AN ECONOMIC ANALYSIS OF ALTERNATIVE MARKET SCENARIOS FOR WHEAT IN SOUTH AFRICA

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Abstract

The marketing of wheat has been controlled by the Wheat Board since 1935 and wheat is currently marketed through a one channel fixed price scheme. In this paper various market scenarios for wheat in South Africa are simulated with the use of a regional linear programming model which incorporates negative-sloping demand functions, substitution in demand between wheat and maize, and income risk. The model is used to predict changes in product prices, production levels, location of production and welfare transfers under the different market scenarios.

A free market simulation showed a distortion in production patterns of the major crops caused by the price support policy. The domestic free market equilibrium price of wheat was predicted to be about 15 per cent lower than the mean fixed price. Owing to the strong price relationship between wheat and maize there is no significant decrease in the wheat price in a free market for winter cereals only and when maize is the only crop marketed under a fixed price system. The social cost analysis showed clearly that to reduce social costs a combined marketing policy for wheat and its related industries is required.

Uittreksel

Die bemarking van koring word sedert 1935 deur die Koringraad beheer en koring word tans deur middel van 'n eenkanaal-vasteprysstelsel bemark. In hierdie artikel word verskillende markscenarios vir koring in Suid-Afrika nageboots met behulp van 'n streek-liniêre-programmerings model wat negatief-hellende vraagfunksies, substitusie in vraag tussen koring en mielies, en inkomsterisiko behels. Die model word gebruik om veranderinge in produkpryse, produksiepeile, produksielokaliteit en welvaartsoordragte ingevolge die verskillende markscenarios te evalueer.

'n Vryemark-nabootsing dui op die verwringing in produksiepatrone van die hoofgewasse wat deur die vasteprysstelsel veroorsaak is. Daar word voorspel dat die binnelandse vryemark-ewewigsprys van koring ongeveer 15 persent laer as die gemiddelde vasteprys sal wees. As gevolg van die sterk prysverwantskap tussen koring en mielies is daar geen beduidende afname in die koringprys in 'n vrye mark vir uitsluitlik wintergraansoorte terwyl mielies ingevolge 'n vasteprysstelsel bemark word nie. Die sosiale koste-ontleding het duidelik getoon dat, ten einde sosiale koste te verminder, 'n gekombineerde bemarkingsbeleid vir koring en die verwante bedrywe daarvan benodig word.

1. Introduction

From the 1988/89 season the fixed producer price for wheat was replaced with a delivery price for wheat. This delivery price is estimated according to available information on the size of the current crop. The delivery price can be supplemented at a later stage if the income from the sale of wheat is higher than anticipated. (The domestic selling price of wheat remains on a fixed price scheme). This could be seen as a movement towards a more market orientated price for the wheat producer. The aim of this paper is to evaluate various market scenarios for wheat, using a mathematical programming model that simulates crop production in the main wheat growing areas.

With the inclusion of income risk and negative-sloping demand functions, including substitution in demand between wheat and maize, the model can be used to compare different market scenarios for wheat. In this paper these scenarios include a free market for wheat and all competing crops, a free market for winter cereals only, and the effect of changes in the price of maize (the main substitute for wheat) relative to the wheat price. Also discussed are the social costs related to the above scenarios.

2. The model

Details of the model and verification of it are given in Howcroft and Ortmann (1990). In summary, the main wheat producing areas of the country were divided into three regions, namely the Orange Free State/Transvaal (OFS/Tvl), Swartland and Rûens. These production regions were subdivided into

reasonably homogeneous farming areas (RHFA). Scheepers *et al* (1984) divided the Highveld region into RHFAs. Use was made of the 'Agricultural development programme' of the Winter Rainfall Region (1985) which divides the Swartland and Rûens into RHFAs. No information on RHFAs for central Orange Free State was available and magisterial district data were used for aggregation.

Enterprises that compete with wheat for land and other resources in the different production areas were included in the model. For production costs of cash crops, use was made of the General Farm Management Results, a publication by the Directorate of Agricultural Production Economics (1978-86). For the sheep and dairy enterprises, use was made of Combud reports compiled by the Directorate of Agricultural Production Economics (1986).

