View metadata, citation and similar papers at core.ac.uk brought to you by CORE
provided by Research Papers in Economics

MODELLING THE WHEAT SECTOR IN SOUTH AFRICA

F Meyer & J Kirsten[1]

Abstract

In this study, the structure of the South African wheat market is analysed using economic theory and econometric modelling techniques. The model is used to make baseline projections regarding the supply and use of wheat in South Africa and to analyse the impacts of various policy alternatives on the wheat sector for the period 2004–2008. Results indicate that the area harvested in the summer as well as winter region will decrease over time. Domestic consumption will marginally increase over time, which will result in higher levels of imports. The ability of the model to simulate policy shocks is illustrated by means of simulating the impact of the elimination of the wheat import tariff on the wheat sector.

1. INTRODUCTION

Wheat is the most important grain crop in South Africa after maize and interestingly, the past decade has brought about a shift in the style of wheat marketing characterized by the transformation of a highly regulated dispensation to an essentially free one. As a result, the phasing out of the Wheat Board in 1997 has ensured that wheat producers are increasingly being exposed to international wheat markets. In addition, the economic policy in South Africa has changed dramatically, accompanying the almost global movement towards deregulation and liberalisation of the economy; resulting in a more market-based approach to both agricultural and macro-economic policy. The dynamic environment in which producers of agricultural products operate urges the need to understand the production and consumption patterns of the products that they produce. It is against this background that commodity modelling can play an important role to assist role players in decision-making.

Commodity modelling is a methodological and complete technique that provides a powerful analytical tool for examining the complexities of commodity markets. Generally, commodity models can be used for three levels of analysis, namely, market analysis, policy analysis, and as a forecasting tool (Boubaker, 1997). The specific approaches developed for

[1] *Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, South Africa.*

commodity modelling in this study have not, as yet, been applied in South Africa, and may provide a systematic and comprehensive approach to analysing and forecasting the behaviour of commodity markets in the country. The application of this econometric modelling technique has already been undertaken on a range of commodities and, therefore, the econometric analysis of the wheat sector will thus only serve as an example of the usefulness of these kinds of modelling techniques.

The convenient and efficient methodology developed by the Food and Agricultural Policy Research Institute (FAPRI) for conducting policy analysis research, is particularly pertinent to this study and hence underpins the approach used for modelling the market and policy alternatives for the South African wheat sector. Ordinary Least Squares (OLS) is used to estimate single equations, which are collapsed into one system and estimated simultaneously using the Two-Stage-Least-Squares (2SLS) estimation method. After the validation of the model's performance it is used to make baseline projections for the South African wheat sector during the period 2004-2008.

The paper is organised as follows: The following section describes the theoretical structure of the model, using a Flow and P-Q space diagrams. Section three presents the empirical results of the model, and discusses the performance of the model. Section four illustrates the baseline projections for the period 2004–2008 for the wheat sector in South Africa. The policy simulation results and their implications are reported in section five. A summary of the study and concluding remarks are given in section six.

2. THEORETICAL STRUCTURE OF THE MODEL

The Flow and P-Q Space diagrams provide a theoretical framework for an empirical model of the South African wheat sector. Figure 1 shows the flow of wheat through the market channel from the wheat producer to the ultimate consumer of the wheat product. The wheat model is basically composed of three blocks namely, the supply block, the demand block, and the price linkage block. In the supply block, the producer has to make the initial decision on the size of the area to be planted. Due to the unavailability of data on area planted, it has been common practice to begin crop modelling with area harvested, since area harvested is a good proxy for the area planted and it is also a reliable indicator of planned production.

