MSU International Development Working Paper

The Effects of Market Reform on Maize Marketing Margins in South Africa

by

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MSU International Development Working Paper No. 83
2004

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THE EFFECTS OF MARKET REFORM ON MAIZE MARKETING MARGINS IN SOUTH AFRICA: AN EMPIRICAL STUDY

by

Lulama Ndibongo Traub and T.S. Jayne

October 2004

This report is published by the Department of Agricultural Economics and the Department of Economics, Michigan State University (MSU). Funding for this research was provided by the Food Security III Cooperative Agreement (GDG-A-00-02-00021-00) and the Rockefeller Foundation.

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ISSN 0731-3438

Published by the Department of Agricultural Economics and the Department of Economics, Michigan State University, East Lansing, Michigan 48824-1039, U.S.A.

ACKNOWLEDGMENTS

This report has benefited from the comments of Akin Adesina, Johann Kirsten, Ferdi Meyer, John Staatz, Tobias Takavarasha, Michael Weber, and Jeffrey Wooldridge for comments and advice in the preparation of this paper. The authors acknowledge support for this work from the Rockefeller Foundation, and from USAID/Economic Growth, Agriculture, and Trade Mission and the Initiative to End Hunger in Africa (IEHA) through the Food Security III Cooperative Agreement. The views expressed here are solely those of the authors and should not be taken to reflect the official positions of any organization or agency.

EXECUTIVE SUMMARY

Prior to the reform of South Africa's maize marketing system in 1997, maize meal prices and marketing margins for millers and retailers were among the highest in the Southern Africa region. This article determines the effect of market reform on the size of maize milling/retail margins in South Africa. Regression models of monthly milling/retail margins are run from the period May 1976 to September 2003. To assess the robustness of our findings, we estimate several different model specifications representing structural change, vary the sample period to examine the sensitivity of findings to unusual weather and market conditions in the region during the 2001-2003 period, and run the models using different estimation techniques, OLS with Newey-West robust estimators and Feasible General Least Squares.

In virtually all models, the results indicate that real maize milling/retailing margins in South Africa have increased even further since the deregulation of prices and reform of markets in 1997. Controlling for disturbances in weather, wages, exchange rate levels and volatility, inflation-adjusted margins accruing to millers and retailers has risen 29 to 42% between 1997 and 2003. Simulations indicate that the deregulation of maize meal prices has caused a 16 to 20% increase in the mean retail price of maize meal since 1997. Maize meal prices in South Africa remain the highest of all maize producing countries in the region, even though mean wholesale prices in South Africa are relatively low compared to its regional neighbors.

Unlike experiences in neighboring countries, the reform of the maize market in South Africa has not benefited consumers. Further investigation is needed on market concentration and possible entry barriers in South Africa's maize marketing system, and the extent to which the factors leading to high maize meal prices in South Africa are adversely affecting consumers in the wider Southern Africa region.

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1. INTRODUCTION

Maize is the dominant staple food in South Africa. Maize marketing and processing costs typically account for 50 to 70% of the total cost of maize meal paid by South Africa consumers.

Marketing activities are essential in order to get food from farmers' fields onto consumers' tables. These activities include assembly and bulking of product, storage to even out differences between the timing of harvest and the continuous nature of consumption, processing of maize into meal, and delivery of maize meal to consumers. All of these activities involve costs, which must be borne by the farmers, consumers, businesses, or government. A goal of policy in any country is to ensure that these tasks be done as reliably and cost-effectively as possible. There are several reasons why South Africa's farmers, business community, and government should care greatly about marketing costs within the maize sector. First, marketing costs act as a wedge between the prices farmers receive and the prices that consumers pay. When marketing cost rise, then there is inevitably one of two outcomes: prices to farmers go down and/or consumer prices go up. Both outcomes can adversely affect national food security. In a country such as South Africa where low-income consumers spend up to 20% of their income on maize (National Institute for Economic Policy 1995), the consequences of rising maize meal prices are particularly acute.

Second, maize is a "wage good" in South Africa. Wage goods are commodities that form such a large share of consumer expenditures that their price often indirectly influences the supply of labor and wage rates. When the price of wage goods rise, industries which rely heavily on labor tend to experience rising costs, which over time creates ripple effects throughout the economy, including the erosion of industry's competitiveness in international markets (Delgado 1992). Strategies that effectively drive down costs within the marketing system can simultaneously raise the incomes of farmers, improve poor peoples' food security and disposable incomes, and encourage the types of structural transformation processes that have contributed to economic development in other developing areas (Johnston and Kilby 1975; Mellor 1976; Timmer 1997).

Beginning in the 1930s and up to 1997, maize marketing and pricing in South Africa was largely directed by government. However, starting in the mid-1980s, internal pressures within the maize industry led to a series of reforms designed to reduce government's role in pricing and distribution and rely increasingly on market forces and the private sector. These developments mirrored policy changes occurring in the agricultural sectors of other African countries.

Ex post studies of the impact of maize market reform in neighboring countries, such as Zimbabwe, Zambia, Mozambique, and Kenya, have found that in general, the reforms led to lower maize milling/retailing margins in real terms (Arlindo 2001; Jayne et al. 1995; Jayne et al. 1999). Milling/retailing margins are defined as the difference between retail price of maize meal and the price at which millers purchase maize, after accounting for extraction rates and the value of by-products produced in the milling process. There were two general explanations for this consistent finding that market reform had reduced maize milling/retail margins in these countries. First, the reforms put greater pressure on existing milling firms to reduce their margins. The former market control system suppressed competition at the milling and retailing stages of the marketing system in urban areas. Typically, a few officially registered maize processing firms had a *de facto* oligopoly on milling maize and supplying the retail sector. These regulations made it difficult for non-registered millers and traders to acquire grain from the marketing boards and hence discouraged the development of alternative marketing channels for supplying maize and maize meal products to consumers in rural as well as urban areas (Jayne et al. 1995; Rubey 1995; Mukumbu 1994; Republic of Zambia 1995). Governments set fixed prices throughout each stage of the maize marketing system. Maize meal prices followed a cost-plus approach based on registered milling firms' stated costs. Market reform opened this system to greater competition as small-scale millers and retailers who were previously excluded from entering the market were now allowed to procure and transport grain freely across district boundaries. Rapid investment in medium- and small-scale milling and retailing networks occurred almost immediately after the reforms were implemented. Consumer surveys in these countries showed particular price-responsiveness by low-income consumers. In response to greater competition, the registered large milling companies cut their prices in an attempt to regain lost market share. Greater competition in milling and retailing exerted downward pressure on the milling/retailing margins of the large-scale firms' products, benefiting consumers (Jayne and Argwings-Kodhek 1997; Rubey 1995; Tschirley, Donovan, and Weber 1996).

Second, the small-scale millers, who rapidly entered the market after the reforms, produced a range of maize meal products. Some of these maize meal products were relatively refined, while others were unrefined, including relatively inexpensive whole maize meal. Studies indicated that these marketing channels became the primary means by which relatively low-income consumers procured their staple maize meal.[1] The emergence of these alternative marketing channels contributed to the downward pressure on maize meal prices that were observed in these countries after maize marketing reforms (Jayne et al. 1999).

These observations about maize marketing margins in Southern Africa motivate the objectives of this study: to determine how the market reform process has affected marketing margins for processed maize in South Africa. This objective is address by estimating several alternative models for representing structural change in monthly maize milling/retailing margins, as well as using alternative estimation processes, and time periods. We first describe South Africa's maize marketing system and reform process. We then present the marketing margin models estimated in the analysis, describe the data and variables used in the models, explain the estimation procedures used, and interpret the model results. The paper concludes with policy implications and identifies salient issues for future research on maize marketing and food security in South Africa.

[1] For example, many individual consumers would procure their maize meal by purchasing small quantities of maize grain in local markets, take it to a nearby hammer mill, and have it processed into meal for a fee.

2. SOUTH AFRICA'S MAIZE MARKETING SYSTEM

2.1. Salient Features of South Africa's Maize System

There are three basic kinds of maize meal in South Africa: super (most highly refined and highest priced), special, and sifted (least refined and least expensive). The six major milling companies in South Africa produce mostly super and special, and very little of the less refined meals are commercially produced. Demand for maize meal is considered to be price inelastic, although price responsiveness may be considerably higher when allowances are made for substitution between maize meal types.

Prior to 1996, South Africa's maize marketing system was characterized by a single-channel marketing system. Roughly 4,000 large commercial farmers supplied the bulk of the market for a population of 40 million people. Through the Maize Board, the government set maize and maize meal prices at each stage of the system. Rather than handle maize directly, the Maize Board appointed agents, mostly farmer cooperatives, to buy from farmers and sell to registered corporate millers and stockfeeders on its behalf. Over time, these cooperatives grew and consolidated, and by the late 1980s, six of them controlled virtually all of the bulk handling and storage facilities of the main commercial maize growing areas of the country (Essinger, Hill, and Laubscher 1998).[2] The single-channel system also encouraged concentration at the stage of maize milling and retailing by giving protected local oligopolies to licensed traders and discouraging entry by potential competitors (Bernstein 1996). Controlled pricing was ostensibly intended to keep farm prices and marketing margins in line with costs. However, controlled prices and margins in practice generally followed a cost-plus pricing approach, based on information provided by the processors and retailers themselves (Bayley 2002; Essinger, Hill, and Laubscher 1998; Bernstein 1996). Attempts to modify the price setting process within the framework of a single-channels system in the early 1990s actually exacerbated the government's financial drain, and brought pressures for more fundamental reform (Bernstein 1996; Wright and Nieuwoudt 1993; World Bank 1994).