Crop yields and animal stocking rates for the various RHFAs were obtained from Scheepers *et al* (1984) and the 'Agricultural development programme' (1985). For the magisterial districts in central Orange Free State yield data were taken from Agricultural census reports which is a publication by the Department of Statistics (1975-1984).

Product prices were based on six year means (1981 to 1986) and inflated to a 1986 basis using the Consumer Price Index (CPI).

To aid simulation, rotation restraints, negative-sloping demand functions (including substitution in demand between wheat and maize) and variance-covariance matrices to account for income risk, were incorporated in the model.

The objective function of the model can be expressed as follows:

$$\text{Max } Z = [X'M (A-0.5BMX)] - \sum_{i=1}^{N} \{[C'X]_i + [\theta_i(X\Omega X)^{\frac{1}{2}}_i]\}$$

The first term of the equation measures total welfare, which is the integral of the linear product demand function $P = A - BMX$, where M is a nxn diagonal matrix of average yields per hectare and X is a nxl vector of aggregate hectares generated endogenously within the model. Production costs are deducted in the term [C'X] where C is a vector of production costs per hectare. Costs associated with risk are deducted in the last term, where Ω is a variance-covariance matrix of gross income per hectare, θ_i is an aggregate "risk aversion" coefficient for all farms in region i and N the number of major regions (three in this study).

The value of θ was varied to determine the best simulation of cropping patterns and prices. The values of the risk aversion coefficient that gave the "best fit" for simulation were 0,3, 0,35 and 0,6 for the OFS/Tvl, Swartland and Rûens areas respectively. These gave an overall correlation coefficient and percentage absolute deviation (PAD) of 0,997 and 12,2 per cent respectively for actual land and predicted land usage. The overall correlation coefficient and PAD for actual production and predicted production were 0,999 and 6,3 per cent respectively. These correlation coefficients and PADs indicate that crop production in the main wheat growing areas has been adequately simulated.

3. Market scenarios

Four different market scenarios for wheat are simulated, namely:

(i)   A free market for all crops.
(ii)   A free market for winter cereals only.
(iii)   A price support programme for maize but all other crops marketed under a free market system.
(iv)   A price support for maize at a decreased real price but all other crops marketed under a free market.

These marketing scenarios will be compared with the fixed price scheme that was in operation until 1989 so that predictions can be made about the changes that can be expected should these alternatives come about. It should be noted that although some of the operational structures may change in a free market system it is difficult to quantify these changes. The objective of this study is to indicate the direction of change of certain parameters in a changing market system.

3.1 Fixed price scheme

Wheat, maize, barley and oats were, during the period under study, all marketed through a one-channel fixed price scheme. Sorghum and sunflowers were marketed under a floor price scheme and a pool price scheme respectively. However, relatively small amounts of sorghum and sunflowers are produced in the wheat areas. Therefore, for the purposes of simulation, demand curves for these two products were assumed to be perfectly elastic.

The one-channel fixed price scheme was in operation for wheat in the base year of the model (1986), so it was necessary to model this scheme, firstly to test the model for adequate simulation and secondly to enable comparisons with other policies. The simulation procedure was satisfactorily performed as mentioned earlier.

3.2 Free market for all crops

The solution to a free market programme for all crops compared to the fixed price scheme is given in Table 1. In a free market social costs are zero, so the distortions caused by other programmes on production patterns are highlighted. Results of the model reflect long term adjustments in the wheat in-

dustry, and show that the predicted domestic equilibrium price for wheat in a free market of R342,30 per ton is 14,5 per cent lower than the fixed price of R400,50 per ton. The predicted price for wheat is an average price for the whole of South Africa. In a free market there will be differences in this price between regions owing to transport costs.

Import and export activities were included in the model; however, the model showed that at average world prices it was not profitable for South Africa to produce wheat for export.

The free market scenario results in a general decrease in the area under wheat of about 13 per cent and a decrease in wheat production of 16 per cent. However, there are large production decreases in the Swartland and Rûens of 21 per cent and 46 per cent respectively. Most of this land is put under pastures.

The maize price is predicted to fall by 11 per cent with an overall 15 per cent decrease in production. The price of sorghum falls by 10 per cent with a 52 per cent decline in production. There is a rightward shift in the supply curve for sunflowers, so that although there is a six per cent decrease in price, production increases by 54 per cent. This outward shift of the supply function is a result of the decrease in the opportunity cost of land (the only limited resource) which more than offsets the decrease in price.

