Source: South Africa Canegrowers and own calculations, 2011

The PCR for the different regions are: 0.8 for the Northern Irrigated Region, 0.75 for the Midlands, 0.89 for the Coastal Region and also 0.89 for Zululand. Interpretation of the above ratio indicates that value adding is taking place and that the typical sugarcane producer can only afford pay between 11 % and 20 % more for non-tradable expenditure.

5.1.2. Reasons for differences

5.1.2.1. Income

The income for the different areas amounts to R26 827 for the Northern Irrigated Region, R15 690 for the Midlands, R14 095 for the Coastal Region and R15 906 for Zululand aregion.

5.1.2.2. Non- tradable expenditure

Figure 1 illustrates the expenditure for non-tradables and tradables. Labour cost is the highest contributor towards non-tradable items. It contributes 28.22 % (R4 264.3) in the Northern Irrigated Region; 43.4 % (R3 382.6) in the Midlands; 44 % in the Coastal Region (R3180); and 41.5 % (R3 565.4) in the Zululand Region. Electricity for the Northern Irrigated Region is the next highest contributor towards non-tradable costs. The contribution towards the dry land area is between 2 % and 5 % of the total cost of non-tradable items. The cost of land constitutes 17.9 % (R2 700) for the Northern Irrigated Region; 18 % (R3352.6) for the Midlands; 16.6 % (R1200) for the Coastal Region; 15.1 % (R1 300) for Zululand. The non-tradable part of maintenance on irrigation equipment also forms 9.93 % of the non-tradable cost of the Northern Irrigated Region. The other areas do not make use of irrigation equipment and, therefore, have no attributable cost component of non-tradable items. Administration constitutes 6.23 % (R950) and is the fifth-highest component of non-tradable costs for the Northern Irrigated Region. Zululand's administration cost is the second highest (R943) towards non-tradables. The Coastal Region follows with R714.33 and then the Midlands, with R535.89. Interest on operational capital for Zululand constitutes R919 (10.69 %); the Coastal Region is the second highest with R686 (9.5 %); then the Midlands with R560.74 (7.19 %); and then the Northern Irrigated Region with R525.49 (3.48 %) of non-tradables.

5.1.2.3. Tradable expenditure

Fertilizer is the biggest component of tradable cost and constitutes 44 % (R2 885/ha) of the Northern Irrigation Region; 33 % (R1 452) of the Midlands Region; 52 % of the Coastal Region and 48 % (R2 534) of Zululand. Repairs and maintenance form the second biggest expenditure under tradable inputs, with an average of 14 % (R688) for the Coastal Region; 16 % (R816) for Zululand; 18 % (R1 183) for the Northern Irrigation Region; and 24 % (R1 069) for the Midlands Region. Pesticides constitute 8 % (R357.8) for the Midlands; 8.86 % (R465.69) for Zululand; 9.8 % for the Coastal Region and 12.03 % (R787.59) for Northern Irrigation Region.

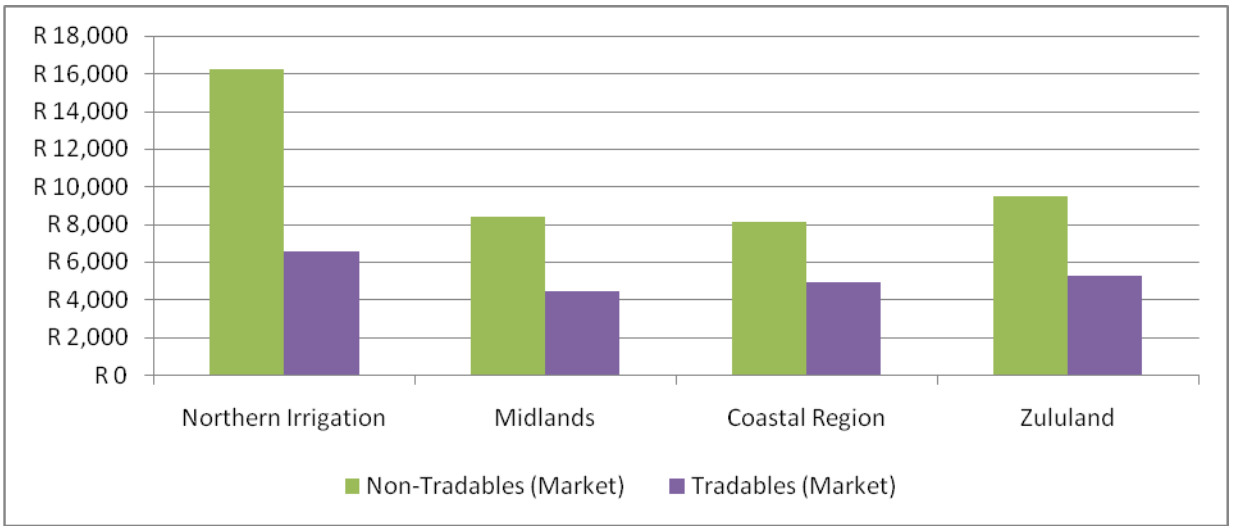

Figure 2: Production cost, tradable and domestic resources.
Source: South Africa Canegrowers and own calculation, 2011