Major reforms were implemented in South Africa's maize marketing system in 1997. Price setting at each stage of the system was deregulated and based entirely on negotiation between market actors. The Maize Board was abolished. Futures trading emerged quickly through the new South African Futures Exchange (SAFEX), as did modified "spot" prices at Randfontein, a location near Johannesburg.[3]

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[2] Essinger, Hill, and Laubscher report (1998) that there were 37 central cooperatives in South Africa in 1995. The government was mainly responsible for the financing of the cooperative system during the single-channel control period. Hence, in the late 1990s, when many cooperatives initiated processes to convert to limited liability companies, the Ministry of Agriculture took legal action to stop them on the grounds that the cooperative facilities were, at least in part, government assets, and their conversion to private hands was a form of asset grabbing. However, these conversions generally went ahead and the former cooperative silos are now fully in private hands (South Africa Foundation 2003).

[3] In actuality, the SAFEX "spot" prices are a futures contract introduced for trading in the succeeding month. For example, in the middle of January, a February futures contract is issued. In this way, the market always has an indication of the spot price based at Randfontein. Location differentials can be used to obtain an indicative price at other silos around the country, although local supply and demand conditions may vary, leading to negotiation between buyer and seller, but such prices are not transparent and hence localized spot prices do not exist (le Clus 2002; Chris Sturgess, personal email communication, 16 January 2004). Silos generally do not post buying prices.

2.2. Maize Meal Prices and Marketing Margins

During the mid-1990s, studies found that maize meal prices and marketing margins appeared unusually high in South Africa compared to its regional neighbors. Between 1985 and 1994, retail prices for maize meal in South Africa were significantly higher than those in Zimbabwe (Jayne, Takavarasha, and van Zyl 1994). Rubey (1992) also found South African maize milling margins and prices to be substantially higher than those in Zimbabwe. However, most of these studies were conducted prior to the reform and deregulation of South Africa's maize marketing system in 1996. Indeed, one of the main objectives of maize market deregulation in South Africa has been to promote competition and reduce costs throughout the maize supply chain for the benefit of consumers as well as farmers.

Information in Table 1 provides more recent evidence of a similar situation. This table compares maize grain and maize meal prices, and imputed milling/retailing margins during an identical three-year period, January 1996 to December 1998, in Kenya, Zambia, Zimbabwe, Mozambique, and South Africa as reported in Jayne et al. (1999). While producer prices and wholesale prices in South Africa were relatively low during this period compared with the other countries, retail prices of maize meal were by far the highest among the five countries. Maize milling/retailing margins in South Africa were substantially higher than the other countries as well, accounting for 58% of the total retail price of maize meal (US$258 of the total retail price of US$443 per ton, as shown in Table 1). However, this period covers a transition period in South Africa, including about a year before comprehensive price deregulation was implemented. Hence, this picture may not be indicative of the current situation after full reform of the maize marketing system in South Africa. Providing an updated assessment of changes in the size of maize milling/retailing margins in South Africa after market deregulation and reform is a primary motivation of this study.

2.3. Maize Market Reform in South Africa

While the implementation of food market reform in most African countries has succeeded in reducing the marketing cost wedge between producer and consumer prices, and has generally benefited consumers (Jayne et al. 1995; Sahn, Dorosh, and Younger 1997), there are *a priori* reasons why this outcome might not be expected in South Africa. Bernstein's (1996) study of South Africa's maize sector, highlighting the connections between political power and market organization, contends that the market was deregulated without due consideration of the highly concentrated maize wholesaling, milling, and retailing industries that had evolved during the control period. Chabane (2002) and Watkinson and Makgetla (2002) state that three of the recently privatized grain cooperatives, Sentraalwes (SWK), OTK, and NWK own 72% of all silos in the country. Their studies suggest that some of these firms appear to extracting "supernormal profits" and that concerns of "widespread manipulation" of the market have abounded, particularly after the dramatic increase in maize prices in the 2001/02 season (Chabane 2002). Diamant (2003) indicates that two food-retailing companies, Shoprite Checkers and Pick ′n Pay, control 80% of retail food sales. There is extensive shareholder affiliation between large silo owners, commercial milling companies, and retail stores. For example, Tiger Milling Company, one of the largest in South Africa, owns at least two grain silos in each of the country's nine provinces, and also owns the Spar Group Limited, a major retail chain (Traub forthcoming). In this way, Tiger milling is vertically integrated both upstream through

Table 1. Mean Monthly Prices of Maize Grain and Maize Meal, January 1996 - December 1998, Converted into US$ Per Ton Based on Nominal Exchange Rates

	Kenya	Zambia	Zimbabwe	South Africa	Mozambique
	US$ per ton				
Maize and maize meal prices:					
Producer price*	190	133	109	113	101
Wholesale price**	241	174	120	133	217
Industrial milled sifted meal***	390	285	172	443	424
Hammer-milled whole meal****	272	204	124	--	254
Wholesale-to-retail margins:					
Industrial milled roller meal	106	94	53	258	169
Hammer-milled whole meal	31	30	23	--	37

Sources:

* Producer price reference markets: Zimbabwe: Grain Marketing Board pan-territorial producer price; Zambia: mean of prices received by small- and medium-scale farmers in Post Harvest Surveys, 1996/97, 1997/98, and 1998/99 for Choma, Chipata, and Copperbelt regions (CSO, various years); Kenya: average of Kitale and Eldoret markets (Market Information Bureau, Ministry of Agriculture); South Africa (Maize Board until April 1997, SAGIS thereafter); Mozambique: average of Manica and Mocuba markets (Agricultural Market Information System data files, Ministry of Agriculture, Government of Mozambique).

** Wholesale price reference markets: Zimbabwe: Zimbabwe Agricultural Commodity Exchange price quotes (ZIMACE); Mozambique: Maputo market (SIMA); Zambia: Lusaka public markets (Agricultural Market Information Center data files, Ministry of Agriculture and Cooperatives, Government of Zambia); Kenya: Nairobi public markets (Market Information Bureau, Ministry of Agriculture); South Africa: Randfonteine spot prices (South Africa Futures Exchange).

*** Retail prices for industrial milled roller meal: Zimbabwe: Harare (Ministry of Trade and Industry data files); Zambia: Lusaka (Agricultural Market Information Center data files, Ministry of Agriculture and Cooperatives, Government of Zambia); Mozambique: Maputo (SIMA); Kenya: Nairobi (Ministry of Agriculture). South Africa retail prices are national averages derived from CPI data (Statistics South Africa).

**** Retail costs for hammer-milled meal computed as wholesale maize grain prices x 1.15 wholesale-to-retail mark-up margin, plus custom-milling fee of urban hammer mills in Harare, Lusaka, Maputo, and Nairobi, observed by national market information systems except in Nairobi, where the source is market observations by Egerton University Tegemeo Institute, Nairobi.

purchasing maize from farmers and downstream through retailing to consumers. Concerns have also been intimated by a former manager of South Africa's powerful maize farmer lobby, Grain-South Africa,[4] in an informal report highlighting the need for a more efficient and transparent price discovery process in areas outside of Randfontein, where the SAFEX spot and futures market operates for maize (le Clus 2002).

By contrast, other assessments indicate that the maize marketing and pricing system is functioning with reasonable efficiency and is more competitive than indicated above (Vink and Kirsten 2002; Competition Commission 2002). For example, while three major silo owners may account for a major share of maize storage in the country, they store grain on behalf of other traders, and hence the structure of the maize wholesale market is not as concentrated as it appears. A recent study by the Food Price Commission indicates that factors such as the exchange rate and stock levels could explain most of the recent SAFEX wholesale price movements, although less attention appears to have been given to the factors influencing retail maize meal prices (Business Day 2004). However, there is a dearth of publicly available information on market structure at various levels of the maize supply chain to make informed policy decisions.

An assessment of how maize marketing margins have evolved in the post-reform period may provide some important clues as to the potential impacts of market concentration since the deregulation of maize prices. As indicated previously, the difference between the price at which millers purchased maize and the price at which maize meal was purchased by consumers (adjusted for extraction rates and by-product values) during the pre-reform period of the late 1980s and early 1990s was unusually high in South Africa compared to its regional neighbors (Jayne, Takavarasha, and van Zyl 1994; Jayne et al. 1999). There is little *a priori* reason for expecting the cost structure of large-scale maize processing and retailing to be very different in South Africa and countries such as Zimbabwe, Zambia, Kenya, and Mozambique. If anything, one would expect the major costs of transport, storage, financing, electricity, and packaging to be lower in the relatively developed economy of South Africa. This would suggest that, if anything, we would expect maize processing and retailing margins to decline after the deregulation of prices, to levels roughly commensurate, if not lower, with those in neighboring countries – assuming that there are sufficient competitive pressures at each stage of the system to ensure that marketing margins roughly approximate marketing costs. This position is consistent with standard industrial organization theory positing that the removal of regulatory barriers and other impediments to market entry should lead to increased competition, greater efficiency, and downward pressure on marketing costs. On the other hand, if marketing margins have not fallen after the deregulation of the market, this may indicate (but in no way prove) cause for concern over the contestability of the market, remaining entry barriers, and potential non-competitive behavior at the stages of maize wholesaling, milling, and retailing.

[4] Formerly the National Maize Producers Organization, NAMPO.

3. THE MODEL

Agricultural economists have developed various models of agricultural marketing margins (e.g., Lyon and Thompson 1993; Gardner 1975; Waugh, 1964; Wohlgenant and Mullen 1987). Tomek and Robinson (1990) show how many of these models produce quite similar reduced form specifications. We start with a general reduced form data generating process of monthly maize marketing margins:

$$MM_t = X_t^* \beta_i^* + U_t \qquad (1)$$

Here, MM_t is the difference between the retail price of maize meal and millers' purchase price of maize grain in month *t*, modified by grain-to-meal extraction rates. Details on this variable are contained in the section below on variable construction. We refer to this margin as the "wholesale-to-retail" margin. X_t^* includes all the exogenous variables affecting this marketing margin, and U_t is an identically and independently distributed error term.