Barley production is predicted to increase by 38 per cent which will enable the industry to supply local malt production requirements while a small percentage could be exported or sold locally as feed. The estimated supply response for oats is high. This is indicated by a decrease in price of about nine per cent resulting in a decrease in production of nearly 60 per cent. Therefore, without a price support programme for oats, production is expected to fall considerably.

It is interesting to note that the regional supply response for wheat is inelastic in the OFS/Tvl region but elastic in the Swartland and Rûens. This highlights the differences in respect to costs and production alternatives faced by farmers in these regions.

With the introduction of a free market, total land area under wheat drops by about 13 per cent with the largest decrease (46 per cent) being in the Rûens. In the Swartland the decrease is 20 per cent, compared to the OFS/Tvl region where the decrease is only three per cent. Decreases in land under wheat and oats in the Swartland and Rûens are mainly taken up by pastures. The land area under barley production in the Rûens increases by 35 per cent.

Areas under maize and sorghum are predicted to decrease by 19 per cent and 59 per cent respectively, while the area under sunflower production increases by 61 per cent.

In total there is a six per cent decrease in land cropped under a free market. (Fallow land is included under land cropped as it is put under production in the following crop season). The largest decrease is in the OFS/Tvl region where 10 per cent of the land is taken out of crop production. This land would more than likely be used for livestock production. Total area cropped in the Swartland decreases by 0,3 per cent, while there is no change in the area cropped in the Rûens.

3.3 Free market for winter cereals

Under this scenario wheat, barley and oats are produced in a free market. All summer crops remain on a fixed price scheme. Results are given in Table 2.

A very small decrease (0,4 per cent) in the price of wheat is predicted which only results in an overall decrease in production of 0,1 per cent. There is a shift from maize and wheat to oats production in the OFS/Tvl region, resulting in an increase of 42 per cent in the production of oats.

Table 1: Land areas, production and product prices under the original fixed price scheme compared to a free market system (Prices on a 1986 basis)

Region and crop	Price support programme			Free market			Percentage change		
	Area (1000ha)	Price (R/t)	Production (1000 t)	Area (1000ha)	Price (R/t)	Product. (1000 t)	Area	Price	Production
OFS/Tvl									
Wheat	832.8	400.5	806.0	809.1	342.3	777.5	-2.8	-14.5	-3.5
Maize	1179.1	255.2	2021.9	955.6	227.1	1729.4	-19.0	-11.0	-14.5
Sorghum	48.9	243.9	73.3	20.2	219.9	35.0	-58.7	-9.8	-52.3
Sunflower	88.1	457.9	97.1	142.5	429.1	149.1	61.6	-6.3	53.5
Oats	15.0	238.3	22.5	50.7	215.9	34.7	37.9	-9.4	54.4
Total area	2163.9			1948.1			-10.0		
Swartland									
Wheat	390.6	400.5	359.8	313.0	342.3	285.6	-19.9	-14.5	-20.6
Oats	77.0	238.3	81.2	11.3	215.9	11.2	-85.3	-9.4	-86.2
Pastures	21.0			181.0			762.8		
Fallow	227.6			208.7			-8.3		
Total area	716.2			714.0			-0.3		
Rûens									
Wheat	194.6	400.5	278.2	105.2	342.3	149.4	-46.0	-14.5	-46.3
Barley	87.5	336.2	109.5	118.4	302.5	150.6	35.4	-10.0	37.6
Oats	13.7	238.3	15.1	2.8	215.9	3.4	-80.0	-9.4	-77.4
Pastures	208.3			401.3			92.7		
Fallow	123.5			0.0			-100.0		
Total area	627.7			627.7			0.0		
Total									
Wheat	1418.0	400.5	1443.9	1227.3	342.3	1212.4	-13.4	-14.5	-16.0
Maize	1179.1	255.2	2021.9	955.6	227.1	1729.4	-19.0	-11.0	-14.5
Sorghum	48.9	243.9	73.3	20.2	219.9	35.0	-58.7	-9.8	-52.3
Sunflower	88.1	457.9	97.1	142.5	429.1	149.1	61.6	-6.3	53.5
Barley	87.5	336.2	109.5	118.4	302.5	150.6	35.4	-10.0	37.6
Oats	105.8	238.3	118.8	34.7	215.9	49.4	-67.1	-9.4	-58.5
Pastures	229.3			582.4			154.0		
Fallow	351.1			208.7			-40.6		
Total area	3507.8			3289.7			-6.2		

However, in the Swartland oats production ceases with the land going to a wheat-fallow rotation and to pastures. Overall there is a 60 per cent decrease in production of oats. Because the wheat price remains high there is no change in the enterprise mix in the Rûens.