5.1.3. Policy Transfer

An output transfer is defined as the difference between the actual market price of a commodity, produced by an agricultural system, and the efficiency valuation for the commodity. The Nominal Protection Coefficient (NPCo) and Effective Protection Coefficient (EPC) measure the magnitude of policy distortions. The NPCo (Market Income/Economic Income) indicates the magnitude of the impact of policies that cause a divergence between the market price and the social price of a commodity, i.e. it indicates the degree of output transfer.

5.1.3.1. Nominal Protection Coefficient for outputs (NPCo)

An NPCo greater than one, indicates that policies increased the market price to levels higher than the economic price. Thus, if the domestic price is constantly higher that the economic or shadow price (international price), it indicates that policies on the domestic market cause prices being paid by domestic consumers to be higher than they would have paid in the absence of such policies. Hence, an NPCo greater than one indicates that consumers are indirectly taxed. The NPCo for all regions is 1.41. This indicates that policies increase output prices by 41 %, because world prices do not set domestic prices.

5.1.3.2. Nominal Protection Coefficient for inputs (NPCi)

The NPC on tradable inputs (NPCi), defined as Market Tradable Inputs/Economic Tradable Inputs, shows the degree of tradable-input transfer. An NPC on inputs of 1.14 shows that policies are increasing input costs; the average market prices for these inputs are 14 % more than the world prices.

5.1.3.3. Effective Protection Coefficient (EPC)

The EPC ((Market Income – Tradable Market Expenditure)/(Economic Income – Tradable Economic Expenditure)) measures the value-added in market prices, relative to the value-added in economic prices, i.e. it measures the degree of policy transfer from product market-output and tradable-input policies. If the EPC is higher than one, it indicates that the market profit is higher than it would have been if no commodity policies had been in place. Thus, it indicates that policies are in place that increase profits artificially.

The EPC for the different regions are: 1.54 for the Northern Irrigated Region; 1.57 for the Midlands; 1.63 for the Coastal Region; 1.61 for Zululand. Please note that there are differences between regions. The fact that the EPRs differ widely amongst regions is due to the different use of inputs amongst the regions. Some regions may, for example, use more fertiliser than others. Policy with respect to these different inputs also differs, e.g. there is no tariff on the import of fertiliser whereas, when it comes to pesticides, herbicides and fungicides, or ingredients of these, tariffs are in most cases applied. The fact that the EPCs are, in most cases, considerably higher than one, indicates that distortions in input markets should not be under-estimated. The interpretation of an EPC of 1.54 is that the net impact of government policy and tradable input price policy, influences product markets. In short, the effect of the two types of policy mentioned above is found to have a value added, in private prices, of 54 % to 63 % higher than the value added without policy transfers.

5.1.4. Economic profitability or regional comparative economic advantages

Economic profitability measures efficiency or comparative advantage. When economic profits are negative, a system cannot survive without assistance from the government. Such systems waste scarce resources by producing at social costs that exceed the costs of importing. The choice is clear for efficiency-minded economic planners: enact new policies or remove existing ones to provide private incentives for systems that generate social profits, subject to non-efficiency objectives. When systems producing different outputs are compared for relative efficiency, the domestic resource cost ratio (DRC), defined as Non-Tradable Expenditure/(Economic Income – Tradable Expenditure), serves as a proxy measure for social profits. The DRC plays the same substitute role for social profits as does the PCR for private profits. In both instances, the ratio equals one if its analogous profitability measure equals naught. Minimizing the DRC is thus equivalent to maximizing social profits.

Table 7 shows the comparative advantages of the four regions. As mentioned earlier, RCR of less than one indicates that a crop has a comparative advantage over products imported from overseas. If the RCR is greater than one, such an area does not have a comparative advantage.

Table 7: Domestic resource cost ratio for the four region producing sugarcane.

	Northern Irrigation	Midlands	Coastal Region	Zululand
Economic Profitability	-R3 877	R87	-R1 210	-R1 568
RCR	1.29	0.99	1.21	1.24

Source: Own calculation, 2011

5.2. Results Scenario 1

SASA indicated that the world sugar market is distorted by an estimated 58 % with reference to the LMC International Report of 2008. The economic income is adjusted accordingly. The effect of the adjustment is illustrated in Table 8. If distortion is taken out of the market, the shadow price for sugarcane is higher that the market income.

Table 8: Market and economic profitability and policy measures in the regions.

