Model closure and price formation under switching grain market regimes in South Africa

by

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I declare that the dissertation that I hereby submit for the degree in Agricultural Economics at the University of Pretoria has not previously been submitted by me for degree purposes at any other university.

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ABSTRACT

MODEL CLOSURE AND PRICE FORMATION UNDER SWITCHING GRAIN MARKET REGIMES IN SOUTH AFRICA

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This study develops the structure and closure of an econometric regime-switching model within a partial equilibrium framework that has the ability to generate reliable estimates and projections of endogenous variables under market-switching regimes. Models used in policy evaluation usually either ignore the possibility of regime switching, using just a single method of price determination based on average effects, or incorporate highly stylised components that may not reflect the complexities of a particular market. This study proposes an approach that allows the incorporation of features of regime switching in a multisector commodity level model which capture salient features of the South African market and are therefore able to produce more reliable projections of the evolution of the sector under alternative shocks. The following hypothesis is tested in the study:

With the correct model structure and closure, a combination of modelling techniques can be applied to develop a simulation model that has the ability to generate reliable estimates and projections of endogenous variables under market-switching regimes.

The technique that is used to "close" a simultaneous or recursive simulation model determines the manner in which market equilibrium is achieved in the model. The choice of closure technique will depend on the equilibrium pricing condition in a specific

market, specifically which market regime prevails in the market. It is important to note that trade flow and equilibrium pricing conditions under various trade regimes in the SA grain markets do not occur strictly according to these definitions. In the SA white and yellow maize markets some level of trade does occur with neighbouring countries at price levels that suggest that the market is trading under a type of regional autarky isolated from world markets. Industry experts argue that trade in the Southern African region is largely driven by regional issues like staple food, adverse weather conditions, location and quality concerns of genetically modified imported maize from non-African destinations, and to a lesser extent by arbitrage opportunities. This study, therefore, refers to "near-autarky". Given the fact that markets can fluctuate between different trade regimes (therefore equilibrium pricing conditions), some type of regime-switching model needs to be utilised to determine model closure. A switching mechanism is introduced that allows the white maize model to switch between model closer under import parity, near-autarky, and export parity, the yellow maize model to switch between model closure under import parity and near-autarky, and the wheat model to close under import parity.

Various approaches are used to test whether the regime-switching model complies with the hypothesis of this study. The first approach involves the simulation of baseline projections under a combination of different trade regimes in the grain markets. The second approach illustrates the usefulness of the automated switch between the various model closure techniques by comparing *ex-post* simulation results of the regime-switching model to the results of a previous version of the sector model that does not have the ability to switch between various market regimes. The last approach presents a more hands-on application of the regime-switching model to real-life examples by analysing the impact of a combination of market- and policy-related shocks in the form of scenario analysis.

This study proves that the regime-switching model is able to capture a richer variety of market behaviour than standard models as a result of the regime-switching innovation outlined, therefore more accurately capturing the likely effects of shocks on the domestic market. It is therefore consistent with the hypothesis of this study. The regime-switching model is, by design, more rigorous than the previous model in that it emphasises price

formation and correct model closure under alternative regimes. Although the model is particularly appropriate for the South African grain market as specified here, it provides a template for which models for other countries and commodities may be developed.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS (iii)

ABSTRACT (iv)

TABLE OF CONTENTS (vii)

LIST OF TABLES (x)

LIST OF FIGURES (xii)