Not all of the X_t^* variables can be identified because of the lack of observable data. Therefore we can re-write $X_t^* \beta_i^*$ as being composed of two parts:

$$X_t^* \beta_i^* = X_t \beta_i + H_t \alpha_i \qquad (2)$$

where X_t contains the observable data and H_t the unobservable data. We can now write the data generating process as:

$$MM_t = X_t \beta_i + V_t \qquad (3)$$

where:

$$V_t = H_t \alpha_i + U_t \qquad (4)$$

is the Wold representation of the stochastic component of $H_t \alpha_i$ and U_t. Any deterministic mean, trend, or seasonal component of $H_t \alpha_i$ can be incorporated in the intercept, trend or seasonal component of X_t.

The variables in X_t would normally include exogenous components of marketing costs (e.g. labor wages, transport rates, and electricity costs in milling) as well as exogenous factors commonly found in structural models of maize supply and demand, such as rainfall, categorical variables to account for potential seasonality in prices and margins, and macroeconomic variables.[5] Time trends are often included as regressors to account for slow moving processes such as changes in technology. Finally, we must develop a representation of marketing and pricing deregulation to

[5] Some studies have included variables such as Q, the total quantity marketed or total quantity of farm output, as an explanatory variable in marketing margin models. We have chosen not to include Q in our reduced form model because of likely endogeneity. For similar reasons, we also do not include farm or retail prices in our models, for these prices are involved in the computation of the dependent variable. Instead we have chosen to include exogenous variables influencing production and prices, in keeping with the reduced form specification of our model. These include variables such as rainfall, labor wage rates, cost of capital, etc.

measure its impact on margins. Assuming a linear relationship between the marketing margin and the independent variables, equation 3 can be expressed as:

$$MM_t = \delta_0 + \mathbf{X}_t\beta_i + \delta_1 REFORM_t + \delta_2 T_t + \Sigma^{11}_{m=1} \gamma_i \mathbf{D}_{mt} + v_t \quad (5)$$

The exogenous explanatory variables contained in the **X** vector include labor costs lagged by one period, real exchange rates between the Rand and the US dollar, modified by differential inflation rates, an index of macroeconomic risk lagged one period, and a rainfall index based on the most recent maize growing season. T is a time trend to capture slow-moving trends, **D** is a vector of eleven monthly dummy variables, and REFORM is a variable capturing structural change in the maize marketing system. The simplest representation of REFORM is a categorical variable taking on a value of zero during the pre-reform period and a value of one afterward. The coefficient δ_1 measures the difference in mean marketing margins between the pre-reform and post-reform periods. All prices were adjusted by the 2000 consumer price index.

Alternate specifications can allow for changes in both the mean level of margins over time as well as the trend in the margins between the two periods. One such specification is:

$$MM_t = \delta_0 + \mathbf{X}_t\beta_i + \delta_1 REFORM_t + \delta_2 T_t + \delta_3 REFORM(T_t - T_R) + \Sigma^{11}_{m=1} \gamma_i \mathbf{D}_{mt} + v_t \quad (6)$$

Equation 6 is a piecewise linear regression model imposing the restriction that there be no discontinuous change in margins at the point of market reform, T_R. In this model, the estimated margin prior to market reform reduces to:

$$E(MM_t) = \delta_0 + \mathbf{X}_t\beta + \delta_2 T_t + \Sigma^{11}_{m=1} \gamma_i \mathbf{D}_{mt} \quad (7)$$

where the monthly trend in the level of the margins is δ_5 and the intercept is δ_0. After reform, REFORM=1 and hence the estimated milling/retail margin at time *t* is:

$$E(MM_t) = (\delta_0 + \delta_1 - \delta_3 T_R) + \mathbf{X}_t\beta + (\delta_2 + \delta_3)T_t + \Sigma^{11}_{m=1} \gamma_i \mathbf{D}_{mt} \quad (8)$$

Before proceeding, we examine the potential non-stationarity of the data which could potentially lead to problems of I(1) cointegration. However, in conducting Augmented Dickey-Fuller tests for unit roots on the inflation adjusted prices and other variables in the model, we rejected the hypothesis of a unit root at the 5% level for wholesale-to-retail margins, the real exchange rate, and the rainfall index, and at the 1% level for real wage rates and exchange rate volatility. While the monthly maize and maize meal prices themselves are found to be non-stationary, the margin, which is related to the difference between them, is stationary. This indicates that the time series process is I(0), and that our models 5 and 6 are appropriately estimated ig11evels.

4. DATA, VARIABLE CONSTRUCTION, AND DESCRIPTIVE STATISTICS

The definition, source, and expected sign for each the variables in the model are as follows.

4.1. Maize Prices and Milling/Retail Margin (MM)

The wholesale-to-retail marketing margin estimated in this analysis is a processing plus retailing margin. Because the maize milling industry tends to be vertically integrated with retail firms selling maize meal, it is difficult to obtain data on prices struck between millers and retailers. Thus, the difference between maize meal retail prices and wholesale maize prices includes the value added from milling, packaging, and transport of the meal to retail stores, and retailing.

The processing of maize into meal also produces by-products that are sold to agro-industries as an input to livestock feed, dog food, and cooking oil. The formula used to estimate the wholesale-to-retail maize margin, following Jayne, Takavarasha, and van Zyl (1994) and Jayne and Argwings-Kodhek (1997) is:

$$MM_t = P_{rt} - P_{wt} * z + [(z\text{-}1)*P_{bt}] \qquad (9)$$

where P_{rt} equals the retail price of maize meal at time t, P_{wt} is the wholesale price of the maize grain at time t, z represents the average extraction rate of 1.80 tons of grain used, on average, to produce one ton of meal), and P_{bt} is the value of the residual maize by-product. In the margin computations used in this analysis, z is 1.8 (as indicated by Kirsten 2004[6]) and P_{bt} is approximated as 70% of the wholesale maize price in month t, based on information provided by the commercial maize milling industry to Johann Kirstin, University of Pretoria (Kirsten 2004[6]). However, given that the extraction rate and the price of the by-product may vary from miller to miller, 12 different estimates of the milling margins were calculated, by varying the extraction rate from 1.2 to 1.8 and by varying the by-product "chop" value from 30% to 70% of the wholesale white maize price. The results of these calculations are summarized in Figure 1. From this figure, it is evident that the 12 simulated mill/retail margins are highly correlated regardless of choice of extraction rate or by-product value (the lowest correlation coefficient among the 12 series is 0.98). This indicates, then, that the calculation of the milling margin is not sensitive to variations in the extraction rate and/or by-product values.

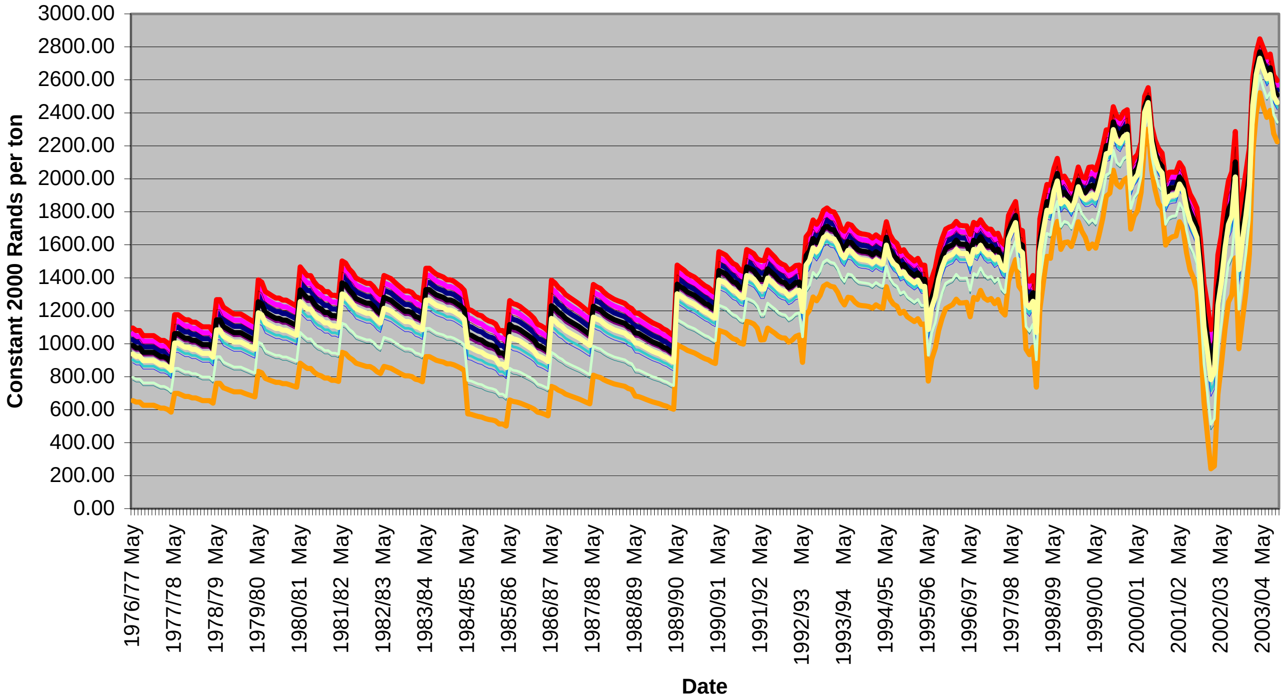
4.2. Wholesale Maize Prices

From the 1970/71 to 1994/95 marketing seasons, wholesale prices were defined as the Maize Board's controlled selling price to millers.[7] These data were obtained from the South African Department of Agriculture's *Abstract of Agricultural Statistics, 2001*. From 1995/96 to 2000/01,

[6] Johann Kirsten, personal interview, 6 April 2004.

[7] The reported prices are for "large" transactions, defined as: 190 tons and more after 1982/83; 216 tons prior between 1979/80 and 1982/83; and 380 tons between 1976/77 and 1979/80.