	Without market distortion			
	Northern Irrigation	**Midlands**	**Coastal**	**Zululand**
Income (Market)	R 26 827	R 15 690	R 14 095	R 15 906
Income (Economic)	R 29 956	R 17 520	R 15 739	R 17 761
Tradables (Market)	R 6 550	R 4 437	R 4 920	R 5 259
Tradables (Economic)	R 5 766	R 3 925	R 4 332	R 4 631
Non-Tradables (Market)	R 16 222	R 8 431	R 8 130	R 9 510
Non-Tradables (Economic)	R 17 071	R 7 077	R 6 840	R 8 179
Profit (Market)	R 4 056	R 2 822	R 1 045	R 1 138
Profit (Economic)	R 7 119	R 6 518	R 4 568	R 4 952
Effect of divergences & efficient policy (Revenue)	R -3 129	R -1 830	R -1 644	R -1 855

Source: Own calculation, 2011

5.2.1. Policy transfer

An output transfer is defined as the difference between the actual market price of a commodity, produced by an agricultural system, and the efficiency valuation for the commodity. The

Nominal Protection Coefficient (NPCo) and Effective Protection Coefficient (EPC) measure the magnitude of policy distortions. The NPCo (Market Income/Economic Income) indicates the magnitude of the impact of policies that cause a divergence between the market price and the social price of a commodity, i.e. it indicates the degree of output transfer.

5.2.1.1. Nominal Protection Coefficient for outputs (NPCo)

No effect with an increase in economic income.

5.2.1.2. Effective Protection Coefficient (EPC)

The EPC ((Market Income – Tradable Market Expenditure)/(Economic Income – Tradable Economic Expenditure)) measures the value added in market prices, relative to the value added in economic prices. That is, it measures the degree of policy transfer from product market-output and tradable-input policies. If the EPC is higher than one, it indicates that the market profit is higher than it would have been, if no commodity policies were in place.

The EPC for the different regions change from 1.54 to 0.84 for the Northern Irrigated Region; 1.57 to 0.83 for the Midlands; 1.63 to 0.8 for the Coastal Region; and 1.61 to 0.81 for Zululand. Please note that there are differences between regions.

Economic profitability or regional comparative economic advantages in a global market without distortion

Table 9 shows the comparative advantage of the four regions. As mentioned earlier, RCR of less than one indicates that a crop has a comparative advantage over products imported from overseas. If the RCR is greater than one, such an area does not have a comparative advantage.

Table 9: Domestic Resource Cost Ratio for the four region producing sugarcane.

	Northern Irrigation	Midlands	Coastal	Zululand
Economic Profitability	R7 119	R6 518	R4 568	R8 179
RCR	0.71	0.52	0.60	0.62

Source: Own calculation, 2011

6. Conclusion and recommendations

South Africa has a comparative advantage in growing sugarcane in a free global environment. The current global environment is distorted, and therfor South Africa needs support from government to have a sustainable sugarcane industry. The main conclusion is that the industry only can survive with intervention or if global distortion is removed from the market. With the current intervention, the analysis shows fairly reasonable market profitability. The Northern Irrigation Region has the highest profits of R4 056/ha; followed by R2 822 for the Midlands; R1 138 for Zululand; and R1 045 for the Coastal Region, in 2010. The economic profits are negative in three regions, which indicate that these regions are not efficient users of scarce resources, bearing in mind that sugarcane is a perennial crop and the analysis is a flashpoint of the results of 2010/11 season.

The sustainability of the Sugar industry is dependent on the efficient allocation of inputs. Inputs are taxed relatively highly in comparison with the economic prices thereof. The current policy environment is exerting pressure on the comparative advantage of sugarcane production.

Current policy measures do not provide sufficient protection to the South African sugarcane industry against a distorted world market. This situation is amplified by domestic policy/regulatory measures pertaining to inputs (e.g. taxes on fuel, regulated prices in the electricity sector). Given the potential of this industry the current protection the industry attracts must be reviewed, as well as measures to soften the impact of especially regulated prices.

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Appendix 1

1. Methodology of the Comparative Economic Advantage

Comparative economic advantage is the most commonly criterion used to evaluate the economic efficiency of alternative productive uses of scarce land, labour, capital and water resources, within a particular country or region (Hassan and Faki (1993); Jooste and van Zyl (1999)). According to Hassan and Faki (1993) measures of economic efficiency include: the Net Social Profitability (NSP); Value Added (VAD); and Resource Cost Ratios (RCR). The DRC methodology provides the analytical tool for an empirical evaluation of economic efficiency among alternative enterprises. The DRC method generates several measures of relative economic efficiency of production alternatives. 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).