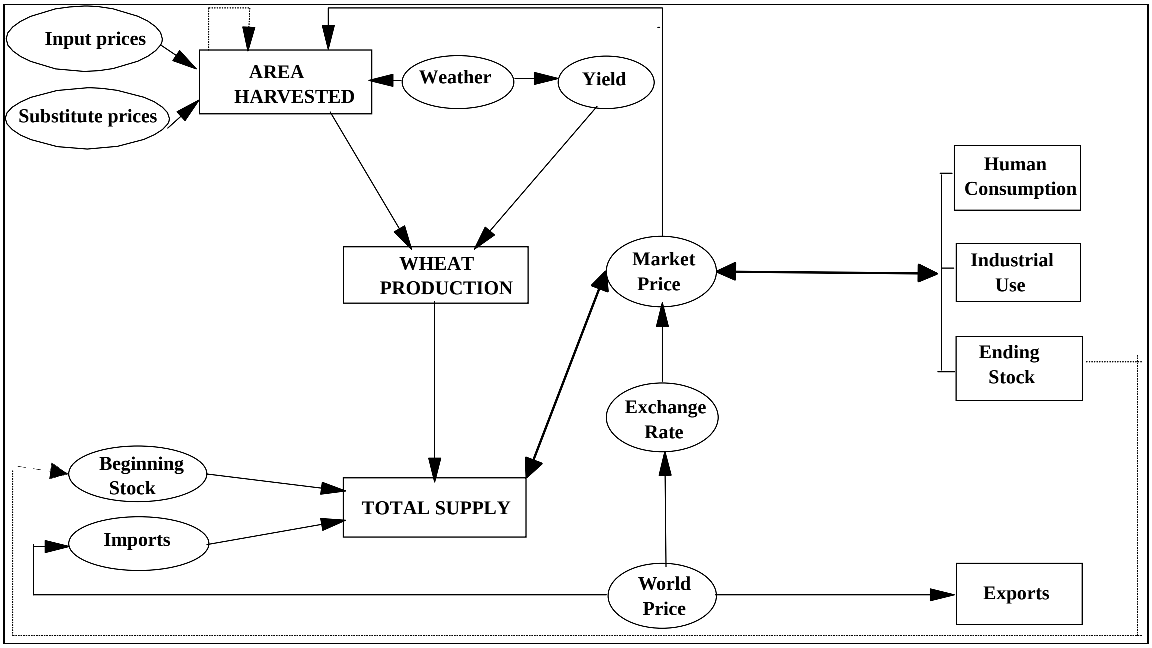

Figure 1: Flow diagram of the South African wheat sector

The producer price of wheat[2], input prices, producer prices of substitutes and complements, the weather conditions, and the previous year's area planted will influence the wheat producer's decision. After the wheat producer has taken the decision to plant, the yield, which is also influenced by the weather conditions, will determine the total production of the crop. The total supply of wheat in South Africa is then calculated by adding the beginning stock and total imports to the total production of the country. Imports are treated as the "clearing identity" This implies that imports are not estimated by means of a behavioural equation, but are used to balance domestic demand and supply. The impact of world prices and exchange rate are all introduced into the system of equations mainly by means of the price linkage equation (equation 8) and marginally by means of the export equation (equation 5).

In the demand block human consumption, feed and seed consumption, exports, and ending stocks determine the total demand for wheat in South Africa. Human consumption is influenced by the market price and *vice-versa*. A two-directional arrow illustrates this relationship. Feed consumption makes up less than five percent of the market and the data that reports on seed use is unreliable. As a result, these two categories are not estimated by means of behavioural equations but are included as exogenous variables in the calculation of total demand. Ending stocks in period t depend on the local

[2] *The market price in the flow diagram also represents the producer price. This price is the average annual SAFEX spot price.*

production of wheat, the market price of wheat, and the beginning stocks in period t. Ending stocks in period t are equal to the beginning stocks for period t+1. A dotted line is used to denote the lagged effect between ending stocks in period t and beginning stocks in period t+1.

The price linkage block formalises the interaction between the supply block and the demand block and also links the world price and the exchange rate to the local market. The one-direction arrow from the world price to the local market price indicates that the local price is influenced by the world price, but the local price does not influence the world price. The reason for this is that South Africa is a price taker in the world wheat market.

