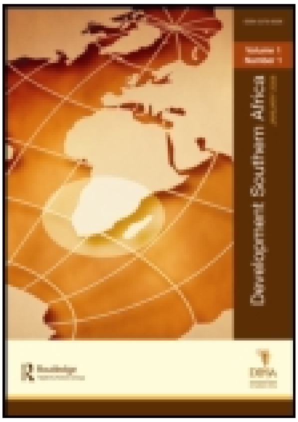

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Tinashe Kapuya [a] , Ferdinand H Meyer [b] & Johann F Kirsten [a]
[a] Department of Agricultural Economics, Extension and Rural Development , University of Pretoria , Pretoria 0002, South Africa
[b] Bureau for Food and Agricultural Policy (BFAP), Department of Agricultural Economics, Extension and Rural Development , University of Pretoria , Pretoria 0002, South Africa
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Modelling the impact of the 'fast track' land reform policy on Zimbabwe's maize sector

Tinashe Kapuya[1], Ferdinand H Meyer[2] &
Johann F Kirsten[3]

Zimbabwe has recently gone through a widely criticised land reform process that is argued to be the cause of subdued agricultural production. This paper attempts to present a counterfactual picture of the maize market in Zimbabwe had land reform been managed appropriately. The counterfactual is developed through a partial equilibrium framework in order to quantify the impact of the land reform programme. This, to our knowledge, is the first attempt at applying a partial equilibrium framework to an analysis of the impact of land reform. The results of the post-2000 land reform policy simulation showed that actual total maize output was lower than what could have been produced if it was under a pre-2000 land reform system. The study validates the assertion that land reforms contributed to the contraction of output. These results suggest the need for a well planned and executed land reform process, which can still play an important role in output growth and food security.

Keywords: land reform policy; partial equilibrium model; maize; Zimbabwe

1. Introduction

Between 2000 and 2008, Zimbabwe faced acute and persistent maize shortages. Between 5.2 million and 7.2 million people in Zimbabwe were in either chronic or transient food insecurity, or both, over the period of land reform implementation (Zimbabwe Emergency Food Security Assessment Report, 2002; Human Rights Watch, 2003; FEWSNET, 2008). Low maize output levels led to substantial emergency grain imports and food aid that were estimated at a cumulative cost of US$ 2.8 billion between 2001 and 2008 (Cross, 2009).

From a policy perspective, the persistence, scale and scope of Zimbabwe's food deficits reflect a lack of understanding of the dynamic and structural changes in the maize sector over time. It is against recurrent maize shortages hitherto that the sector needs to be carefully assessed in order to understand the impact of the land reform policy, a landmark shift that fundamentally affected the structure of the maize sector in Zimbabwe. A prevailing rationale suggests that the persistent and unprecedented maize shortfalls have, to a fair extent, been triggered by the 'fast-track' land reform

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[1]Research Assistant, Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria 0002, South Africa. Corresponding author: tinashekapuya@gmail.com
[2]Director, Bureau for Food and Agricultural Policy (BFAP), Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria 0002, South Africa.
[3]Professor and Head of Department, Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria 0002, South Africa.

policy implemented in 2001 (Richardson, 2007a, 2007b). However, analysing the effect of the land reform on the maize market is complex for three key reasons. Firstly, there are the additional effects of a combination of other ongoing market policy factors during the implementation of land reforms; secondly, macroeconomic instability affected input availability and incentives for production; and thirdly, the droughts in 2002 and 2005 also adversely impacted on output (Andersson, 2007). Therefore, attributing maize shortages to the land reform policy, given the susceptibility of the market to policy, droughts and the broader macroeconomic environment, remains debatable. Unpacking these various influences and isolating the quantitative impact of the land reform programme is difficult and there has been limited effort undertaken to evaluate its impact on agricultural production. To date, one study by Chitiga & Mabugu (2008) attempted to evaluate impacts of land reform, albeit on poverty levels and equality using a computable general equilibrium framework.