The RCR provides an explicit indication of the efficiency with which production alternatives use domestic resources to generate or save foreign exchange (Morris, 1990), thus serving as a relative indicator of the degree of efficiency. According to Hassan and Faki (1993), the major difficulty that arises, when using the DRC and RCR methods, is the valuing of inputs and outputs, especially when choosing the appropriate opportunity cost of both non-tradable and tradable. This difficulty is mainly due to an absence of markets in the case of non-tradables and, often, the lack of correspondence of prices of tradables to their true economic value. Both methods therefore distinguish between social and economic and market (private) prices.

In this study, RCR measures of the CEA will be calculated to measure the degree of efficiency among the alternative regions; furthermore, policy measure ratio will also be calculated and interpreted in the results section. The RCR value is then interpreted as follows:

- $0 < RCR < 1$ Value of domestic resources used in producing is less than the value of foreign exchange earned or saved; thus there is a comparative advantage.

- $RCR > 1$ Value of domestic resources used in production exceeds the value of foreign exchange earned/saved, thus there is no comparative advantage.

- RCR < 0 More foreign exchange used in the production of the commodity than

the commodity is worth; thus there is a net loss of foreign exchange and no comparative advantage.

Jooste and van Zyl (1999) referred to Hassan and D'Silva (1994), who investigated the reasons for the importance of conducting CEA analysis within an agro-ecological framework. They concluded that agricultural production is primarily a biological process that is highly dependent on the prevailing biophysical conditions. Agricultural suitability reveals the similarity in natural resource endowments and production potential and, hence, complimentarity or competitiveness in trade, between countries.

The agro-ecological zonation approach will be adopted as the framework for classifying production environments, according to biophysical conditions. Variations within agro-ecological zones (AEZ), due to variations in technology, tenure, etc., will be captured by coding different production systems as distinct activities. Variations in market and infrastructural factors will be reflected in prices and transportation costs. These variations will be captured by defining a central market node for every zone, at which all trade will be assumed to take place. Consequently, prices and transport costs between these market centres (nodes) will reflect the opportunity cost of producing a commodity locally, versus importing it from another region/zone or from outside the country. Variations in resource endowments will be reflected in the relative rental values of those resources, in the different market centres.

Data pertaining to commercial enterprise budgets for the four regions was gathered on a regional basis, by Sugarcane South Africa. These data include production, supply, stocks and price information.

In order to conduct the CEA analysis, it is necessary to value inputs and outputs according to their shadow prices (also social or economic prices), i.e. those prices that will prevail in the absence of any policy or other distortions. This can be a major problem if one, firstly, has to decide what variables are considered as tradable and what as non-tradable and secondly, due to the fact that in various instances there is no market for some non-tradables, or there may be a lack of information on prices that do exist for both tradables and non-tradables. According to Dasguptha (1972) tradable goods and services are those goods or services that are, or can be, traded on international markets without the interference of governments, monopolies or other restrictive behaviour. Hansen (1978) defines non-tradable goods and services as those for which the production cost and international transport cost are too high to make exports profitable, but too low to justify imports. In order to derive the shadow price of tradables and non-tradables, different statistical methods and techniques are used in the study.

1.1. Market Profitability

The term market (also known as private) refers to observed revenues, a cost reflecting actual market prices received or paid by farmers, merchants or processors in the agricultural system.

The market or actual market prices thus incorporate the underlying economic costs and valuations, plus the effects of all policies and market failures. The calculation begins with the construction of separate budgets for farming, marketing, and processing.

The market profitability calculations show the competitiveness of the agricultural system, given current technologies, output values, input cost, and policy transfers. The cost of capital, defined as the pre-tax return that owners of capital require to maintain their investment in the system, is included in non-tradable costs; hence, profits are excess profits-above-normal returns to operators of the activity. If private profits are negative, businesses are earning a subnormal rate of return and thus can be expected to exit from this activity, unless something changes to increase profits to at least a normal level. Alternatively, positive market profits are an indication of super-normal returns and should lead to future expansion of the system, unless the farming area cannot be expanded or substitute crops are more profitable (Monke and Pearson, 1989:20).

1.2. Economic Profitability

Smith (1985:1) explains that the 'social profitability' or economic profitability of public sector projects is calculated in the same way a business in the private sector would calculate the profitability of its business activities, but the resources used and the outputs produced are valued differently. In a cost-benefit appraisal, 'shadow prices', which reflect the social or economic value of goods, replace the market prices in the calculation. In a perfectly competitive economy, market prices and shadow prices will coincide, if we ignore complications introduced by issues of income distribution. Cost-benefit analysis and calculation of market profitability will yield the same result in this case. Market distortions, however, will cause shadow prices and market prices to differ. This makes cost-benefit analysis difficult, since 'shadow prices' or market values (social values) cannot be directly observed