The P-Q diagram (Figure 2) and the flow diagram are closely related. The P-Q diagram reflects the different layers of the market. The P-Q diagram consists of two blocks. The upper block is the supply block and consists of the total area harvested (summer and winter), the beginning stock, and imports. The lower block is the demand block and consists of the total domestic consumption, exports, and ending stocks.

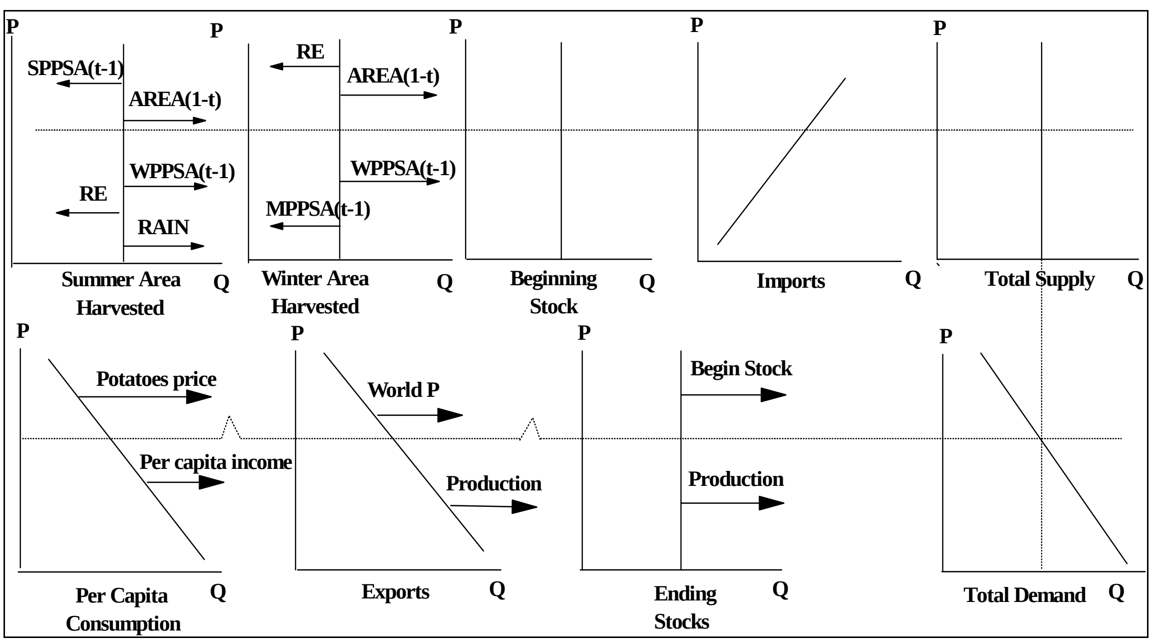

Figure 2: Price-Quantity diagram for the wheat sector in South Africa

It is important to note that the P-Q diagram depicts the economic relationships amongst the dependent and explanatory variables at different layers in the wheat market. This implies that each layer is influenced by the market price and the intersection of total demand and total supply yields the equilibrium price, i.e. the area harvested and domestic consumption are influenced by the market price and exports are influenced by the world price. The nature of the relationships among the dependent and explanatory variables is depicted by means of the shifters (arrows). A rightward shifter is used to explain a positive relationship between the dependent and independent variable, i.e. the expected sign of the parameter associated with the variable in the estimated equation is positive. A negative sign is expected for a leftward shifter.