The total area of cropped land decreases by only 0,5 per cent, with the OFS/Tvl showing the largest decrease of 0,7 per cent.

3.4 Free market for all crops except maize

In this scenario the price of maize is fixed at R255 per ton (base price of the model) and all other crops are assumed to be produced in a free market. Results are compared with the fixed price scheme in Table 3.

This market scenario confirms the strong relationship between the wheat and maize prices. With a relatively high fixed price of maize, but with all other competing crops produced in a free market, the price of wheat remains above its predicted domestic free market equilibrium price of R342,30/ton. The price of wheat decreases by two per cent to R391,10/ton from its fixed price resulting in only a 0,1 per cent decrease in overall production. There is an increase of maize production of 5 per cent. The price of sorghum decreases by four per cent resulting in a

58 per cent drop in production. This land area is mostly taken up by oats. Although there is a small decrease (one per cent) in the price of sunflowers, production remains unchanged.

A shift from oats and wheat production to pastures is predicted for the Swartland. In the Rûens there is a shift from barley, oats and pasture production to a wheat and fallow rotation.

A decrease in total cropped land of 0,5 per cent is predicted, with the largest decline being in the OFS/Tvl (0,7 per cent).

3.5 Decrease in the real price of maize

This market scenario is the same as the previous one except that the fixed price of maize is reduced by 20 per cent to R204,20 per ton (lower than the estimated free market price of maize of R227,10 per ton). The results are compared with the original fixed price scheme in Table 4. This scenario leads to a large area moving from maize and sorghum production to competing crops.

The decrease in the fixed price of maize results in an outward shift in the regional supply curve of wheat for OFS/Tvl, which more than offsets the reduction in the price of wheat.

Table 2: Land areas, production and product prices under the original fixed price scheme compared to a free market for winter cereals only (Prices on a 1986 basis)

Region & crop	Price support programme			Free market for winter cereals			Percentage change		
	Area (1000ha)	Price (R/t)	Product. (1000 t)	Area (1000 ha)	Price (R/t)	Product. (1000 t)	Area	Price	Production
OFS/Tvl									
Wheat	832.8	400.5	806.0	831.5	399.0	803.9	-0.2	-0.4	-0.3
Maize	1179.1	255.2	2021.9	1161.5	255.3	1995.0	-1.5	0.0	-1.3
Sorghum	48.9	243.9	73.3	48.9	243.9	73.3	0.0	-0.0	0.0
Sunflower	88.1	457.9	97.1	88.1	457.9	97.1	0.0	-0.0	0.0
Oats	15.0	238.3	22.5	19.0	236.5	31.9	26.5	-0.7	41.7
Total area	2163.9			2148.9			-0.7		
Swartland									
Wheat	390.6	400.5	359.8	390.6	399.0	359.8	0.0	-0.4	0.0
Oats	77.0	238.3	81.2	0.0	236.5	0.0	-100.0	-0.7	-100.0
Pastures	21.0			63.0			200.0		
Fallow	227.6			260.4			14.4		
Total area	716.2			714.0			-0.3		
Rûens									
Wheat	194.6	400.5	278.2	194.6	399.0	278.2	0.0	-0.4	0.0
Barley	87.5	336.2	109.5	87.5	336.1	109.5	0.0	-0.0	0.0
Oats	13.7	238.3	15.1	13.7	236.5	15.1	0.0	-0.7	0.0
Pastures	208.3			208.3			0.0		
Fallow	123.5			123.5			-0.0		
Total area	627.7			627.7			0.0		
Total									
Wheat	1418.0	400.5	1443.9	1416.7	399.0	1441.9	-0.1	-0.4	-0.1
Maize	1179.1	255.2	2021.9	1161.5	255.3	1995.0	-1.5	0.0	-1.3
Sorghum	48.9	243.9	73.3	48.9	243.9	73.3	0.0	-0.0	0.0
Sunflower	88.1	457.9	97.1	88.1	457.9	97.1	0.0	-0.0	0.0
Barley	87.5	336.2	109.5	87.5	336.1	109.5	0.0	-0.0	0.0
Oats	105.8	238.3	118.8	32.7	236.5	47.0	-69.1	-0.7	-60.4
Pastures	229.3			271.3			18.3		
Fallow	351.1			383.9			9.3		
Total area	3507.8			3490.6			-0.5		