Market failure and government intervention can have the result that market prices often do not reflect the scarcity value of goods and services. It is, therefore, necessary to calculate the economic price (shadow price) of goods and services. Joubert and van Schalkwyk (2000:84) explain that Bradfield (1993) gives an intensive explanation of the different theoretical methods that can be used to calculate different shadow prices; he also asserted that the world price method is the most practical method for calculation of shadow prices. The methods examined by him include: opportunity cost, willingness to pay, the marginal cost method, domestic resource cost, effective tariff protection, world price model and linear programming. Bradfield (1993) concluded that the world price method is the most practical for the calculation of the shadow price of goods and services. Mullins (2007:24) postulated that shadow prices are the opportunity costs of products and services, when the market price, for whatever reason, does not reflect these costs in full. Examples are: shadow wages of labour where the fact that minimum wages are fixed, is taken into account; a shadow price for fuel, where taxes and subsidies are excluded; the marginal cost of generating one kilowatt-hour of electricity, etc.

The effective allocation of scarce resources is essential to maximize welfare. Since market prices in many cases do not reflect the scarcity value of resources, the calculation of shadow prices is essential in comparative economic analyses. The general principle for the use of shadow prices is that they must only be used when the market prices of goods and services do not reflect the scarcity value or economic contribution correctly. In other words, in circumstances where market prices of goods and services do not reflect their scarcity value or economic contribution due to, among other things, government intervention and market failure, they should be adjusted. For these reasons, both market and economic profitability analyses were conducted (Jooste and van Zyl, 1999:29). It can be a very complex exercise to calculate shadow prices, because many factors must be taken into account.

There is, however, one issue which the world price method cannot address, namely the calculation of shadow prices for non-traded products and services. Such specialised practices are only used in one country. In this study, cases where the world price approach could not be used, shadow prices were determined by the opportunity-cost approach. The opportunity-cost approach uses the production that is given up elsewhere, by withdrawing these inputs from alternative uses. On the other hand, for the shadow prices of outputs, the additional incremental benefit achieved by undertaking the project, relative to the situation, had it not been undertaken, is used.

Monke and Pearson, (1989:20) explain that efficient outcomes are achieved when economic resources are used in activities that create the highest levels of output and income. Market profits are efficiency measures because outputs and inputs are valued in prices that reflect scarcity values or market opportunity costs. For outputs and inputs that are traded internationally, the appropriate economic valuations are given by world prices (cost, insurance and freight (CIF)) import prices for goods or services that are imported or (free on board (FOB)) export prices for exportable commodities. World prices represent the government's choice to permit consumers and producers to import, export, or produce goods or services domestically; the market value of additional market output is thus the foreign exchange saved by reducing imports or earned by expanding exports (for each unit of production, the CIF import or FOB export price). Because of global output fluctuations or distorting policies abroad, the appropriate world prices might not be those that prevail during the base year chosen for the study. Instead, expected long-run values serve as economic valuations for tradable outputs and inputs. The services provided by non tradable factors of production-labour, capital, and land do not have world prices because the markets for these services are considered domestic or non-tradable. The economic valuation of each factor service is found by estimation of the net income forgone because the factor is not employed in its best alternative use.

The practical use of economic valuation of non-tradable factors begins with a distinction between mobile and fixed factors of production. Mobile factors, usually capital and labour, are factors that can move from agriculture to other sectors of the economy, such as industry, services, and energy. For mobile factors, aggregate supply and demand forces determine prices. Because alternative uses for these factors are available throughout the economy, the economical values of capital and labour are determined at a national level, not solely within the agricultural sector. Actual wage rates for labour and rates of return on capital investment are,

therefore, affected by a host of policies, some of which may distort factor prices directly. An enforced and binding minimum-wage law, for example, raises the market wage above what it would have been, in the absence of policy, and causes observed wages to become higher than the economic opportunity cost of labour. But indirect effects can also be important. Distortion of output prices causes different activities to expand or contract, altering in turn the demand and prices of mobile domestic factors (Monke and Pearson, 1989:21).

The minimum wage loan introduced into the agriculture sector can create an effect of non-efficiency. This also can create a substitution effect from non-tradable inputs towards tradable inputs.

1.3. Effect of divergences between private and social prices.

The second identity concerns the differences between market and economic valuations of revenues, costs, and profits. Each divergence between the market and economic price must be explained by the effects of policy or by the existence of market failures. This critical relationship follows directly from the definition of economic prices. Economic prices correct for the effects of distorting policies. Distorting policies are policies that lead to an inefficient use of resources. These policies often are introduced because decision-makers are willing to accept some inefficiencies (and thus lower total income) in order to further non-efficiency objectives, such as the redistribution of income or the improvement of domestic food security. In these circumstances, assessing the tradeoffs between efficiency and non-efficiency objectives becomes a central part of policy analysis (Monke and Pearson,1989:22)