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND 1

1.2 PROBLEM STATEMENT AND JUSTIFICATION OF RESEARCH 3

1.3 STATEMENT OF HYPOTHESIS 7

1.4 OBJECTIVES AND METHODOLOGY OF THE STUDY 8

1.5 OUTLINE OF STUDY 12

CHAPTER 2: MODEL CLOSURE AND PRICE FORMATION: CONCEPTS AND APPLICATIONS

2.1 INTRODUCTION 13

2.2 PRICE FORMATION AND MODEL CLOSURE: A REVIEW 13

2.2.1 BACKGROUND OF PRICE FORMATION 14

2.2.2 CONCEPTUALISING MODEL CLOSURE 21

2.3 AN OVERVIEW OF THE GRAIN MARKETS 27

2.3.1 THE DATABASE 27

2.3.2 IDENTIFYING THE ALTERNATIVE MARKET REGIMES 29

2.4 SUMMARY 35

CHAPTER 3: THEORETICAL FOUNDATION OF PARTIAL EQUILIBRIUM MODELLING

3.1 INTRODUCTION 36

3.2 THE DOMESTIC DEMAND AND SUPPLY COMPONENTS OF THE EXISTING PARTIAL EQUILIBRIUM MODEL 37

3.2.1 DOMESTIC SUPPLY 37

3.2.1.1 PRODUCER SUPPLY 37

3.2.1.2 BEGINNING STOCKS 43

3.2.2 DOMESTIC DEMAND 43

3.2.2.1 CONSUMER DEMAND 44

3.2.2.2 FEED DEMAND 46

3.2.2.3 ENDING STOCKS/INVENTORY 47

3.3 MODEL CLOSURE AND PRICE FORMATION UNDER SWITCHING MARKET REGIMES 49

3.3.1 THE FLOW DIAGRAM AND THE PRICE QUANTITY (P-Q) DIAGRAM 49

3.3.2 THE TRADE AND PRICE LINKAGE COMPONENTS UNDER SWITCHING MARKET REGIMES 55

3.3.2.1 NEAR- AUTARKY 55

3.3.2.2 IMPORT AND EXPORT PARITY 57

3.4 ESTIMATION PROCEDURES, MODEL SOLVING AND VALIDATION 58

3.5 SUMMARY 60

CHAPTER 4: THE REGIME-SWITCHING MODEL

4.1 INTRODUCTION 61

4.2 EMPIRICAL RESULTS 61

4.2.1 DOMESTIC SUPPLY 62

4.2.2 DOMESTIC DEMAND 70

4.2.3 MODEL CLOSURE 80

4.3 THE REGIME-SWITCHING MECHANISM 91
4.4 SUMMARY 94

CHAPTER 5: BASELINE PROJECTIONS, IMPACT MULTIPLIERS AND SCENARIO ANALYSES

5.1 INTRODUCTION 96
5.2 THE BASELINE 97
5.3 IMPACT MULTIPLIERS 109
5.4 THE OLD VERSUS THE NEW MODEL 112
5.5 ELASTICITY MATRICES 117
5.6 SCENARIO ANALYSIS 118
5.7 SUMMARY 122

CHAPTER 6: CONCLUSION 124

REFERENCES 129

APPENDIX 1
APPENDIX 2

LIST OF TABLES

Table 2.1:	Export parity price for yellow maize, February 2005	30
Table 2.2:	Import parity price for yellow maize, February 2005	31
Table 5.1:	Macroeconomic assumptions and world price forecasts, 2006 – 2012	98
Table 5.2:	Baseline 1 - White maize	100
Table 5.3:	Baseline 1 - Yellow maize	100
Table 5.4:	Baseline 1 – Wheat	100
Table 5.5:	Baseline 2 - White maize	103
Table 5.6:	Baseline 2 - Yellow maize	103
Table 5.7:	Baseline 2 – Wheat	103
Table 5.8:	Baseline 3 - White maize	105
Table 5.9:	Baseline 3 - Yellow maize	106
Table 5.10:	Baseline 3 – Wheat	106
Table 5.11:	10 percent increase in the white maize parity prices – import parity regime	109
Table 5.12:	10 percent increase in the white maize parity prices – autarky regime	109
Table 5.13:	10 percent increase in the white maize parity prices – export parity regime	110
Table 5.14:	10 percent increase in the yellow maize parity prices – import parity regime	110
Table 5.15:	10 percent increase in the yellow maize parity prices – autarky regime	110
Table 5.16:	10 percent increase in the wheat parity prices – import parity regime	111
Table 5.17:	Price and trade impact multipliers under alternative market regimes, 2007	112
Table 5.18:	White maize baseline projections – old model	113
Table 5.19:	Yellow maize baseline projections – old model	114
Table 5.20:	White maize impact multipliers – old model, 2007	116

Table 5.21:	Yellow maize impact multipliers – old model, 2007	116
Table 5.22:	Area harvested own and cross price elasticity matrix, 2006	117
Table 5.23:	Human grain consumption own and cross-price elasticity matrix, 2006	118
Table 5.24:	Feed grain consumption cross-price elasticity matrix, 2006	118
Table 5.25:	Assumptions of exogenous variables – ethanol scenario	120
Table 5.26:	White maize impact multipliers – economic and political shocks	120
Table 5.27:	Yellow maize impact multipliers – economic and political shocks	121
Table 5.28:	White maize impact multipliers – ethanol scenario, 2007 – 2010	121
Table 5.29:	Yellow maize impact multipliers – ethanol scenario, 2007 – 2010	122

LIST OF FIGURES

Figure 1.1:	Three different market regimes	4
Figure 2.1:	Price and trade space for white maize, May 2000 – May 2005	32
Figure 2.2:	Price and trade space for yellow maize, May 2000- May 2005	33
Figure 2.3:	Price and trade space for wheat, May 2000 – May 2005	34
Figure 3.1:	Flow diagram of SA grain market in near-autarky	50
Figure 3.2:	Flow diagram of a typical grain market in net export or net import parity	51
Figure 3.3:	P-Q diagram for three different trade regimes	53
Figure 4.1:	The regime selector	92
Figure 5.1:	Baseline 1 - Price space for white maize, 1997 – 2012	101
Figure 5.2:	Baseline 1 - Price space for yellow maize, 1997 – 2012	101
Figure 5.3:	Baseline 1 - Price space for wheat, 1997 – 2012	102
Figure 5.4:	Baseline 2 - Price space for white maize, 1997 – 2012	104
Figure 5.5:	Baseline 2 - Price space for yellow maize, 1997 – 2012	104
Figure 5.6:	Baseline 2 - Price space for wheat, 1997 – 2012	105
Figure 5.7:	Baseline 3 - Price space for white maize, 1997 – 2012	107
Figure 5.8:	Baseline 3 - Price space for yellow maize, 1997 – 2012	107
Figure 5.9:	Baseline 3 - Price space for wheat, 1997 – 2012	108
Figure 5.10:	Price space for white maize – old model, 1997 – 2012	114
Figure 5.11:	Price space for yellow maize – old model, 2007 – 2012	115