Wheat production increases by 27 per cent with the price reducing by eight per cent. However, overall production of wheat increases by only seven per cent due to decreases in production in the Swartland and Rûens.

As a result of an outward shift in their supply functions, production of sunflowers and oats increases in the OFS/Tvl despite a decrease in prices. In the Swartland, land cultivated to wheat and oats under a fixed price scheme shifts to pasture production.

In the Rûens barley production becomes more profitable relative to wheat resulting in increased production. In general there is a shift from crop to pasture production in the Rûens.

There is a significant decrease (13 per cent) in the total area cropped owing to the fall in profitability of maize production in the OFS/Tvl region. Over one-fifth of the land presently being cropped in the OFS/Tvl is taken out of crop production.

4.   Land rents

Effects of the different market scenarios on land rents were estimated and are presented in Table 5. The fixed price scheme caused a substantial increase in land rents as compared to a free market. With the introduction of a free market the greatest drop in land rents is in the Swartland where rents are predicted to fall by 43 per cent.

It is predicted that land rents would not drop significantly in a free market for winter cereals only and if the price support scheme for maize remains. However, a decrease in the maize price to R204 per ton would result in a large decrease in land rents in the OFS/Tvl region.

5.   Social costs

The inclusion of negative-sloping demand functions in the model allows for estimation of producer and consumer surplus under the various market scenarios discussed. From Marshallian welfare analysis social costs can be defined as the loss in consumer and producer surplus caused by deviations from the competitive equilibrium (Beck, 1974, as cited by Ortmann and Nieuwoudt 1987:305). In a free market situation demand and supply functions are free to interact and establish a market equilibrium for all crops. This causes a solution that maximises the sum of producer and consumer surplus. Consumer surplus can be defined as the area under the demand curve above the price line. Producer surplus is the area above the product supply curve and below the price line (Currie *et al* 1971; Mishan, 1968).

Table 3: Land areas, production and product prices under the original fixed price scheme compared to a free market for all crops except maize (Prices on a 1986 basis)

Region & crop	Price support programme			Free market for winter cereals			Percentage change		
	Area (1000ha)	Price (R/t)	Product. (1000 t)	Area (1000 ha)	Price (R/t)	Product. (1000 t)	Area	Price	Production
OFS/Tvl									
Wheat	832.8	400.5	806.0	785.8	391.1	753.9	-5.6	-2.3	-6.5
Maize	1179.1	255.2	2021.9	1237.3	255.3	2124.6	4.9	0.0	5.1
Sorghum	48.9	243.9	73.3	20.6	233.4	30.9	-57.8	-4.3	-57.8
Sunflower	88.1	457.9	97.1	88.1	452.4	97.1	0.0	-1.2	0.0
Oats	15.0	238.3	22.5	17.0	236.5	28.6	13.5	-0.7	27.2
Total area	2163.9			2148.9			-0.7		
Swartland									
Wheat	390.6	400.5	359.8	307.6	391.1	303.6	-21.2	-2.3	-15.6
Oats	77.0	238.3	81.2	22.4	236.5	18.4	-71.0	-0.7	-77.4
Pastures	21.0			178.9			752.5		
Fallow	227.6			205.1			-9.9		
Total area	716.2			714.0			-0.3		
Rûens									
Wheat	194.6	400.5	278.2	268.8	391.1	384.4	38.1	-2.3	38.2
Barley	87.5	336.2	109.5	77.7	336.1	91.6	-11.2	-0.0	-16.3
Oats	13.7	238.3	15.1	0.0	236.5	0.0	-100.0	1.7	-100.0
Pastures	208.3			24.7			-88.2		
Fallow	123.5			256.5			107.6		
Total area	627.7			627.7			0.0		
Total									
Wheat	1418.0	400.5	1443.9	1362.3	391.1	1441.9	-3.9	-2.3	-0.1
Maize	1179.1	255.2	2021.9	1237.3	255.3	2124.6	4.9	0.0	5.1
Sorghum	48.9	243.9	73.3	20.6	233.4	30.9	-57.8	-4.3	-57.8
Sunflower	88.1	457.9	97.1	88.1	452.4	97.1	0.0	-1.2	0.0
Barley	87.5	336.2	109.5	77.7	336.1	91.6	-11.2	-0.0	-16.3
Oats	105.8	238.3	118.8	39.5	236.5	47.0	-62.7	1.7	-60.4
Pastures	229.3			203.5			-11.2		
Fallow	351.1			461.6			31.5		
Total area	3507.8			3490.6			-0.5		