Monke and Pearson (1989:23) assert that the accounting is done in domestic currency, but world prices are quoted in foreign currency. Hence, a foreign exchange rate is needed to convert world prices into domestic equivalents. The social exchange rate may differ from observed exchange rates. Undervalued exchange rates reflect an excess supply of foreign exchange that is accumulating as excessive reserves and reducing potential income. Overvalued exchange rates correspond to conditions of excess demand; this demand results in extra foreign borrowing, excessive drawing down of exchange reserves, or rationing of foreign exchange among domestic users. An overvalued exchange rate is an implicit tax on producers of tradable products, because too little domestic currency is earned by exports or paid out for imports. In the absence of commodity policy, the world price of tradable goods determines their domestic prices. When the exchange rate is overvalued, the domestic price is lower than its efficiency level and domestic producers are effectively taxed. Undervalued exchange rates exert the opposite effect. Correction for this distortion is done by conversion of world prices at the social exchange rate, rather than at the official rate. Because exchange rates affect both product prices and factor prices, exchange-rate adjustments are limited to special circumstances – the appearance of multiple exchange rate regimes or the government's failure to adjust the exchange rate enough to offset the effects of domestic inflation.

The economic costs of non-tradable or domestic factors reflect underlying supply and demand conditions, in domestic factor markets. Factor prices are thus influenced by the prevailing set of macro-economic and commodity price policies. In addition, the government can affect factor costs with tax or subsidy policies, for one or more of the factors (capital, labour, or land) that create a divergence between economic costs and market costs.

The net transfer caused by policy and market failures is the difference between market and economic profit. The net transfer from distorting policy is the sum of all factor, commodity, and exchange-rate policies (apart from efficient policies that offset market failures). The calculations thus permit comparison of the effects of market failures and distorting policies for the entire set of commodity and macro price (factor and exchange-rate) policies. This comparison can be made for the complete agricultural system and for each of its outputs and inputs (Monke and Pearson (1989:25).

1.4. Policy Transfers

Transfers are normally calculated from the differences between market and economic values. If market failures are unimportant, these transfers measure mainly the effect of distorting policy. Efficient systems earn excess profits, without any help from the government, and subsidizing policy (Market profit - economic profit > 0) increases the final level of private profits. Because subsidizing policy permits inefficient systems to survive, the consequent waste of resources needs to be justified in terms of non-efficient objectives. A comparison of the extent of policy transfers between two or more systems with different outputs, also requires the formation of ratios. The nominal protection coefficient (NPC) is a ratio that contrasts the observed (market) commodity price with a comparable world (economic) price. This ratio indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes a divergence between the two prices. The NPC on tradable outputs (NPCO), defined as Market Income/Economic Income, indicates the degree of output transfer; for example, an NPC of 1.10 shows that policies are increasing the market price to a level 10 % higher than the world price. Similarly, the NPC on tradable inputs (NPCI), defined as Market Tradable Expenditure/Economic Tradable Expenditure, shows the degree of tradable-input transfer. An NPC on inputs of 0.80 shows that policies are reducing input costs; the average market prices for these inputs are only 80 % of world prices. The effective protection coefficient (EPC), another indicator of incentives, is the ratio of value added in private prices (Market Income – Tradable Expenditure) to value added in world prices (Economic Income – Market Tradable Expenditure). This coefficient measures the degree of policy transfer from product market–output and tradable-input – policies. However, like the NPC, the EPC ignores the transfer effects of factor or non-tradable expenditure market policies. Hence, it is not a complete indicator of incentives. An extension of the EPC to include factor transfers is the profitability coefficient (PC), the ratio of market and economic profits (PC). The PC measures the incentive effects of all policies and thus serves as a proxy for the net policy transfer. Its usefulness is restricted when market or economic profits are negative, since the signs of both entries must be known to allow clear interpretation. A final incentive indicator is the subsidy ratio to producers (SRP), the net policy transfer as a proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies. The SRP permits comparisons of the extent to which all policies subsidize agricultural systems. The SRP measure can also be

disaggregated into component-transfer to show separately the effect of output, input factors policies (Monke and Pearson, 1989:28).

Appendix 2

Calculation of shadow prices for tradable and non-tradable components

Shadow pricing of tradables: fertilisers, pesticides and commodities

In this study the world price approach was used as the principle method to estimate the economic prices of tradables. In this regard, the conversion method and the tariff protection method are used to calculate the economic price of tradables. Ward and Deren (1991) state that the conversion method entails that the world prices of goods and services are determined and adjusted with the cost-insurance-and-freight component of imported goods and services. This approach is denoted by the following equation:

$$CIFW_{ij} = (IntP_{ij} + TransC_{ij} + Ins_{ij}) \times ExhR_{ij}$$

Where;

$CIFW_{ij}$	=	cost-insurance-freight-value of imports in domestic prices;
$IntP_{ij}$	=	International market price in US$;
$TransC_{ij}$	=	Transport cost;
Ins_{ij}	=	Insurance;
$ExhR_{ij}$	=	Exchange rate in Rand/US$;
i	=	Product identification;
j	=	Year.