3. ESTIMATION PROCEDURES, RESULTS AND PERFORMANCE OF MODEL

A single –equation approach is used in the first stage of the estimation procedures. Ordinary Least Squares (OLS) produces the best linear unbiased estimators for a single equation (Pindyck and Rubinfeld, 1998). Once the behavioural equations have been estimated, they will form part of a system of simultaneous equations that will express the interdependence of variables, which influence the supply and utilisation of wheat in South Africa. The equations in the model are estimated using the two stage least squares (2SLS) estimation technique for the period 1976–2002. In the first stage, the method of ordinary least squares is used to determine the fitted value of the dependent variable. In the second stage the original dependent variable is replaced by the first-stage fitted dependent variable. The second stage will also use the method of ordinary least squares to estimate consistent and efficient parameters for predetermined variables in the supply and demand equations.

The equations reported in this section form the South African wheat model and are taken from the 2SLS estimations. The estimated results include the parameter estimates, t-statistics in parenthesis, short-term elasticities in brackets, and long-term elasticities in square brackets. The R^2 and DW (or DH) statistics are reported for every equation. The elasticities were calculated at the mean values of the corresponding variables. In order to better understand and interpret the economic significance of the variables used in the equations, a detailed description of all the variables is included in the Appendix.

The South African wheat model consists of the following ten equations, six behavioural equations and four identities. The supply block is composed of equations 1 to 3, the demand block is composed of equations 4 to 7, the price linkage equation is presented in equation 8 and the wheat model is closed with the market clearing identity in equation 9.

1. Wheat summer area harvested

$WSAHSA_t$ = 0.062 + 0.812 LAG(WSAHSA)
(7.91)
+ 0.036 ((SHIFT97*(WPPSA)+(**1**-SHIFT97)*LAG(WPPSA))/ CPIF
(3.13)
<0.31>
[0.76]
-0.028 $(SPPSA/CPIF)_{t-1}$ + 0.0015RAIN
(-1.60) (4.51)
<-0.21>
[-0.56]
-0.50 DUM92 + 0.22 DUM96
(-4.57) (2.39)
R^2 = 0.938 Adj. R^2 = 0.912 F Value = 34.96 D.H = 0.422

2. Wheat winter area harvested

WWAHSA = 0.56 + 0.32 LAG(WWAHSA)
(1.59)
+ 0.017 ((SHIFT97*(WPPSA)+(**1**-SHIFT97)*LAG(WPPSA))/CPIF
(1.83)
<0.18>
[0.45]
-0.016 LAG (MPPSA/CPIF) -0.23 SHIFT90
(-1.54) (3.29)
<-0.15>
[-0.35]
R^2 = 0.925 Adj. R^2 = 0.905 F Value = 44.97 D.W = 1.795 D.H = 0.823

The results show that South African wheat competes with sunflowers in the summer rainfall region and with mutton in the winter rainfall region with short run cross price elasticities of -0.21 and -0.15 and long run cross price elasticities of –0.56 and -0.35 respectively. The rainfall variable used in the model represents the sum of the rainfall for the months March, April, and May. The rainfall of these three months will influence the farmers planting decision.

3. Wheat production

WPROSA = (WSAHSA + WWAHSA)*WYSA

Wheat production is an identity equal to the sum of summer and the winter area harvested multiplied by the average yield. The variables used for the summer and winter areas harvested in equation 3 were estimated in equation 1 and 2. For this study yield was treated as an exogenous variable and was thus not estimated.

4. Wheat per capita consumption

WPCCSA = 9.63 - 0.117 (WPPSA/CPIF) + 0.008 (PRPSA/CPIF)
(-2.09) (2.43)
<-0.19> <0.06>
+ 0.0005 (PCGDP/CPIF) – 11.70 SHIFT90
(2.47) (-3.34)
<0.13>

$R^2 = 0.854$ Adj.$R^2 = 0.824$ F Value = 27.95 D.W = 1.550

The results of equation 6 show that wheat competes with potatoes on a retail level, with a cross price elasticity of 0.06. Contrary to what was expected, maize meal was not found to be a substitute for wheat. Per capita income was also found to have a positive effect on domestic wheat utilization with an income elasticity of 0.13.