This paper re-examines the land reform policy in Zimbabwe by focusing on the complexities of maize markets, an aspect largely ignored in the discourse about the effects of land reform on food production. The paper makes two contributions to the literature and policy on land reform. First, it assesses the decline in maize production in Zimbabwe by establishing the maize production scenario if the government implemented a credible land reform exercise under a stable macroeconomic environment. This is a theoretical question given that the land reform programme was administered in a climate of growing macroeconomic instability and therefore requires the construction of a relevant counterfactual. Given the complexity and multiplicity of views regarding Zimbabwe's land reform, disagreements over a relevant counterfactual are inevitable. For the sake of a perspective, the issue of a counterfactual is handled by constructing a model that assumes the maintenance of pre-crisis macroeconomic structural conditions. Second, drawing on commodity market modelling literature, the paper presents a relatively novel approach for analysing the impact of land reform on the production structure of commodity markets. Under a partial equilibrium framework, the complex interface between land reforms and food production is carefully placed within the scope of maize market performance. A partial equilibrium model incorporates land harvested between communal and commercial sectors. This gives an elaborate link between the land reform policy and maize supply (and demand) within a specific context and market setting. The value added of the work carried out in this paper lies in the policy impacts of land reform on grain production structure and market performance, as well as policy implications for future land reform implementation.

2. Zimbabwe's land reform programme and its contemporary relevance

In all of the natural farming areas or agro-ecological zones of Zimbabwe, research has established that, under properly functioning markets, output per hectare increases with reduced farm size (Elich, 2005). Hence, it could be argued that the fragmentation of land through massive land redistribution such as those carried out in Zimbabwe in 2001 would translate into gains in marketed output. The reality, however, is not so straightforward. As Richardson (2004, 2006) contends, land redistribution in Zimbabwe post 2001 was regressive because the programme failed to uphold private property rights, a key incentive in capitalist-oriented market economies. Output and productivity gains could also have been achieved if land reforms were aligned with agrarian input market structures. In Zimbabwe, land acquisitions dissipated commercial agriculture through which communal farmers drew seed inputs, low-interest loans and subsidised fertiliser (Richardson, 2007a). As a result, resettled farmers suffered from a lack of adequate funding, agricultural input shortages and limited commercial farming skills (Kapuya et al., 2010). While these are cited as shortfalls of the land reform programme that emanated from its poor planning and implementation, it is important to probe how agricultural markets would have responded had government maintained a pre-2000 land redistribution exercise under credible market policies that sustained a strong market and agrarian structure. Although in reality agricultural production post 2000 operated within the frame of systemic challenges (such as lack of credit, lack of inputs, insufficient funding and lacking farm management skills, as discussed), generating a counterfactual benchmark would be essential to draw comparisons on the proximate impacts of the structural policy shift. This information can be used to inform future land reform policy decisions, such as the pending land audit in Zimbabwe. It could thus be used to devise future alternative land reform programme implementation strategies, which avoid the adverse impacts on the maize market (and food security) and correct for past policy errors.

3. Land restructuring: The proverbial policy shift and its implications on production

3.1 From the old (pre-2000) to the new (post-2000) land structure

Zimbabwe's pre-2000 agricultural sector was dual in nature, with a white-dominated large-scale commercial sector co-existing with a predominantly black smallholder agricultural sector. The smallholder sector consisted of small-scale commercial agriculture (with farmers resettled under the pre-2000 land reform) and communal agriculture. The post-2000 land reform programme redefined the pre-2000 structure by allocating former large-scale commercial farms to indigenous farmers under the A1[4] and A2[5] resettlement models. The new A1 model is analogous to the old communal sector farms while the new A2 model is comparable with the pre-2000 small (to medium)-scale commercial sector. The modified post-2000 structure is as follows: the traditional communal sector comprises 16.4 million hectares, the A1 resettlement model has taken up 4 231 080 hectares and the A2 model has been allocated some 2 198 814 hectares (Moyo, 2004).[6] However, due to ongoing land occupations, the A1 and A2 model resettlement figures are highly likely to have increased.

3.2 Maize output trends under a changing production structure

The share of maize production among the communal and commercial sectors has changed in line with shifts in land allocation under instituted land reforms since 1980. As shown in Table 1, the average national production between 1980/81 and 1989/90 was 1.93 million tonnes, with the communal sector contributing an average 54.79% against a commercial sector contribution of 47.37% of the total average output.

[4]The A1 model has plots with 5 to 6 hectares arable land and in excess of 6 hectares for grazing.
[5]The A2 model has farms ranging from 15 to 50 hectares in the peri-urban areas, from 15 to 250 hectares in Agro-ecological region 1, and from 350 to 2000 hectares in Agro-ecological region V. See Appendices B and C.
[6]The Mashonaland provinces (Central, East, and West), which are the main grain-producing regions, accommodated 46% of A1 land beneficiaries and 74% of all A2 beneficiaries (Moyo, 2004).