The tariff protection rate is an indication of the percentage deviation of domestic prices from international prices. The shadow price calculation, using the tariff protection method, is denoted by the following equation (Bradfield, 1987):

$$W_p = D_p/(1 + T_{pr})$$

Where:

W_p	=	World price;
D_p	=	Domestic price; and
T_{pr}	=	Tariff protection rate expressed as a percentage.

1.4.1. Shadow price of fuel

In order to calculate the shadow price of fuel, one has to take into account the pump price of fuel and any levies and taxes that may have an influence on the price the consumer pays for that fuel. A similar methodology to that of Conningarth Consultants (1995) was used to calculate the shadow price of diesel. Table 1 shows the calculation of the conversion factor for diesel that is used in production of sugarcane in 2008.

Table 1: Calculation of the factor adjustment regarding the shadow price

Item	Unit	2010
Pump price	c/l	799.00
Minus: Taxes, customs		
Fuel taxes	c/l	-152.50
Customs and excise	c/l	-4.00
Other charges (pipe line levy, slate levy	c/l	-87.65
Plus: Taxes that could be seen as user charges		
Multilateral Motor fund	c/l	
Multilateral Motor fund (rebate)	c/l	
NTSC	c/l	
Transfer to national road fund	c/l	
Tax rebate		
Shadow price	c/l	554.85
Factor adjustment		**0.69**

Source: Department of Energy, 2011. Own calculations

1.4.2. Shadow pricing of non-tradables

In any production process the use of non-tradable inputs is plentiful. In this study labour, land, water and electricity were regarded as non-tradable. It can be argued that electricity should be regarded as a tradable input, since electricity is supplied from South Africa to neighbouring countries. According to Jooste and van Zyl (1999), the scale of distribution is very small and in some cases, certain areas in South Africa do not have access to this luxury. Hence, over the short term electricity can be regarded as non-tradable.

1.4.2.1. Labour

According to Bradfield (1987), there are three types of labour, namely skilled labour, semi-skilled labour and unskilled labour. The conventional approach is, however, to distinguish only between skilled and unskilled labour. Distortions in the labour market, which cause the price of labour to deviate from the marginal product, necessitate the calculation of shadow prices for labour. Harberger (1972) emphasized that, when the economy is characterised by under-

employment and unemployment, the shadow price for labour needs to be calculated in order to properly reflect the opportunity cost of labour.

1.4.2.2. Unskilled labour

Conningarth Consultants (1995) is of the opinion that the employment of unskilled labour will entail fewer or no opportunity costs. The classic position has been that unskilled labour should have a shadow wage of zero (Sassone and Schaffer, 1978), or close to zero (Dasgupta and Pearce, 1972). However, this is unrealistic, since people will only work if there is some form of reward attached to the work, such as money or food.

Conningarth Consultants (1995) states that the shadow wage of rural labour in slack seasons may be taken as roughly the equivalent of three kilograms of grain per day. Using this methodology, they calculated the shadow price adjustment factor for unskilled labourers in the agricultural sector to be 0.609. Hence, due to the lack of more precise information, the shadow wage adjustment factor for unskilled labourers used in this study was taken as 0.605, as suggested by Conningarth Consultants (1995).

1.4.2.3. Skilled labour

For purposes of the study, skilled agricultural workers are classified as those workers who can drive tractors or operate machinery. It is also assumed that skilled labour is in full employment, whilst this is not the case for unskilled labour. This means that the market wage rate for skilled labour closely approximates the social opportunity cost. The shadow wage adjustment factor for skilled labour used in this study is zero.

1.4.2.4. Electricity

Conningarth Consultants (1995) calculated the shadow selling price of electricity in South Africa. The shadow conversion factor calculated by them suggests that electricity is subsidized in South Africa. The opportunity cost for electricity is 58c/kWh in world terms. After the current increase, the average cost for electricity is 41c/kWh. The shadow conversion factor used for electricity was calculated on 1.40.

1.4.2.5. Land

Gittinger (1982) defined the economic cost of land (opportunity cost) as the net value of production forgone, when the use of land is changed from its 'without' use to its 'with' use, measured in border prices. In the absence of a market value that reflects the opportunity cost to use land, Monke and Pearson (1986) state that the rental value can be used instead. This statement is echoed by Tsakok (1990), who mentions that if there is a competitive market in renting or leasing land, the analyst can consider the rental value as indicative of the contribution of land to the alternative output. For the purposes of this study, rental values for land were calculated as four per cent of the market value of land in different regions. This is consistent with the findings of van Schalkwyk and van Zyl (1996).