Figure 1. Inflation-adjusted Milling/Retail Margins at Various Extraction Rates and By-product Prices: May 1976 to September 2003



Note: The extraction rate z in equation 9 is defined as the tons of grain required to produce one ton of maize meal.

miller's procurement cost of maize grain is approximated as the maize spot prices quoted monthly on the South African Futures Exchange, SAFEX.[8] Millers now use a variety of pricing mechanisms for sourcing maize, including hedging and forward contracting. The use of these tools may mean that the actual procurement price of a particular miller may be greater or less than the SAFEX spot price, and these prices are not publicly available. Nevertheless, it can be argued that the SAFEX spot price is an appropriate reference for the opportunity cost of acquiring maize at a particular point in time.[9] If a miller's procurement price is consistently greater than the SAFEX spot price, it is likely to become uncompetitive and would lose market share in a competitive market.

4.3. Maize Meal Prices

Between the marketing years 1970/71 and 1993/94, maize meal retail prices were obtained from the Maize Board Annual reports. However, the Board stopped compiling retail price information after 1995, and at least until December 2003, there has been no public reporting of retail maize meal prices in South Africa. However, two sources of maize meal prices have been obtained and compared for analysis in this paper. The first source is the Central Statistical Service of South Africa, which monitors maize meal prices nationwide for purposes of compiling its monthly consumer price index. The second source is from the market intelligence firm, A.C. Nielsen, which provides maize meal price data to its clients on a commercial basis, although this service simply selects from electronic retail transaction data the lowest priced maize meal purchased on a particular day of the month in selected stores and therefore is biased toward monitoring the least refined types of maize meal or maize meal on sale during that day. For these reasons, it is not considered representative of the prices of the relatively refined meal that most consumers pay in South Africa. Hence, this analysis relies on the maize meal price series compiled by the Central Statistical Service of South Africa (Statistics South Africa).[10] All prices and monetary variables in the models were deflated by the CPI with 2000 being the base year.

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[8] The deregulation of markets led to the establishment of a futures market. Early in 1995 SAFEX Agricultural Derivative posted its first agricultural commodity on the exchange market. The exchange trades on average 90,000 tons of maize a day. Over 420,000 contracts have been traded since 1995, with the bulk of trades arising from the white maize contract (SAFEX).

[9] The SAFEX price is quoted stock free alongside rail from a basis point to Randfontein, near Johannesburg. Millers using the SAFEX price to hedge would incur additional costs for broker commissions, outstanding storage fees (handling fees and most storage costs are paid by the depositor of the grain, hence outstanding storage costs are usually small) and theoretically the transport costs of product from Randfontein to the mill. In actuality, however, millers can often procure at prices below the SAFEX spot price. Because farmers receive the SAFEX price *minus* transport cost differentials to Randfontein and outstanding storage, millers will pay this new amount only and in this way obtain the discount of receiving stock not at Randfontein. If the miller receives stock close to his mill, he will continue to get the full discount to Randfontein, but will benefit since the transport costs to the mill will be significantly cheaper (Chris Sturgess, personal email communication,16 January 2004).

[10] The A.C. Neilsen data is nevertheless strongly correlated with the maize meal data recorded by Statistics South Africa. For example, over the 48-month period in which the two data sets overlap, October 1999 to December 2001, the Spearman correlation coefficient between the inflation-adjusted maize meal prices from Statistics South Africa and the Southern Transvaal maize meal series from A.C. Nielsen was 0.82. The mean price level over this period was 3.165 rand/kg vs. 2.451 rand/kg for the Statistics South Africa vs. A.C. Neilson data, respectively.

4.4. Salaries and Wages

The average wages and salary measures for the manufacturing sector within South Africa was used to measure labor costs in maize milling and retailing, which was obtained from the Statistical Services of South Africa on industry labor statistics.

4.5. Real Exchange Rates

This variable is defined as the nominal exchange rate between the South African Rand and US dollar, adjusted by differential inflation rates. Real exchange rate movements can affect maize prices and marketing margins in a variety of ways, including through the imported content of capital equipment, indirect effects on interest rates, and in deficit situations especially, through the determination of import parity prices. Monthly exchange rate and CPI data comes from Statistics South Africa.

4.6. Real Exchange Rate Volatility

The South African economy has been exposed to episodes of exchange rate volatility during the 1990s. Uncertainties associated with price and macroeconomic volatility has been shown in other studies to generate risk premia that affect prices and marketing margins.[11] We use a simple expression of macroeconomic risk, based on the squared deviation between the current and lagged exchange rate values, $(E_t - E_{t-1})^2$. The coefficient on this term is expected to positively affect maize grain and maize meal prices, though not necessarily to the same extent. Exchange rate data was obtained from Statistics South Africa.

4.7. Weighted Average Critical Rainfall per Province

South African Weather Service (SAWB)[12] and Weatherscape are the two main sources for the average monthly rainfall data, measured in millimeters, from 1975-2001. If the effects of rainfall-induced changes in supply on producer, wholesale, and retail maize prices may not be the same, then rainfall would have potentially significant effects on marketing margins. Maize production in South Africa is heavily influenced by rainfall in the growing season from October to April. A weather index was constructed by summing the October to March rainfall for each subsequent marketing year, April to March. The value of the weather index is thus constant within each marketing year and varying across marketing years.

4.8. Marketing and Price Policy Change

As discussed earlier, the effects of maize market reform, as implemented in South Africa, are hypothesized to depend on initial market structure and the degree of new entry and response in the sector. To examine the robustness of our findings, we report two alternative methods of modeling the structural change that accompanied full price deregulation of maize and maize meal products in May 1997. These alternate models were (a) the inclusion of an intercept shift variable equaling zero before May 1997 and one afterward, as in equation 5; and (b) a piecewise

[11] For examples, please see articles by Watkinson and Makgetla (2002), COSATU (2002), and Diament (2003).

[12] South African Weather Service website: http://www.SAWeatherService.gov.za

linear regression approach restricting a discontinuous change in margin levels at the time of reform, as in equation 6.

4.9. Time Trend

Although nothing about trending variables necessarily violates the classical linear model assumptions of OLS, it is important to allow for the fact that many economic time series have a common tendency to grow over time, and that the unobservable factors that cause the dependent variable to grow might be correlated with the growth in explanatory variables. For these reasons, we include a time trend variable in the models to mitigate the potential for spurious correlation.

4.10. Seasonal Dummy Variables

Monthly dummies are included to account for potential seasonality in the price data.

Table 2 presents basic descriptive statistics for all the variables in the model over three periods described earlier in Section 2. The first period (Phase I) represents the controlled pricing and marketing period from the beginning of the sample period in May 1976 until April 1989. The partial decontrol period (Phase II), from May 1989 until April 1997, was characterized by government still setting prices and directing import and export decisions but with increased efforts to align prices with market conditions. The third period (Phase III), from May 1997 until the present, is characterized by full deregulation of maize grain and maize meal prices and the withdrawal of government from direct participation in marketing.

4.11. Estimation Period

To examine the sensitivity of model results to recent events in Southern Africa, we estimate models 5 and 6 using two sample periods: May 1976 to April 2001 and May 1976 to September 2003. We truncate the statistical analysis to April 2001 for two reasons, both of which may exert idiosyncratic effects on the results. First, starting in mid-2000, significant agricultural policy changes and political turmoil in neighboring Zimbabwe may have had demonstrable statistical effects on South African maize prices (Schimmelpfennig et al. 2003). With Zimbabwe's transition from reliable exporter to net importer of maize, the region's demand for South African maize has apparently surged, especially in drought years. Secondly, drought and episodes of substantial exchange rate volatility have exerted unusual effects on South Africa's maize sector since late 2001. Including this period in the analysis might tend to bias the analysis in the direction of finding higher than usual marketing margins. As shown in Table 2, the period May 2000 to September 2003 is characterized by unusually high inflation-adjusted maize and maize meal price and milling/retailing margins.

To rule out recent drought and exchange rate volatility as possible main reasons driving our results, we report estimation results based on the first three periods specified in Table 2 (May 1976 to April 2001) in addition to the full May 1976 to September 2003 period.

Table 2. Descriptive Statistics of Real Maize Prices, Marketing Margins, and Other Variables Used in the Analysis (All Variables in Monetary Units are Expressed in Constant 2000 Rand per Metric Ton)

	Phase 1: Control Period 5/1976 - 4/1987 (n=132)	Phase 2: Partial Reform 5/1987 – 4/1997 (n=120)	Phase 3: Full Market Reform 5/1997 – 4/2000 (n=36)	5/2000-9/2003 (n=41)
Producer price, maize grain (R/mt)				
Mean	1171	728	651	892*
Coefficient of variation (%)	8.5	20.6	12.7	36.2
Wholesale price, maize grain (R/mt)				
Mean	1012	908	818	1017
Coefficient of variation (%)	13.0	8.7	13.1	39.9
Retail price, maize meal (R/mt)				
Mean	2299	2468	2856	3166
Coefficient of variation (%)	10.6	7.4	10.1	10.2
Producer-to-retail margin (R/mt)				
Mean	847	1684	2143	2095*
Coefficient of variation (%)	20.1	18.3	19.3	9.0
Wholesale-to-retail margin (R/mt)				
Mean	1062	1344	1841	1904
Coefficient of variation (%)	11.0	15.1	16.4	26.4
Rainfall index**				
Mean	567.05	591.26	562.42	604.62
Coefficient of variation (%)	17.7	22.1	10.0	26.4
Exchange rate volatility**				
Mean	0.006	0.004	0.034	0.190
Coefficient of variation (%)	350.6	223.8	341.7	312.3
Real exchange rate (R/US$)**				
Mean	8.96	5.86	6.13	7.86
Coefficient of variation (%)	20.8	13.4	7.7	16.6
Real wages**				
Mean	3679.98	3900.65	4510.02	4287.83
Coefficient of variation (%)	10.2	9.0	6.7	6.1

Sources: As defined in Section 4.
Notes:
* Producer prices are estimated in this period as the SAFEX/Randfontaine monthly spot price minus the median transport cost from various production points to Randfontaine as published by SAFEX at http://www.safex.co.za/ minus an additional 43 R/mt representing commissions and storage charges.
** As defined in Section 4.