5. Wheat exports

WESA = 673.53 – 424.85 (WPPSA/(WPPKC*EXCH/100))/CPIF +1796.95 (WPROSA/WDUSA)
(-1.85) (-1.48)
<-3.97> <1.06>

$R^2 = 0.746$ Adj.$R^2 = 0.693$ F Value = 13.98 D.W. = 1.981

South African wheat exports were modelled as a function of two ratios. Firstly the price ratio of the domestic wheat producer price over the Kansas City price of hard red winter wheat no.2 multiplied by the exchange rate. For this ratio the model produced a large negative price elasticity of –3.97. Secondly, wheat exports were modelled as a function of the local wheat production over local wheat consumption. The results suggest a positive elasticity of 1.06. Both sings can be explained by economic theory.

6. Wheat ending stock

WENDSA = -0.55 + 0.80 LAG(WENDSA) + 0.32 WPROSA – 0.87 DUM88
(3.93) (2.99) (-2.58)
<0.78> <1.21>

$R^2 = 0.729$ Adj.$R^2 = 0.655$ F Value = 9.73 D.W. = 1.934

In Equation 6 the ending stocks were estimated as a function of the lagged wheat ending stocks and total production. Initially wheat domestic prices and Free on Board (FOB) export prices were used as explanatory variables, but then dropped from the equation. Both produced wrong signs and were found to be statistically insignificant. These findings suggested that South African wheat stocks are perfectly inelastic with respect to their own price.

7. *Wheat total domestic use*

$$WDUSA = WPCCSA*POP$$

South African domestic wheat use is an identity defined as wheat per capita consumption times total population.

8. *Wheat price linkage equation*

$$WPPSA = 160.70 + 0.33\,(WPPKC*EXCH/100 + Tariff) - 78.21\,(WPROSA/WDUSA)$$

(1.88) (-2.54)

<0.46> <-0.15>

$R^2 = 0.965$ Adj.$R^2 = 0.961$ F Value = 289.56 D.W. = 1.25

The local wheat producer price is modelled as a function of the Kansas City price of hard red winter wheat no.2 plus the tariff and a ratio of local wheat production over consumption. Results suggest that an increase of 10% in the world wheat price results in a 4.6% increase in the local producer price of wheat.

9. *Wheat market clearing identity*

$$WISA = WBSSA+WPROSA - WDUSA - WESA - WENDSA$$

Wheat imports were used as the market clearing identity. In other words, they were used to close the wheat model. They were defined as the beginning stock plus production minus domestic use minus exports minus ending stocks. The market clearing identity is reached at an equilibrium price in the market.

In order to complete the process of model development, the model is simulated over the historic period. In this study, the Gauss-Seidel algorithm is used to solve the model's simultaneous system of equations. Now the estimated system of equations is validated based on four criteria (Ferris, 1998; Pindyck and Rubinfeld, 1998). These are: the Root Mean Square errors (*RMSE%)*; the Mean Error percentages; Theil's Inequality Statistics; and finally the response of the system to exogenous shocks, which is referred to as impact multipliers. The estimated equations were subjected tot the full range of statistical tests. Based on the results of these tests, it can be concluded that the estimated econometric model provides reliable estimates of South African wheat supply and utilization. For the purpose of this paper, only the Goodness of Fit measures are illustrated in Table 1. Results indicate that only two of the equations had percentages for the Root Mean Squared Error (*RMSE%*), which were significantly higher than ten percent. This implies that the simulated endogenous variables track their corresponding data series very closely.