As social costs are zero in a free market this allows comparison of the social costs (loss in producer and consumer surplus) under the other market scenarios. The estimated producer and consumer surpluses and related social costs under the different market scenarios are given in Table 6.

With the introduction of a free market a 37 per cent drop in producer surplus and a 47 per cent increase in consumer surplus are predicted. This indicates that under the price support programme welfare is distributed from consumers to producers. The social cost of the price support programme is high, constituting nine per cent of total welfare. With a free market for winter cereals only, social costs are reduced by 37 per cent.

With all crops operating in a free market except maize, social costs are reduced by 50 per cent. This highlights the fact that to reduce social costs a combined marketing policy for all agricultural products that compete with wheat is necessary. If wheat is handled in isolation then distortions in the market place for wheat are transferred to its competing crops.

Interestingly, when the real price of maize drops below its estimated domestic free market equilibrium price, social costs increase dramatically owing to the underutilization of resources.

6.   Conclusion

The move away from a fixed producer price to a policy where producers are liable for the financing of any surplus stocks, suggests a shift in policy by the Wheat Board to a more market orientated approach in wheat marketing. The problems associated with a fixed price system are numerous. The setting of this price above market-clearing prices has resulted in higher returns which have been capitalised into higher land values. The model shows that, on average, land prices have increased by 38 per cent above the equilibrium price of land estimated under a free market.

The free market simulation showed the distortions in production patterns caused by the price support programme. The domestic free market equilibrium price of wheat was predicted to be about 15 per cent lower than the mean fixed price. This would cause a large drop in production in the traditional wheat growing areas of the Swartland and Rûens. The model switched land previously under wheat to pastures owing to the lack of viable alternative enterprises. Only mixed pastures for sheep were considered in the model for the Swartland. Other viable enterprises (eg. lupins) may be substituted only to a limited extent in certain areas.

Table 4: Land areas, production and product prices under the original fixed price scheme compared to a free market for all crops except maize which is fixed at R204 per ton (Prices on a 1986 basis)