5. ESTIMATION PROCEDURE

When Ordinary Least Squared method of estimation is applied to both our reduced form linear equations, it was found that the wholesale-to-retail margin model exhibited both serially correlated error terms and heteroskedasticity (non-stationary error variances). We used two alternate procedures to correct for this. First, when error autocorrelation was found to be AR(1), serial correlation was modeled and corrected for through a weighted least squares AR(1) procedure, Feasible General Least Squares estimation.

We estimated the equation by the standard Prais-Winsten method of estimation, providing standard errors that are robust to heteroskedasticity. The resulting Feasible General Least Squares estimators are asymptotically efficient and all the standard errors and test statistics from the Prais-Winsten method are asymptotically valid.

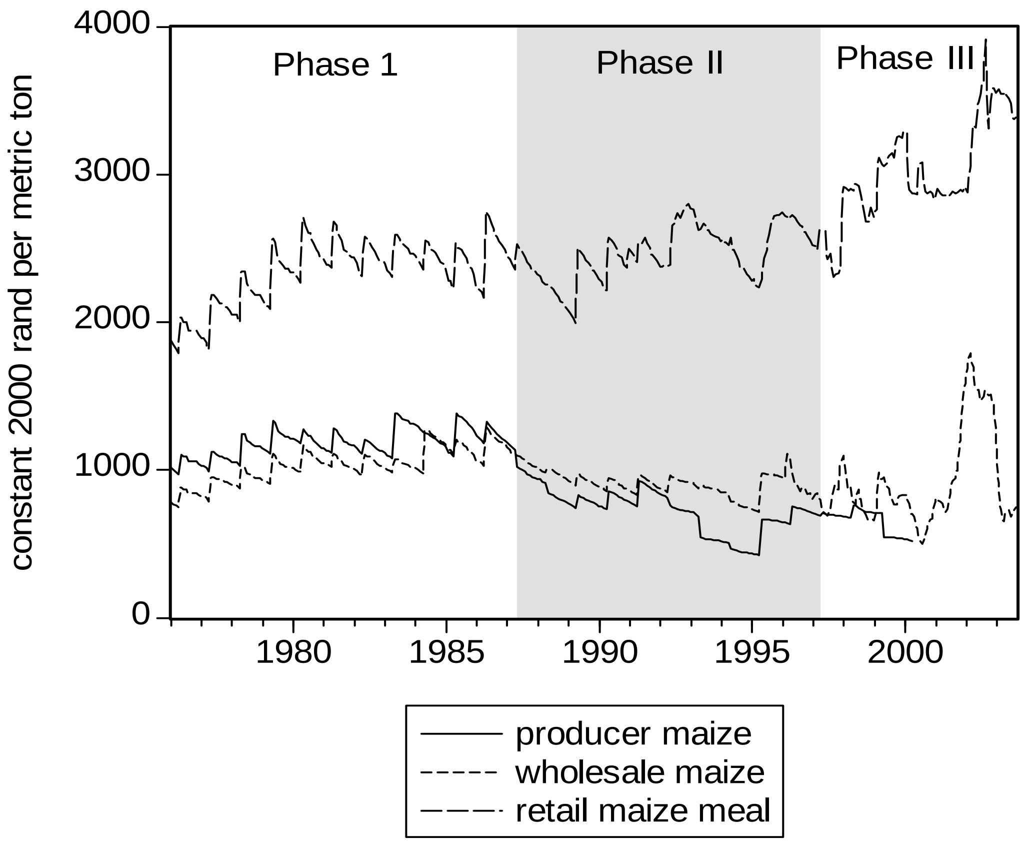
However, FGLS is technically appropriate only for error structures of AR(1). When serially correlated errors were found to be AR(2) or higher, as it was in most cases, we use the Newey-West (NW) serial correlated robust inferences after OLS. The NW procedure has become more popular in recent years because it is intended to provide standard errors that are robust to fairly arbitrary forms of serial correlation and heteroskedasticity (Wooldridge 2000). The serial correlation-robust standard errors are typically higher than the usual OLS standard errors when there is serial correlation. Lag length selection procedures indicated a need for up to two lags for the May 1976-April 2001 estimations and up to four lags for the May 1976-September 2003 period.

To summarize, we run two different reduced-form models (equations 5 and 6) over two sample periods (May 1976-April 2001 and May 1976-September 2003) using two alternate estimation techniques (OLS with Newey-West procedure and, where AR(1) error processes are found, Feasible Generalized Least Squares). This variety of alternate regression results allows us to examine the sensitivity of findings to different econometric representations of market reform, sample period, and estimation procedure.

6. RESULTS

Figure 2 depicts the movement of deflated annual average wholesale and retail prices in the maize market over the sample period. The figure divides the period into the three phases of marketing policy. One can see dramatic changes in real producer prices between Phase 1 and Phase 2. For most of Phase 1, producer prices were higher than the prices at which the Maize Board sold to millers, reflecting subsidization of the Board's marketing costs. This came to an end in Phase 2 when producer prices were the residual after the Maize Board deducted its costs from sales revenues. Mean producer prices declined by 25% between Phase 1 and Phase 2 and also become more volatile, while wholesale prices declined by roughly 10%. But retail prices remained roughly constant between Phase 1 and 2, indicating that both the producer-to-retail

Figure 2. Inflation-adjusted Maize and Maize Meal Prices, South Africa, January 1975 to September 2003



Sources: Producer prices are from files from the Maize Board of South Africa. Wholesale prices are Maize Board selling prices to millers until April 1995, and thereafter are SAFEX white maize spot prices for Randfonteine. Retail maize meal prices are from the Maize Board until April 1995, and thereafter are from the Central Statistical Service of South Africa, which is also the source for the consumer price index data.

margin and the wholesale-to-retail margins increased (Table 2). In the Phase III period, from May 1997 to September 2003, the now-decontrolled producer and wholesale prices declined even further in real terms, while retail prices of maize meal rose further. The unconditional means and coefficient of variations for the maize prices and margins are presented for the three periods in Table 2.

Overall, Figure 2 and Table 2 show a substantial widening of the wholesale-to-retail margin accruing to maize millers and retailers after May 1997 when prices were deregulated. (This stays the same.) However, this descriptive picture does not take account of changes in market conditions and other exogenous shocks such as weather and exchange rate volatility, which might be driving the findings; hence, we resort to methods to control for these factors in the next section.

6.1. Econometric Results

The first column of Table 3 presents the results of the OLS/NW estimation results for equation 5, in which the categorical variable REFORM measures the change in mean wholesale-to-retail margins after price deregulation in 1997. The R^2 of this model indicates that the model explains approximately 79 and 73% of the sample variation in the milling/retail margin for the period May 1976-April 2000 and May 1976-September 2003, respectively.

Most notably, the deregulation variable has a highly significant positive coefficient, indicating that the conditional mean of the maize mill/retail margin increased after the deregulation of prices by R358 per ton during the May 1997 to April 2001 period, and then by an additional R122 per ton during the May 1997 to September 2003 period. These figures represent a 29 and 40% increase over mean inflation-adjusted milling/retailing margins during the 1976 to 1997 period of controlled pricing.

Over and above this finding, the results in Table 3 also show a very gradual upward trend in maize processing/retail margins over the entire sample period of roughly 1 Rand per month. There is also a strong seasonal component to the maize milling/retail margins. They are lowest during the September to April period, when maize wholesale prices typically surge (thus putting downward pressure on margins unless maize meal prices rise to the same extent), and are highest during the May-August period immediately after harvest when wholesale prices are typically low. This pattern of seasonality in the margin indicates that wholesale maize prices adjust to market conditions more quickly than maize meal prices. Maize meal prices exhibit less seasonality and tend to rise gradually over the long run, somewhat independently of wholesale price seasonality.

Table 3 results indicate that real exchange rate depreciation tends to contract the maize processing/retailing margin. Recalling that the margins are based largely on the difference between maize wholesale and retail maize meal prices, our results indicate that real exchange rate depreciation exerts a stronger upward effect on wholesale prices than on prices of meal, indicating again that wholesale maize prices are more sensitive than the relatively sticky price of maize meal. The results in Table 3 indicate that a one-period exchange rate depreciation of 0.5 rand (e.g., from 6.5 to 7.0 Rand per US$), holding inflation constant, would cause a reduction in the milling/retailing margin in the range of 13 to 29 Rand per ton.