Table 1: Measurements for the Goodness of Fit

Variable	Mean Error%	RMSE%	Inequality Coefficient (U)
WSAHSA	-0.2999	15.276	0.0439
WWAHSA	1.3537	10.993	0.0469
WPRODSA	0.2239	8.9219	0.0352
WENDSA	0.5878	24.645	0.1384
WPCCSA	0.3347	8.0988	0.0388
WESA	1.6500	4.2530	0.2155
WDUSA	0.3117	7.7000	0.0379
WTSSA	-1.0200	6.8079	0.0339
WPPSA	0.7129	11.677	0.0428
WISA	0	0.1834	0.2481

The final criterion to determine the goodness-of-fit of the model is Theil's inequality coefficients, which are also presented in Table 1. U can take on values between 0 and 1. If U = 0, there is a perfect fit, whereas, if U = 1, the predictive performance of the model is as bad as can be. With the highest value of 0.24181 for Wheat Imports (WISA), which is also the residual variable, these results also suggest that the *ex post* forecast of the model has performed well and consequently the model can be used for forecasting purposes as well as policy analyses.

4. THE BASELINE

To facilitate the generation of a baseline, the model needs to be solved for a specific period in the future. Various assumptions are made regarding future values for the exogenous variables in the model. The baseline projections are considered as a commodity market outlook rather than as forecasts because they are produced conditional on a number of assumptions. These assumptions relate mainly to agricultural policies, the macroeconomic environment, and weather conditions.

The baseline assumes that no changes will take place in the agricultural policies currently in force. This implies that the policy on the import tariff will stay in place for the baseline period. Projections for the following macroeconomic variables were obtained from FAPRI's 2003 baseline: the World Price of Wheat and Sunflower, the Exchange Rate, the Gross Domestic Product Deflator (GDPD), and Population. The wheat world price is projected to gradually increase to a level of $148.05/ton in 2008. After the strong appreciation in 2003 and 2004, the exchange rate is expected to gradually depreciate against the US dollar to a level of 831 SA cents/USD in 2008. The population is assumed to stay fairly constant at 45 million until 2008. GDPD is projected to increase at a decreasing rate from 4.8 percent in 2004 to 1.9 percent in 2008. The baseline projections also assume trend yields and normal weather conditions. Table 2 presents baseline projections for the South African wheat sector over the period 2002 to 2008.

Table 2: Market outlook for the South African wheat sector

	2004	2005	2006	2007	2008
	thousand hectares				
Summer area harvested	474.1	433.4	410.3	398.8	388.8
Winter area harvested	345.4	404.8	397.2	392.7	388.6
	t/ha				
Average yield	2.35	2.59	2.63	2.68	2.72
	thousand tons				
Production	1924.6	2171.0	2126.3	2117.4	2110.8
Feed consumption	78.1	87.8	88.8	88.6	87.2
Human consumption	2519.7	2548.7	2557.3	2567.4	2573.9
Domestic use	2622.8	2661.5	2671.1	2681.0	2686.1
Ending stocks	537.4	596.8	645.0	687.4	722.9
Exports	29.3	8.6	23.9	47.0	66.0
Imports	801.7	558.6	616.9	653.0	676.7
	R/ton				
Average producer price	1528.3	1591.7	1670.4	1743.4	1801.9

The wheat area harvested in the summer rainfall region gradually decreases to a projected level of 388,800 hectares in 2008. The reason for the initial big decrease in the area harvested in 2005 is due to the impact of the higher sunflower producer price. The wheat area harvested in the winter rainfall region also decreases consistently to reach 388,600 hectares in 2008. After an initial decline in the wheat imports in 2005, imports are projected to increase to reach 676,700 tons in 2008. Despite of higher average yields, local production is projected to decrease, while local consumption will increase. This will result in higher local producer prices.

5. THE WHEAT SECTOR OUTLOOK FOR A SHIFT IN THE POLITICAL ENVIRONMENT

The constructed model can now be used to make projections taking into account different policy shifts that will result in a change in the macroeconomic environment. Policy and business decisions can be assessed using a range of *"what if"* questions. Although various scenarios were simulated, only the results of one specific policy shift will be illustrated and discussed, namely, the elimination of the wheat import tariff. This shift in the political environment is introduced in 2005. The model is solved and the results are compared to the initial baseline, which was generated without any changes in policies, world markets and the production environment.