1.4.2.6. Water

Water in South Africa can be regarded as one of the scarcest resources available. This means that one unit of water, used in one sector, reduces the water available to be used in other sectors by one unit. Hence one can attach a scarcity value to water which relates to its opportunity cost.

Since there is not a market for water in South Africa, it is necessary to estimate its scarcity value. Hassan et al (1996) calculated the scarcity value of water for dry-land production to be R0.35 per m^3. Various other scarcity values have been calculated by, amongst others, Viljoen, Symington and Botha (1992), Hassan and van der Merwe (1997) and Louw and van Schalkwyk (1997). The estimated scarcity values by these authors ranged from R0.50 to R6.00 per m^3. Viljoen et al (1992) estimated the scarcity value of water in terms of its net contribution towards production value in the Vaalharts River Basin, whilst Hassan and van der Merwe (1997), as well as, Louw and van Schalkwyk (1997) estimated the scarcity value of water in respect of high-value, long-term crops. Since these values do not conform to short-term crops in the latter case and, since in the former case the methodology used relates to the total production value, it was decided to adapt the R0,35m^3 estimated by Hassan et al (1996), with the inflation rate index. This assumption is not entirely correct, but after discussions with, amongst other, Mullins (2000) it became clear that the additional effort to estimate the scarcity value of water in the different regions used would defy the purpose of this study.

1.4.2.7. Shadow price of the Rand (exchange rate)

It is commonly known that the South African Rand rarely reflects its true value in terms of other currencies. The reasons for this state of affairs are plenty and include, amongst others, perceptions of investors, monetary controls and interventions by the Reserve Bank, the political climate, etc. Hence, it is necessary to calculate the 'true' or shadow value of the exchange rate, before incorporating it into comparative economic analysis.

In this study, the buying power parity (BPP) approach was used to calculate the economic value of the South African Rand. This approach implies that changes in relative prices of a country's goods and services are reflected by changes in the exchange rate. This entails relative price changes between countries being used to calculate the shadow exchange rate. Since it is practice in South Africa to value the South African Rand against the US Dollar, the producer price index of the US was used to calculate the shadow exchange rate of the Rand (Bradfield, 1987). The calculation of the shadow exchange rate is denoted by the following equation:

$$SE = (PI_{SA}/PI_{FC}) / E_{bj}$$

Where:

SE = Shadow exchange rate;

E_{bj} = Base year exchange rate;

PI_{SA} = Producer price index for South Africa;

PI_{FC} = Producer price index for the USA.

Bradfield (1993) states that a practical problem in the calculation of the shadow exchange rate is the choice of a realistic base year. According to him, the base year must adhere to the following practical requirements:

- the economic growth rate must be stable or near to the long term growth rate of the economy;
- the balance of payments must be near equilibrium;
- there should not have been any major economic or political crisis in the world;
- there must be domestic political stability;
- international economics must be relative stable;
- the rate of unemployment must not be excessively high;
- the inflation rate must not deviate too much from the long term trend in inflation.

According to Bradfield (1993), the only year which conforms to a large extent to these requirements in South Africa is 1975, and hence it was used in this study. The shadow exchange rate for South Africa was calculated to be R7.279 in 2010.

1.4.3. The tradable/non-tradable composition of the value of inputs and products

After examining the input-output table of South Africa, Bradfield (1993) states that most inputs used in the South African economy consist of tradable and non-tradable components. The following derivation can be made from this:

- the production of tradable goods and services require non-tradable inputs;
- the production of non-tradable goods and services require tradable inputs;
- tradable goods and services require tradable inputs; and
- non-tradable goods and services require non-tradable inputs.

The tradable/non-tradable composition of the value of inputs and products were calculated by Jooste and van Zyl (1999). The same approach is used and is presented in Table 3

Table 10 shows components of the economic value inputs that are tradable/non tradable. The costs of tradable inputs often include substantial amounts of inputs that are not available on international markets, such as transportation, electricity, labour. Therefore, after all market and economic input cost categories were standardized, they were allocated to domestic factor (non-tradable) and tradable input components. The non-tradable components were then added to the cost of the domestic factors (Monke and Pearson, 1989). Due to lack of input-output matrices of national accounts, the decompositions are based on the work of Jooste and van Zyl (1997) and Mahlanze, Mandes and Vink (2003) (see Table 10).

Table 10: Components of the economic value of inputs.

	% Tradable	% Non-tradable
Fertilizer & pesticides	80.00%	20.00%
Other purchased inputs	90.00%	10.00%
Fixed cost of machinery	95.00%	5.00%
Variable cost of machinery	50.00%	50.00%
Electricity	85.00%	15.00%
Contract services	95.00%	5.00%
Transport	60.00%	40.00%
Admin & Insurance & other overheads	40.00%	60.00%