Table 3. Maize Milling/Retailing Margins, Equation (X), OLS with Newey-West (NW) Serial Correlation-Robust Standard Errors

	--- Sample period			---		
Variables	**May 1976 – April 2001**			**May 1976 – September 2003**		
	OLS	NW lag(1)	NW lag(2)	OLS	NW lag(1)	NW lag(4)
Rainfall index	-0.049	-0.049	-0.049	0.008	0.008	0.008
	(-0.567)	(-0.466)	(-0.394)	(0.080)	(0.053)	(0.038)
$Wages_{t-1}$	0.171	0.171	0.171	0.029	0.029	0.029
	(3.384)***	(2.157)**	(1.879)*	(0.557)	(0.343)	(0.244)
ER Volatility $_{t-1}$	-183.597	-183.597	-183.597	-178.417	-178.417	-178.417
	(-0.834)	(-1.195)	(-1.160)	(-3.079)***	(-4.231)***	(-3.882)***
RER $_{t-1}$	-27.761	-27.761	-27.761	-58.306	-58.306	-58.306
	(-3.370)***	(-2.734)***	(-2.284)**	(-6.450)***	(-3.212)***	(-2.277)**
Trend	1.336	1.336	1.336	1.034	1.034	1.034
	(5.259)***	(5.287)***	(4.538)***	(3.746)***	(2.191)**	(1.562)
Dereg	358.038	358.038	358.038	480.59	480.59	480.59
	(8.587)***	(3.799)***	(3.186)***	(9.138)***	(4.666)***	(3.165)***
June	32.045	32.045	32.045	35.672	35.672	35.672
	(0.692)	(1.023)	(1.173)	(0.622)	(0.887)	(1.223)
July	23.597	23.597	23.597	31.735	31.735	31.735
	(0.509)	(0.523)	(0.587)	(0.553)	(0.550)	(0.747)
Aug	10.262	10.262	10.262	30.282	30.282	30.282
	(0.218)	(0.204)	(0.200)	(0.524)	(0.532)	(0.607)
Sept	-29.402	-29.402	-29.402	5.115	5.115	5.115
	(-0.628)	(-0.575)	(-0.560)	(0.088)	(0.086)	(0.086)
Oct	-36.053	-36.053	-36.053	-45.1	-45.1	-45.1
	(-0.772)	(-0.700)	(-0.680)	(-0.773)	(-0.766)	(-0.758)
Nov	-55.465	-55.465	-55.465	-55.354	-55.354	-55.354
	(-1.177)	(-1.080)	(-1.035)	(-0.941)	(-0.957)	(-0.941)
Dec	-96.043	-96.043	-96.043	-79.156	-79.156	-79.156
	(-1.973)*	(-1.515)	(-1.443)	(-1.309)	(-1.178)	(-1.115)
Jan	-199.427	-199.427	-199.427	-63.496	-63.496	-63.496
	(-3.132)***	(-2.208)**	(-1.977)**	(-0.832)	(-0.710)	(-0.565)
Feb	-59.833	-59.833	-59.833	-63.477	-63.477	-63.477
	(-1.281)	(-1.413)*	(-1.392)	(-1.089)	(-0.997)	(-1.161)
Mar	-67.886	-67.886	-67.886	-76.320	-76.320	-76.320
	(-1.465)	(-1.794)*	(-1.910)*	(-1.317)	(-1.190)	(-1.571)
Apr	-88.543	-88.543	-88.543	-64.772	-64.772	-64.772
	(-1.894)*	(-2.258)**	(-2.273)**	(-1.111)	(-1.270)	(-1.462)
Constant	665.554	665.554	665.554	1419.162	1419.162	1419.162
	(3.668)***	(2.012)**	(1.732)*	(6.517)***	(3.839)***	(2.678)***
DW	0.2770			0.2926		
R^2	0.7939			0.7309		
Observations	299	299	299	328	328	328

Notes:
* statistically significant from zero at the 10% level
** statistically significant from zero at the 5% level
*** statistically significant from zero at the 1% level

The effects of exchange rate volatility and wage rates on margins are sensitive to the sample periods chosen. Exchange rate volatility has a strongly negative effect on the margin when the longer sample period is chosen, but insignificant so under the shorter sample period. An increase in real wage rates is, as expected, shown to raise milling/retailing margins under the shorter period, but is statistically insignificant when the longer sample period is used.

We now move to Table 4, which shows the piecewise linear regression results of equation 6. This model allows for a shift in the mean level of milling/retailing margins as well as a shift in the rate of growth of the margin. Because it is a more flexible specification than equation 5, a higher percentage of the variation is explained by the model: as shown by the model R^2, 85 and 79% for the OLS models for May 1976 - April 2000 and May 1976 - September 2003 periods, respectively.

The results in Table 4 indicate that wage rates positively influence the mill/retail margin, as expected. A 10% increase in real wage rates is associated with an increase in the mill/retail margin ranging from 12 to 38 rand per ton. Rainfall during the prior growing season is clearly negatively associated with margins only for the OLS/NW estimations for the shorter sample period. Most of the model estimations presented in Tables 3 and 4 indicate a moderate negative or near zero relationship between rainfall and the mill/retail margin, implying that, for the most part, rainfall has similar effects on both wholesale maize grain prices and retail maize meal prices. As with the results in Table 3, real exchange rates are strongly negatively associated with the size of the mill/retail margin, the effects of real exchange rate volatility appear sensitive to model specification and sample period, and a seasonal pattern in the margin is evident, being highest during the May - August post-harvest period when wholesale prices are lowest, and lowest during the November to April period when wholesale prices are generally at their peak. Consistent with results in Table 3, the findings suggest that wholesale maize grain prices make smaller and more frequent adjustments to market conditions while maize meal prices are less responsive to short-term changes in maize prices.

The OLS/Newey-West and FGLS estimations show again a fairly consistent picture with respect to the effects of maize market reform on maize milling/retailing margins. Both sets of models over both sample periods show statistically insignificant immediate effects on the margin after the initiation of price decontrol and market reform, with coefficient estimates ranging from -49 to +245 Rand per ton. After computing standard errors robust to serial correlation, the OLS/NW results are largely statistically insignificant. However, all of the models presented in Table 4 show a steep increase over time in the mill/retail margin. The monthly increase in the margin ranges from R9.52 per ton for the May 1976 - September 2003 OLS/NW estimation, to R16.71 and R15.34 per ton for the OLS/NW and FGLS estimations for the May 1976 - April 2001 sample period. This implies a steady increase in the conditional mean of the mill/retail margin of 388 to 551 Rand per ton after a three-year period – a 29 to 42% increase over mean mill/retail margins during the Phase 1 and II periods in which prices were controlled. The finding of a rising trajectory in maize mill/retail margins is statistically significant across all models in Table 4 at the 99.5 level of statistical significance or higher.

By contrast, trend growth in the mill/retail margin prior to price decontrol was very close to zero in the OLS/NW runs, and +1.79 Rand per ton per month in the FGLS estimation for the shorter sample period. This contrasts markedly with the estimated sharp increase in the size of the mill/retail margin over the course of the market reform period.

Table 4. Maize Milling/Retailing Margins, Equation (Y), OLS with Newey-West Serial Correlation-Robust Standard Errors and Feasible General Least Squares Estimation

Variables	Sample period: May 1976 – April 2001 OLS	May 1976 – April 2001 Newey-W lag(1)	May 1976 – April 2001 FGLS	May 1976 – September 2003 OLS	May 1976 – September 2003 NW lag(1)	May 1976 – September 2003 NW lag(4)
Rainfall Index	-0.175	-0.175	0.188	0.164	0.164	0.164
	(-2.373)**	(-1.655)*	(-1.125)	(1.712)*	(1.214)	(0.885)
Wages $_{t-1}$	0.077	0.077	0.033	0.107	0.107	0.107
	(1.987)**	(1.425)	(1.525)	(2.212)**	(1.593)*	(1.224)
ER Volatility $_{t-1}$	-36.670	-36.670	-57.246	-193.025	-193.025	-193.025
	(-0.197)	(-0.248)	(-0.802)	(-3.649)***	(-3.914)***	(-3.412)***
RExch $_{t-1}$	-48.096	-48.096	-25.146	-91.813	-91.813	-91.813
	(-6.675)***	(-8.306)***	(-3.017)***	(-9.913)***	(-5.455)***	(3.974)***
Trend	0.983	0.983	1.790	-0.115	-0.115	-0.115
	(4.533)***	(4.721)***	(3.625)***	(-0.397)	(-0.270)	(-0.202)
Deregulation	65.111	65.111	-49.590	245.243	245.243	245.243
	(1.461)	(0.696)	(-0.641)	(4.350)***	(2.400)**	(1.698)*
Dereg*(T_t-T_{253})	16.712	16.712	15.344	9.519	9.519	9.519
	(10.708)***	(5.269)***	(3.229)***	(7.956)***	(4.017)***	(2.862)***
June	31.097	31.097	25.302	37.824	37.824	37.824
	(0.796)	(1.007)	(1.767)*	(0.723)	(1.072)	(1.441)
July	24.640	24.640	19.397	32.164	32.164	32.164
	(0.630)	(0.622)	(0.916)	(0.614)	(0.651)	(0.851)
Aug	17.876	17.876	18.362	21.465	21.465	21.465
	(0.451)	(0.446)	(0.797)	(0.407)	(0.433)	(0.482)
Sept	-18.808	-18.808	-19.143	-3.999	-3.999	-3.999
	(-0.476)	(-0.470)	(-0.709)	(-0.076)	(-0.081)	(-0.080)
Oct	-30.844	-30.844	-29.736	-45.380	-45.380	-45.380
	(-0.783)	(-0.739)	(-1.063)	(-0.852)	(-0.846)	(-0.837)
Nov	-47.497	-47.497	-42.797	-62.483	-62.483	-62.483
	(-1.195)	(-1.129)	(-1.504)	(-1.163)	(-1.191)	(-1.162)
Dec	-76.365	-76.365	-64.796	-98.870	-98.870	-98.870
	(-1.857)*	(-1.542)	(-2.166)**	(-1.789)*	(-1.617)	(-1.529)
Jan	-121.806	-121.806	-81.067	-128.528	-128.528	-128.528
	(-2.247)**	(-1.839)*	(-2.173)**	(-1.834)*	(-1.686)*	(-1.438)
Feb	-66.442	-66.442	-60.414	-72.730	-72.730	-72.730
	(-1.686)*	(-1.628)	(-1.890)*	(-1.367)	(-1.258)	(-1.455)
Mar	-86.772	-86.772	-81.854	-84.164	-84.164	-84.164
	(-2.217)**	(-2.148)**	(-2.622)***	(-1.592)	(-1.470)	(-1.925)*
Apr	-99.523	-99.523	-90.656	-80.616	-80.616	-80.616
	(-2.522)**	(-2.578)**	(-2.967)***	(-1.515)	(-1.828)*	(-2.115)**
Constant	1283.599	1283.599	1186.304	1444.232	1444.232	1444.232
	(7.844)***	(6.110)***	(8.776)***	(7.267)***	(5.096)***	(3.739)***
DW	0.3138		1.9940	0.3790		
R^2	0.8538			0.7767		
Observations	299	299	299	328	328	328

Notes:
* statistically significant from zero at the 10% level
** statistically significant from zero at the 5% level
*** statistically significant from zero at the 1% level

Figure 3 plots the price movement of actual maize meal retail prices against two simulated retail prices series, Pr (simulation 1) and Pr (Simulation 2). Both simulated series refer to the estimated retail price of maize meal assuming market reform did not occur within the country. In particular, simulation 1 was generated by solving equation (9) for Pr, using mill/retail margins estimated from equation (5) OLS with Newey-West corrected standard errors over the full sample period, while equation (6) milling/margin estimates were used when generating Pr (simulation 2). In both simulations, the variable REFORM was set to zero over the entire sample period.