Region & crop	Price support programme			Free market for winter cereals			Percentage change		
	Area (1000ha)	Price (R/t)	Product. (1000 t)	Area (1000 ha)	Price (R/t)	Product. (1000 t)	Area	Price	Production
OFS/Tvl									
Wheat	832.8	400.5	806.0	1042.0	370.5	1022.5	25.1	-7.5	26.9
Maize	1179.1	255.2	2021.9	479.3	204.1	923.3	-59.3	-20.1	-54.3
Sorghum	48.9	243.9	73.3	21.0	215.7	36.3	-57.1	-11.6	-50.5
Sunflower	88.1	457.9	97.1	140.8	429.7	149.1	59.7	-6.2	53.5
Oats	15.0	238.3	22.5	29.4	205.9	49.4	95.9	-13.6	119.4
Total area	2163.9			1712.5			-20.9		
Swartland									
Wheat	390.6	400.5	359.8	358.2	370.5	326.1	-8.3	-7.5	-9.4
Oats	77.0	238.3	81.2	0.0	205.9	0.0	-100.0	-13.6	-100.0
Pastures	21.0			116.9			457.4		
Fallow	227.6			238.8			4.9		
Total area	716.2			714.0			-0.3		
Rûens									
Wheat	194.6	400.5	278.2	135.9	370.5	190.0	-30.2	-7.5	-31.7
Barley	87.5	336.2	109.5	116.3	310.8	148.0	33.0	-7.6	35.2
Oats	13.7	238.3	15.1	0.0	205.9	0.0	-100.0	-13.6	-100.0
Pastures	208.3			342.1	53.7		64.2		
Fallow	123.5			33.4	0.0		-72.9		
Total area	627.7			627.7			0.0		
Total									
Wheat	1418.0	400.5	1443.9	1536.1	370.5	1538.6	8.3	-7.5	6.6
Maize	1179.1	255.2	2021.9	479.3	204.1	923.3	-59.3	-20.1	-54.3
Sorghum	48.9	243.9	73.3	21.0	215.7	36.3	-57.1	-11.6	-50.5
Sunflower	88.1	457.9	97.1	140.8	429.7	149.1	59.7	-6.2	53.5
Barley	87.5	336.2	109.5	116.3	310.8	148.0	33.0	-7.6	35.2
Oats	105.8	238.3	118.8	29.4	205.9	49.4	-72.2	-13.6	-58.5
Pastures	229.3			459.1			100.2		
Fallow	351.1			272.3			-22.5		
Total area	3507.8			3054.1			-12.9		

In the Rûens, barley is a good alternative crop to wheat, however expanding production is limited to the barley malting capacity of the brewing industry as the feed and export markets are at present not viable options.

In the OFS/Tvl region, wheat appears to retain its relative profitability against competing crops since no significant reduction in wheat area occurred.

Owing to the strong price relationship between wheat and maize no significant drop in product prices under a free market for winter cereals only, is predicted. For example, only a 0,4 per cent and 0,7 per cent decrease in the price of wheat and oats respectively, and no change in the price of barley was calculated. The most significant change is in oats production; however this affects a relatively small area of wheat land. Overall, the predicted production patterns remain much the same as under a fixed price scheme.

Results of the market scenario where maize is the only crop operating under a fixed price show only a small decrease (2,3 per cent) in the wheat price as compared to a 15 per cent fall under a free market. This again emphasises the strong price

relationship between wheat and maize. Overall there were no significant changes in prices or production of any of the crops, the largest price fluctuation being a 4,3 per cent decrease in the price of sorghum.

The above two market scenarios highlight the fact that wheat and maize policies cannot be analysed in isolation from one another but rather a combined marketing policy is required.

Over recent years there has been a fall in the real producer price of maize in South Africa. The model simulated the switch-over of traditional maize land to wheat production that has taken place. It is interesting to note the large area of land moving out of crop production (13 per cent) which would more than likely be switched to livestock production. This highlights the restructuring of agricultural production that would occur should the fixed prices of major crops decrease in relation to competing enterprises.

From the social cost analysis it is clear that a fixed price scheme distributes welfare from consumers to producers. Thus in order to reduce the social costs of such a programme any future wheat policy must consider all related industries.

Table 5: Estimated rents (shadow prices) per hectare for different market scenarios relative to the original fixed price scheme in R/ha.

Region	Fixed Price Scheme	Free Market	Free Market for Winter Cereals	Price Support Maize only	Decrease in the Real Price of Maize
OFS/Tvl	82	48 (-41%)	80 (-2%)	80 (-2%)	24 (-74%)
Swartland	70	40 (-43%)	62 (-11%)	68 (-3%)	55 (-21%)
Rûens	92	65 (-29%)	92 (0%)	92 (0%)	75 (-18%)

Table 6: Welfare transfers and social costs under various market scenarios (Million Rand)

Welfare	Fixed Price Scheme	Free Market	Free Market for Winter Cereals	Price Maize only	Decrease in the Real Price of Maize
Producer Surplus	408,852	278,074 (-32%)	407,368 (-0%)	407,286 (-0%)	250,074 (-39%)
Consumer Surplus	477,625	684,403 (43%)	507,526 (6%)	550,429 (15%)	546,357 (14%)
Total Surplus	886,477	962,477 (9%)	914,894 (3%)	957,715 (8%)	796,431 (-10%)
Social Cost	76,000	0,000 (-100%)	47,583 (-37%)	4,762 (-94%)	166,046 (218%)

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