Table 1: Average contribution of the communal and commercial sectors to national agricultural production in Zimbabwe

Period	Communal sector (% of total)		Commercial sector (% of total)		Average total	
	Area	Output	Area	Output	Area (million hectares)	Output (million tonnes)
1980/81–1989/90	81.88	54.79	18.20	47.37	1.24	1.93
1990/91–1999/00	86.25	58.44	13.75	41.56	1.32	1.67
2000/01–2006/07	93.37	84.24	6.73	15.76	1.47	1.18

Sources: AIAS (various issues).

The 1990/91–1999/00 average output was marginally lower, declining to 1.67 million tonnes, with a slight increase in the communal sector contribution, rising to 58.44% against a commercial sector average of 41.56%. The steady decline in output matched the steady decline in commercial sector contribution to total maize output, and this may be due to losses in the average national yield (since commercial farms had higher yield levels) as the commercial sector area declined under land reforms. The post-2000 phase saw average output fall to 1.18 million tonnes, a fall in output mirrored by a dramatic fall in commercial contribution to an average 15.76% of the average total production. This could be due to the restructuring of the farm sector through the 'fast track' land reform, which reduced land area for the commercial sector to only 6.73% of the total average area under maize.

4. The dynamics of maize markets in Zimbabwe: Pre and post 2000

4.1 Maize markets pre 2000

In the pre-2000 era, Zimbabwe's maize industry was a net exporting sector that was underpinned by price, market policy and weather. Historically, the maize sector was typified by an epoch of interventionist market policies. This market system entailed a Grain Marketing Board (GMB), which administered and fixed a pricing system based on a pan-seasonal and pan-territorial framework (Muir-Leresche & Muchopa, 2006). While a 'pseudo free market' existed during the 1990s as part of a general move towards a more market-oriented development approach, the grain market performance during this period reflected not the impacts of 'liberalized markets', but rather a mixed policy environment of legalised private grain trade within the context of highly interventionist government operations in the grain market (The Food Security Group, 2008). Within this framework, the determination of domestic maize prices was based on policy that would be informed by import parity price trends in the domestic and regional maize markets. Thus, policy set the ceiling price at the import parity price and floor price at the export parity price, respectively, with the price band reflecting market fundamentals within which private grain trade regimes operate (Mano, 2003).

However, Zimbabwe's maize equilibrium prices seldom occurred strictly according to these policy prescriptions. The commingling of government negotiations with Commercial Farmer's Union lobby efforts, and, more significantly, factored considerations of GMB's maize forecasts, state of the trading account projections showing stock levels, expected purchases and sales income, transport, handling and storage costs, meant that the pricing framework remained fairly complex (Takavarasha, 1994). This sentiment is implicitly reflected in the real price trends in Figure 1.

As shown in Figure 1, domestic real maize prices fluctuated around the export parity regime, with high production and net exports keeping prices relatively low. Prices, in this case, also seemed to be determined by adverse weather conditions, domestic food self-sufficiency and the net trade position, which was highly positive in most years. The sharp drop in output in 1993, as an after-effect of the devastating 1992 drought, saw only a marginal increase in price, reflecting implicit government intervention through purchase and sale operations in the market that kept prices at low levels. In light of the relatively complex nature of Board operations and other exogenous forces acting on the maize market, Valdes & Muir-Leresche (1993) deduced a simplified price equation in which the producer price of maize was an additive function of GMB lagged ending stocks and lagged producer prices. They expressed this equation mathematically as:

$$P_t = b + b_0(ENDSTOCK_{t-1}) + b_1 P_{t-1} \tag{1}$$

where P_t represents the current GMB maize producer price, $ENDSTOCK_{t\text{-}1}$ represents the lagged closing stock and $P_{t\text{-}1}$ represents the lagged producer prices. According to Equation (1), the government's maize prices are determined by the previous year's prices and available stocks at the end of the season. A closer look at the data, however, shows that ending stocks are discretionarily ad hoc and there is no discernible statistical relationship between prices and lagged ending stocks after 1992. To add, ending stock data are unreliable and parsimonious. One may therefore