Prior to market reform in 1997, the actual and simulated maize meal price all generally tend to move together through time with a slight upward trend. This co-movement indicates that the simulated retail prices are a strong proxy for the actual retail price series. Following the movements of the three series after market reform we see a distinct diversion between actual retail prices and the simulated retail prices. Recall that both simulated price series predict the movement of retail prices assuming no reform. Movements of Pr (simulation 1) and Pr (simulation 2) show that retail prices would have remained somewhat constant with a slight decline between 1998 and late 2001, dramatic rise followed by a sharp decrease within 2002, and then a return to 1997/98 levels. In the case of actual retail prices the movement is clearly divergent, with retail prices increase at a faster rate following the market reform. Based on these results, it would appear that the implementation of market reform led to an increase in retail maize meal prices, in real terms, contrary to what was intended.

Evaluating the various estimation results displayed in Tables 3 and 4, a fairly consistent picture emerges. Although it might have been expected that market reform would have led to downward pressure on real milling/retail margins if it led to new entry and increased competition at the maize milling and retailing stages of the maize supply chain, our findings do not support this. Indeed, South Africa has not witnessed the kind of investment response from small- and medium-scale millers experienced in other countries in the region after market reform. In countries such as Zambia, Mozambique, Kenya, and Zimbabwe, informal millers rapidly captured a large market share of the retail maize meal market in urban areas, which exerted strong downward pressure on maize meal prices and milling margins after reform in these countries (Jayne and Argwings-Kodhek 1997; Jayne et al. 1995; Rubey 1995). These results lend some credence, though in no way proves, that there may be monopoly power within the market and collusion among a few large industry players, and/or substantial barriers to entry in milling and retailing. As Diamant (2003) points out, part of the problem may be how new milling companies can ensure that their products will be purchased by the few large retailers who may prefer to stock the maize meal produced by millers with whom they have had longstanding relationships. However, our statistical results do not clearly reveal the reason for the rise in margins after the decontrol of maize marketing and pricing; this will require further research to uncover whether barriers to entry at the milling stage and/or retailing stage, or other factors are responsible for these findings.

Figure 3. Maize Meal Retail Prices: Actual vs. Simulated Under No Reform Scenario: January 1990 to September 2003

Notes:

Simulation 1: estimated retail price of maize meal assuming that market reform did not occur (generated from mill/retail margins based on equation 5 using the Newey-West lag(4) method of estimation).

Simulation 2: estimated retail price of maize meal if market reform did not occur (generated from mill/retail margins based on equation 6 using the Newey-West lag(4) method of estimation).

In both cases, the variable REFORM was set to zero throughout the entire period from May 1976 to September 2003.

7. CONCLUSIONS

7.1. Summary

The South African agricultural sector, throughout the late 1980s and most of 1990s underwent gradual stages of market reform. The goals and methods of market reform are clearly laid out in the Reconstruction and Development Program (RDP) document, the Broadening Access to Agriculture Thrust (BATAT) initiative, as well as the 1995 and 1997 White Paper on Agriculture. In particular, the ANC policy document on agriculture explains, as the over-reaching goal of market reform, the need to ensure affordable and sustainable prices of basic foodstuffs for low-income groups.

The objective of this study was to determine econometrically the effect of market reform on the maize milling/retailing margins within South Africa in order to evaluate the effectiveness of market reform in attaining its goal of "affordable and sustainable prices" on maize-meal, a basic food good. To assess the robustness of our findings, we use two alternate model specifications of market reform using two different sample periods, and using two different estimation techniques.

South Africa appears to have a food security problem. Despite being a reliable surplus producer of maize, its downstream marketing system has managed to keep prices of maize meal above levels obtaining in other countries, despite the fact that mean wholesale grain prices in South Africa are relatively low compared to its regional neighbors. Prior to market reform, South Africa's maize meal prices were among the highest in the region when compared with other important maize producing countries such as Zimbabwe, Zambia, Mozambique, and Kenya. This was the case even though producer and wholesale prices in South Africa were relatively low compared to price levels in these other countries. Hence South Africa's maize marketing margins were high, which was ironic considering the greater degree of economic development and modernity in South Africa.

The deregulation of maize and maize meal pricing and marketing in South Africa has only exacerbated its food security problem. Findings for all alternative models consistently indicate that the maize sub-sector's milling/retail margins have risen from 20 to 40% in the first 4 to 5 years after the implementation of market reform. There also appears to be a rising trend in the size of the margin over time. These findings bode poorly for staple food consumers in South Africans, and suggest an overall decline in the real disposable incomes of the poor.

7.2. Policy Considerations

Over the past two years, the problem of rising food prices, particularly in the case of maize and other basic foods, has received increasing attention in the news and media of South Africa[13]. The basic stance is that despite the removal of control structures within the maize value chain, maize meal prices have continued to increase over time. Summarizing the main arguments, there are three reasons typically given as to why these high maize prices exist:

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[13] See articles by Baylie (2002) and COSATU (2002).

1. High producer prices based on manipulated import-parity pricing resulting in part from persistent official underestimates of crop yields. Notwithstanding the validity or lack thereof of this assertion, our findings indicate that the rise in maize meal prices may have more to do with rising margins in the downstream milling and retailing stages of the marketing system and not necessarily due to peculiarities at producer level.

2. High food prices have also been allegedly associated with the high degree of concentration of ownership in production. However, as shown in Figure 2 and Table 2, maize producer prices have experienced a long-term decline after adjusting for inflation. Maize wholesale prices in South Africa are generally below those in neighboring countries in the region, when denominated in US dollars at nominal exchange rates. With the exception of a brief drought episode in 2002 and 2003, mean inflation-adjusted producer and wholesale prices have actually been lower since the deregulation of maize prices than during the control period. The simultaneous downward pressure on producer prices and higher maize meal prices clearly suggests problems in the downstream stages of the marketing system.

3. There is also the concern that the benefit of the V.A.T. zero rating on basic foodstuffs is not being passed onto the consumers (COSATU 2002). This is assumed since surveys of certain retail stores have found the cost of brown bread, which is tax exempt, is equivalent to or at times more than the cost of white bread. This concern is given greater credence by our findings, though it in no way proves such assertions.

A competitive market is not created by the absence of government regulations, rather it flourishes when the correct set of regulations is enforced by a public agency (Shaffer et al. 1985). Based on the findings of this paper, it is proposed that government needs to develop a better understanding of how its policies and practices of marketing agents may be affecting competition and possible barriers to entry for new milling and retailing firms. To start with, government could consider:

1. The publication and dissemination of maize meal prices for specific grades and locations. Had it done so earlier, it would have been clear earlier that maize meal prices have risen much more dramatically than wholesale or producer maize grain prices since 1997.

2. The publication of other kinds of market information that is readily and equally available to all market participants. Information asymmetry can arises due to factors such as market concentration and/or imperfect competition and as a result, lead to higher consumer prices.

3. The promotion of alternative supply channels for sourcing maize grain, having it milled and made available to consumers in urban and rural areas where maize is produced by small farmers. In areas such as the Eastern Cape and Limpopo, 19 and 27% of households farm for supplementary food (Watkinson and Makgetla 2002). The maize they grow is typically milled by small-scale mills and consumed as meal. As long as small traders and millers in these areas can source grain from silos and/or farmers, these informal supply channels can be developed and continue to serve consumer needs throughout the season, even after local production is exhausted. Similarly, some consumers, particularly the poor, would derive benefits from having access to supplies of maize grain for purchase and then custom milling their maize at local hammer mills. The milling fees of small-scale mills are typically substantially lower than the margins charged by large millers and retailers for putting their

meal on retailers' shelves. Thus, there is potentially large cost savings to the poor if such informal maize supply chains can be further developed.

4. Reviewing the consequences of recent legislation mandating the fortification of basic foodstuffs. This legislation is a clear barrier to entry into the maize milling industry. In a study conducted by the South African Journal of Clinical Nutrition (Hendricks et al. 2001), it was found that the total cost of fortifying maize meal would be R23.2 million. These costs include the technology needed (dosifiers, mixers, scales, etc.) as well as the cost of micronutrients, equipment maintenance and additional personnel. It was found that within the entire industry, only six of the large-scale millers already had the necessary technology/equipment for the program, leaving approximately 50 or so, small to medium-scale millers with the additional cost of acquiring the necessary technology in order to operate. During hearings on the fortification issue, public testimony by the Free Market Foundation indicated that the proposed legislation would negatively affect small- and medium-scale millers' ability to operate and hence further jeopardize competition in maize milling. Recommendations were made to exempt small millers from the fortification requirements, but these were not adopted (see Free Market Foundation 2003). This is especially ironic considering that vitamin fortification cannot compensate for other nutritional advantages of whole maize meal commonly produced by small-scale mills over the more refined maize meals. For example, whole meal contains 20% more protein than highly refined meal (Table 5).

