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

by

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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.
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