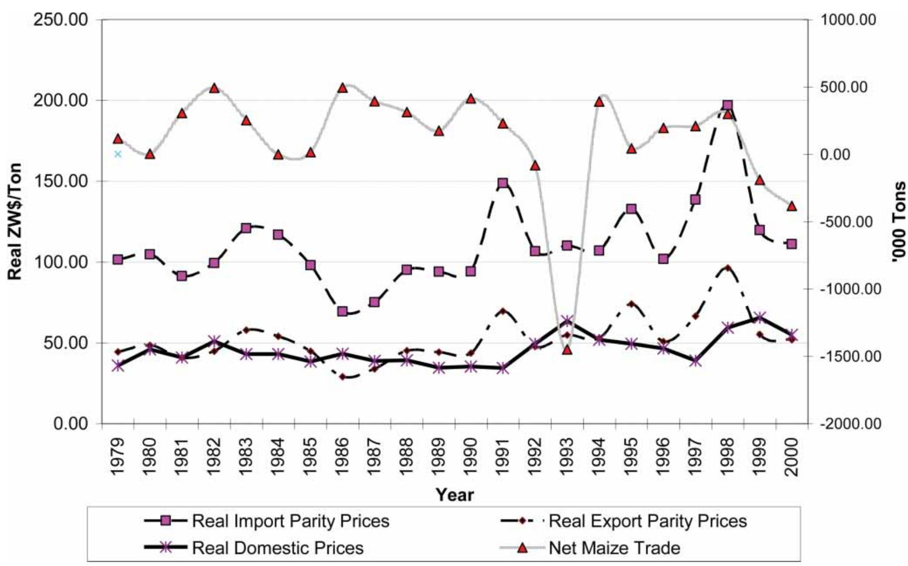

Figure 1: Maize price trends: 1979–2000 (constant 2000 prices)
Source: Adapted from Ministry of Agriculture (2007).

actually argue that the price influences in the Zimbabwe market could have been subject to modeless domestic market irregularities. However, from a purely data perspective, markets can be seen as fluctuating around export parity prices (as shown in Figure 1). Diagnostic tests suggest that export parity prices were correlated with domestic prices, even though domestic markets are argued to be distinct. An assumption is therefore made that parity prices and domestic prices are linked for the purposes of simplifying the complexity underlying price determination. From this viewpoint, it may be plausible to model the domestic price as a function of the export parity prices, although in this case domestic prices would be regarded as predetermined in the domestic market system. On this way, the exchange rate is factored into the domestic prices, and linked to a 'regional maize price' to reflect the co-movement of prices in domestic and parity prices.

4.2 Maize markets post 2000

The post-2000 era was characterised by adverse economic conditions such as hyperinflation, high interest rates, market failures, and shortages of major productive inputs (Mujeyi, 2010). Inflationary pressures had built up from 1997, rising from 19% in that year to 56% by 2000. The inflation rate increased to 238% in 2005 and 231 million% by mid-2008, as shown in Table 2. This created an unfavourable environment for the functioning of formal markets and production systems.

Controlled maize prices in a hyperinflationary environment encouraged 'parallel markets' and speculation, leading to dwindling formal maize trading. On the one hand, the parallel exchange rate depreciated rapidly, thereby creating a disincentive for domestic production; on the other hand, the depreciation of the domestic currency created lucrative margins for licensed grain millers/traders who were able to access foreign currency at the official rate to either trade maize directly at its 'real' market value or import grain (or other higher value commodities goods) for resale on the informal market.

Because maize marketing and production inputs were characterised by partial and/or full government intervention, maize shortages on formal markets subsequently led to the emergence and proliferation of an 'informal economy' running parallel to the formal economy. Input markets were characterised by shortages as demand outstripped

Table 2: Trends in maize prices and macro-economic variables (2000–08)

Variable	2000	2001	2002	2003	2004	2005	2006[a]	2007	2008[a]
Inflation[b]	55.9	71.9	126.9	365.7	350	237.9	948.2	7 689.3	231 million
Exchange rate (ZW$/US$)[b]	55	55	55	824	5 730	77 970	162	17 563	3 billion
Maize prices (ZW$)[c]	15 000	28 000	300 000	750 000	2 248 024	31 300 000	91 300 800	–	–

Note: [a]Estimates: in 2006, three zeros were slashed from the Zimbabwean dollar; and in 2008, 10 zeros were removed.
Sources: [b]Mujeyi (2010). [c]FAO (2012).

supply due to acquisition of most seed producing commercial farms during the land reform (Richardson 2007b; Mujeyi 2010). There was also a shortage of foreign currency that affected capacity utilisation in agro-industries that rely on imported raw materials, particularly the fertiliser industry as well as fuel imports (Mujeyi, 2010). Consequently, the land beneficiaries could not optimally utilise the allocated land and contribute more to food production. The cascade of all these issues was argued to be the after-effects of the eventual displacement and collapse of commercial agricultural due to the land reform programme (Richardson, 2007b).