7.3. Future Research

Although this study clearly shows the effect of market reform on milling/retail margins, it has not clearly identified the reasons behind these high margins and therefore the reasons why market liberalization has not been successful in decreasing real maize meal prices. Future study that looks at structural factors and behavior of firms operating in the maize supply chain within South Africa would be able to adequately answer this question and thereby establish policy outlines aimed at ensuring access to low maize meal prices in real terms to consumers. Furthermore, the evidence of expanding real milling/retail margins after market reform instead of a decline, suggests that unlike countries such as Zimbabwe, Mozambique and Kenya, the small and medium-scale milling system has failed to successfully emerge within South Africa, thereby failing to increase competition among millers or offer less expensive products to consumers. In particular, there is a need for future research to establish why rapid investment by informal hammer mills and small to medium refined millers did not occur after market reform as has occurred in other countries.

Table 5. Nutritional Content of Maize Meal Types (Prior to Fortification)

	Whole maize meal* (99% extraction rate)	Roller meal** (90% extraction rate)	Breakfast meal*** (70% extraction rate)
	Composition per 100 gram portion		
Protein, grams	8.5	7.5	7.0
Food energy, kcals	366	363	354
Fat, grams	4.0	3.5	0.5
Iron, milligrams	2.5	2.5	2.0
Niacin, milligrams	0.35	0.30	0.05
Riboflavin, milligrams	0.13	0.13	0.03

Source: Food Composition Tables, Technical Center for Agriculture and Rural Cooperation, Waginingen Agricultural University, Netherlands, 1987.
Notes:
* a.k.a. mugaiwa (Zimbabwe), mgaiwa (Malawi, Zambia), posho meal (Kenya)
** a.k.a "sifted" meal (Kenya, Tanzania, South Africa)
*** a.k.a. "super-refined" (Zimbabwe), "super-sifted" (Kenya, Tanzania, and South Africa), and "breakfast" meal (Zambia).

REFERENCES

Arlindo, Pedro. 2001. Forecasting Agricultural Prices in an Underdeveloped Open Economy: The Case of Maize in Mozambique. Master's thesis, Michigan State University.

Bayley, B. 2002. *A Revolution in the Market: The Deregulation of South African Agriculture*. Oxford Policy Management Report No. 6. Oxford: Oxford Policy Management.

Bernstein, Henry. 1996. The Political Economy of the Maize *Filiere*. *Journal of Peasant Studies* 23.2 and 3 (double issue): 120-45.

Brorsen, W., J.P. Chavas, W. Grant, and L. Schnake. 1985. Marketing Margins and Price Uncertainty: The Case of the U.S. Wheat Market. *American Journal of Agricultural Economics* 67: 521-28.

Business Day. 2004. New Study Finds No Rigging of Maize Prices. *Business Day* posted to the web March 8, 2004. Johannesburg, South Africa.

Chabane, N. 2002. An Evolution of Influences on Prices and Production in the Maize Market. Paper presented at the Trade and Industrial Policy Strategies (TIP) 2002 Annual Forum, Muldersdrift, South Africa.

Competition Commission South Africa. 2002. *Competition Commission Inquiry into Food Price Rises*. Final Report. Pretoria: University of Pretoria.

COSATU. 2002. Food Security: The Problem of Rising Food Prices. *Dialogue* 6.2. Johannesburg, South Africa.: National Economic and Labour Council.

Delgado, C. 1992. Why Domestic Food Prices Matter to Growth Strategy in Semi-Open West African Agriculture. *Journal of African Economies* 1.3: 446-71.

Diamant, N. 2003. Soaring Food Prices – What's Behind Them? *Food Review* October: 39-41.

Engle, R., D. Lilien, and R. Robbins. 1987. Estimating Time Varying Risk Premia in the Term Structure: The ARCH-M Model. *Econometrica* 55: 391-407.

Essinger, S., L.D. Hill, and J.M. Laubscher. 1998. *Privatization Progress in the South African Maize Industry*. Staff Paper AE-4723. Urbana-Champaign: University of Illinois.

Free Market Foundation. 2003. Director's Report 2003. Online at Free Market Foundation website www.htmupload/pubdoc996.doc

Gardner, B. L. 1975. The Farm-Retail Price Spread in Competitive Food Industry. *American Journal of Agricultural Economics* 57: 399-409.

Hendricks, M., R. Saitowitz, J. Fiedler, T. Sanghvi, I. le Roux, B. Makan, G. Hussey, H. Maglagang, and O. Dary. 2001. An Assessment of the Feasibility Coverage and Cost of Fortifying Maize Meal and Sugar with Vitamin A in South Africa. *South African Journal of Clinical Nutrition* 14.2: 46-52.

Jayne, T.S., and G. Argwings-Kodhek. 1997. Consumer Response to Maize Market Liberalization. *Food Policy* 22.5.

Jayne, T., L. Rubey, D. Tschirley, M. Mukumbu, M. Chisvo, A. Santos, M. Weber, and P. Diskin. 1995. *Effects of Food Market Reform on Household Access to Food in Four Countries in Eastern and Southern Africa.* International Development Paper No. 19. East Lansing: Michigan State University.

Jayne, T.S., M. Mukumbu, M. Chisvo, D. Tschirley, B. Zulu, M. Weber, R. Johansson, P. Santos, and D. Soroko. 1999. *Successes and Challenges of Food Market Reform: Experiences from Kenya, Mozambique, Zambia, and Zimbabwe.* International Development Working Paper No. 72. East Lansing: Michigan State University.

Jayne, T.S., T. Takavarasha, and J. van Zyl. 1994. Interactions Between Food Market Reform and Regional Trade in Zimbabwe and South Africa: Implications for Food Security. *Agrekon* 33.4: 184-201.

Johnston, B.F., and P. Kilby. 1975. *Agriculture and Structural Transformation: Economic Strategies in Late-Developing Countries*. New York: Oxford University Press.

le Clus, K. 2002. The Deregulation of the South African Grain Market, and the Role of Silo Certificates. Consultant report. *Grain South Africa* August.

Lyon, C.C., and G.D. Thompson. 1993. Alternative Marketing Margin Models. *American Journal of Agricultural Economics* 75: 532-536.

Mellor, J. 1976. *The New Economics of Growth: A Strategy for India and the Developing World*. Ithaca: Cornell University Press.

Mukumbu, M. 1994. Consumer and Milling Industry Response to Maize Market Reform in Kenya. In *Proceedings of the Conference on Market Reforms, Agricultural Production, and Food Security, June 22-23, 1994*. Nairobi: Egerton University/Policy Analysis Matrix.

National Institute for Economic Policy. 1995. *Implications of the Maize Price Increase*. NIEP Briefing Paper 1. Johannesburg, South Africa.

Republic of Zambia. 1995. *A Review of Maize Marketing Liberalization During 1994: The Transition Programme 1995/96*. Lusaka: Food Security Division, Ministry of Agiculture, Food and Fisheries.

Rubey, L. 1992. *The Maize Sub-sector in South Africa: Emerging Policy Issues.* Working Paper No. 92-6. Harare, Zimbabwe: University of Zimbabwe.

Rubey, L. 1995. Maize Market Reform in Zimbabwe: Linkages between Consumer Preferences, Small Enterprise Development and Alternative Market Channels. Ph.D. dissertation, Michigan State University.

Sahn, D., P. Dorosh, and S. Younger. 1997. *Structural Adjustment Reconsidered: Economic Policy and Poverty in Africa.* Cambridge: Cambridge University Press.

Schimmelpfennig, D., L. Beyers, F. Meyer, and D. Scheepers. 2003. The Price of Staple Maize in South Africa: Stable Equilibrium or Short-run Disequilibrium? Paper presented at the 25th International Association of Agricultural Economists, 16-22 August, Durban, South Africa.

Shaffer, J.D., with M. Weber, H. Riley, and J. Staatz. 1985. Designing Marketing Systems to Promote Development in Third World Countries. Proceedings of an International Workshop on Agricultural Markets in the Semi-Arid Tropics Held at the ICRISAT Center, Pantacheru, India, October 1983. Pantacheru: International Research Institute for the Semi-Arid Tropics (ICRISAT).

South Africa Foundation. 2003. *Cooperatives in South Africa: Their Role in Job Creation and Poverty Reduction*. Occasional Paper 2/2003. Johannesburg: South Africa Foundation.

Timmer, C.P. 1997. Farmers and Markets: The Political Economy of New Paradigms. *American Journal of Agricultural Economics* 79: 621-27.

Tomek, W., and K. Robinson. 1990. *Agricultural Product Prices* (3rd edition). Ithaca: Cornell University Press.

Traub, L. Forthcoming. *Interlocking in South Africa's Maize Sector*. Draft report. East Lansing: Michigan State University.

Tschirley, D., C. Donovan, and M. Weber. 1996. Food Aid and Food Markets: Lessons from Mozambique. *Food Policy* 21.2: 189-209.

Vink, N., and J. Kirsten. 2002. *Pricing Behaviour in the South African Food and Agricultural Sector*. A Report to the National Treasury. Pretoria, South Africa: Government of South Africa.

Watkinson, E., and N. Makgetla. 2002. *South Africa's Food Security Crisis*. July. Pretoria, South Africa: National Labour and Economic Development Institute (NALEDI).

Waugh, F.V. 1964. *Demand and Price Analysis: Some Examples from Agriculture.* Washington, D.C.: USDA.

Wohlgenant, M., and J.D. Mullen. 1987. Modeling the Farm-Retail Price Spread for Beef. *Western Journal for Agricultural Economics* 12.2: 119-25.

Wooldridge, J. 2000. *Introductory Econometrics: A Modern Approach*. Knoxville, Tennessee: South-Western College Publishing.

World Bank. 1994. *South African Agriculture: Structure, Performance and Options for the Future*. Discussion Paper No. 6. Washington, D.C.: World Bank Southern Africa Department.

Wright, P.D., and W.L. Nieuwoudt. 1993. Price Distortions in the South African Maize Economy: A Comparative Political Analysis. *Agrekon* 32. 2: 51-59.

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