Table 3 Impacts of the elimination of the import tariff on the wheat sector

		2004	2005	2006	2007	2008
Wheat Summer Area Harvested		thousand hectares				
	Baseline	474.10	433.42	410.27	398.82	388.79
	Scenario	474.10	433.42	400.55	390.57	382.85
	Absolute Change	0.00	0.00	-9.71	-8.25	-5.95
	% Change	0.00%	0.00%	-2.36%	-2.06%	-1.52%
Wheat Winter Area Harvested		thousand hectares				
	Baseline	345.38	404.75	397.19	392.72	388.57
	Scenario	345.38	404.75	393.61	389.65	386.33
	Absolute Change	0.00	0.00	-3.58	-3.07	-2.24
	% Change	0.00%	0.00%	-0.01%	-0.01%	-0.01%
Wheat Production		thousand tonnes				
	Baseline	1924.60	2170.96	2126.30	2117.42	2110.81
	Scenario	1924.60	2170.96	2091.30	2087.13	2088.58
	Absolute Change	0.00	0.00	-35.00	-30.29	-22.23
	% Change	0.00%	0.00%	-1.65%	-1.43%	-1.05%
Wheat Ending Stock		thousand tonnes				
	Baseline	537.37	596.83	645.00	687.40	722.88
	Scenario	537.37	617.27	676.24	722.25	757.21
	Absolute Change	0.00	20.43	31.24	34.85	34.34
	% Change	0.00%	3.42%	4.84%	5.07%	4.75%
Wheat Human Consumption		thousand tonnes				
	Baseline	2519.70	2548.70	2557.27	2567.38	2573.93
	Scenario	2519.70	2560.02	2566.20	2573.98	2578.94
	Absolute Change	0.00	11.32	8.93	6.61	5.01
	% Change	0.00%	0.44%	0.35%	0.26%	0.19%
Wheat Exports		thousand tonnes				
	Baseline	29.27	8.59	23.93	47.02	65.96
	Scenario	29.27	30.58	40.78	58.82	74.20
	Absolute Change	0.00	21.99	16.85	11.80	8.24
	% Change	0.00%	256.00%	70.44%	25.10%	12.49%
Wheat Imports		thousand tonnes				
	Baseline	801.71	558.62	616.89	652.97	676.72
	Scenario	801.71	616.24	691.46	707.30	713.10
	Absolute Change	0.00	57.62	74.56	54.34	36.38
	% Change	0.00%	10.31%	12.09%	8.32%	5.38%
Wheat Producer Price		R/ton				
	Baseline	1528.28	1591.73	1670.39	1743.41	1801.90
	Scenario	1528.28	1539.10	1627.05	1710.57	1777.47
	Absolute Change	0.00	-52.63	-43.33	-32.84	-24.43
	% Change	0.00%	-3.31%	-2.59%	-1.88%	-1.36%

Import tariffs replaced quantitative import controls in 1995. These tariffs are usually implemented by means of a gliding scale where the international price drops below a level of $194/ton (Exchange rate R3.69 for $1 USA). It was not until February 1998, that the first import tariff was implemented. The import parity price of wheat dropped under R802 per ton and a R50 per ton import tariff was charged. In 1999, a new tariff structure for wheat was announced with a new reference price of $157 per ton. This tariff structure is still in place.

The tariff is calculated according to the Hard Red Wheat (No.2) price in Kansas City on a weekly basis. If the current price deviates for three weeks by $10 per ton or more from the average price of $157 per ton, the tariff is adjusted. The wheat tariff is currently published at R18.67 per ton. This makes up only a very small share of the local wheat price. However, at the projected Hard Red Wheat (No.2) price of $144/ton for 2005 an average tariff of R87.45 is triggered. Thus the elimination of the wheat tariff dispensation could possibly have a greater effect in later years. It is also important to note that import tariffs in access of R200 per ton have been published in recent years. It is; therefore, appropriate to consider the case where no import tariff is in place as a policy scenario. Results of this scenario are presented in Table 3 below.

With the elimination of the tariff, imports will become cheaper and hence will increase over the projected period. Higher imports will lead to a higher total supply of wheat in the domestic market, which will drive prices down. The results indicate that the average producer prices of wheat immediately decrease by 3.31 percent in 2005 in comparison to the baseline, which would affect the area harvested under wheat for the following production season (2006) because producers respond on the lagged producer prices. Compared to the baseline, the area harvested in the summer rainfall region decreases by 2.36 percent and the area in winter rainfall region decreases by a mere 0.1 percent.

6. SUMMARY AND CONCLUSION

In this paper the structure of the wheat sector in South Africa was analysed using economic theory and econometric modelling techniques. The estimated models were subjected to a range of statistical tests. Based on the results of these tests, it can be concluded that the estimated model provides reliable estimates of relevant variables and can thus be used to better understand the functioning of the wheat market in South Africa and the possible impacts of exogenous factors on this industry. The model was used to make baseline projections regarding the supply and use of wheat in South Africa for the period 2004-2008, and to analyse the impact of the elimination of the wheat tariff on the wheat sector. The model that was presented in this study is an earlier version of a much improved wheat model that was included in the South African Grain, Livestock, and Dairy Model. Later versions of the model include behavioural equations for yield, take cross-commodity linkages into account and are integrated into a larger system of equations with the necessary interaction between the different commodity and livestock sectors. The objective of this study was to clearly illustrate the development and practical application of a system of equations by means of focussing only on the wheat industry in South Africa.

REFERENCES

Boubaker BB (1997). *Econometric models of the Argentine cereal economy: A focus on policy simulation analysis*. Unpublished PhD (Agric) dissertation, University of Missouri-Colombia.

FAPRI (Food and Agricultural Policy Research Institute) (2002). *FAPRI 2002 World agricultural outlook*. Iowa State University, University of Missouri-Columbia.

Ferris JN (1998). *Agricultural prices and commodity market analysis*. McGraw-Hill, Inc, New York.

Pindyck RS & Rubinfeld DL (1998). *Econometric models and economic forecasts*. Forth Edition, McGraw-Hill, Inc., New York.

APPENDIX A

Explanations of variable names used in the estimations	
WSAHSA	Wheat Summer Area harvested, 1000 ha
WWAHSA	Wheat Winter Area Harvested, 1000 ha
WPPSA	Wheat Producer Price South Africa , R/ton
SPPSA	Sunflower Producer Price South Africa, R/ton
RE	Requisites Index, 1995=100
CPIF	Consumer Price Index of Food Items, 1995=100
RAIN	Average Rainfall of Summer Wheat Production Area for first four months of production season (March, April, May, June) when the planting decision is taken
MPPSA	Mutton Producer Price South Africa, c/kg
WPROSA	Wheat Production in South Africa, 1000 tons
WYSA	Wheat Average Yield per Hectare, tons/ha
WISA	Wheat Imports of South Africa, 1000 tons
WESA	Wheat Exports, 1000 tons
WPPKC	Kansas City Wheat Price, Hard Red no.2, $/ton
EXCH	Exchange rate, SA cent/USD
POP	Population in South Africa, 1000 000 people
WTSSA	Wheat Total Supply of South Africa, 1000 tons
WBSSA	Wheat Beginning Stock, 1000 tons
WPCCSA	Wheat per Capita Consumption, kg/capita/year
PRPSA	Potatoes Retail Price, c/kg
PCGDP	Per Capita Gross Domestic Product
WENDSA	Wheat Ending Stocks in South Africa, 1000 tons
WDUSA	Wheat Domestic Use, 1000 tons
SHIFT 97	Shift variable introduced in 1997
SHIFT 90	Shift variable introduced in 1990
DUM92	Dummy variable included in 1992
DUM96	Dummy variable included in 1996