4.3 Data issues

Sound economic models are constructed using good data that are, however, not always readily available. In Zimbabwe, although efforts have been made to collect data over the food crisis period, estimates on maize supply and demand variables have varied across institutions, with Government of Zimbabwe, Food and Agricultural Organisation/Global Famine Early Warning Systems (GIEWS), African Institute for Agrarian Studies and Zimbabwe Vulnerability Assessment Committee approximations offering markedly different balance sheet datasets. For instance, average annual domestic utilisation of maize between 2001/02 and 2008/09 is estimated at 1.98 million tonnes (AIAS, various issues). Estimates from FAO (2008) report average total domestic maize utilisation to be 1.825 million tonnes, while the government estimates domestic consumption at 2.4 million tonnes (after including other discretionary stock uses such as supply stabilisation/precautionary stock). The disparities in data are problematic. Table 3 presents the maize balance sheet for the period 2003/04–2008/09 to show the trend in the supply and demand balance of Zimbabwe's maize sector.

Table 3: Trends in Zimbabwe's maize balance sheets (2003/04–2007/08)

Variable	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Supply						
Production	1 686 000	916 000	1 485 000	1 161 000	471 000	1 240 000
Opening stock imports	88 000	120 000	70 000	0	154 000	32 000
Government imports	340 170	184 901	685 983	250 659	340 170	450 000
Food aid	249 053	73 075	134 487	155 653	327 338	299 000
Informal[a]	–	13 108	1 875	1 617	2 593	23 000
Total	2 363 223	1 292 976	2 377 345	1 568 929	1 141 101	2 044 000
Demand						
Human use	1 529 639	1 549 294	1 648 417	1 747 337	1,632,013	1 825 000
Feed use[c]	150 000	125 000	137 500	437 975[b]	150 000	150 000
Seed use[c]	110 000	101 000	56 000	–	48 000	48 000
Losses[c]	79 000	–	–	–	40 000	57 000
Closing stocks	120 000	70 000	0	154 000	32 000	50 000
Total	1 988 639	1 845 294	1 841 917	2,339,312	1 902 013	2 130 000
Surplus/deficit	374 584	−552 318	535 428	−770 383	−606 912	−86 000

Note: [a]Cross-border informal maize imports from South Africa, Zambia and Mozambique. [b]Aggregate of feed, seed and losses.

Source: AIAS (various issues). [c]FAO (various issues); USAID-FEWSNET (2007, 2009) and MAMID (various issues).

The data show that in 2008/09 Zimbabwe's maize market had a negative balance of approximately 86 000 tonnes, which represents the uncovered deficit in that particular consumption period. Apart from the 2003/04 and 2005/06 seasons, other years in the previous five-year period had been worse – particularly in the 2004/05 and 2006/07 seasons, which had uncovered deficits of just over 552 000 tonnes and 770 383 tonnes, respectively (see Table 3). It is important to note that while every effort has been made to carefully assess the maize data from various sources as presented in the maize balance sheet in this section, such data remain quite messy and difficult to validate. This is particularly true with regard to ending stock figures, imports, food aid, and even human and feed consumption. Various sources have offered diverse stock balances, and an attempt in this paper has been made to present a near-representative maize balance trend. Although the data might not be a precise reflection of the actual supply and demand, they nevertheless provide an insightful and general idea of the maize supply and demand situation in Zimbabwe over the post-2000 land reform period. As can be observed, domestic production has been short of requirements throughout the considered period and has been augmented by imports from government, food aid and cross-border informal trading. Although data precision could be questioned, the point to make is Zimbabwe became a net maize importer during the post-2000 land reform period, a reflection of a clear market shift when compared with the 1980s and 1990s, decades in which Zimbabwe was a major net exporter in the region.

5. The empirical modelling framework

Given the relatively complex nature of price determination and the influence of other policy and macroeconomic factors that impact on domestic maize markets, partial equilibrium modelling becomes a uniquely useful way of analysing Zimbabwe's maize sector. The strength of partial equilibrium modelling as a way of understanding the Zimbabwean maize market rests in several of its strengths. Firstly, using partial equilibrium analysis is empirically simple and the analysis thereof reasonably approximates the general effects of policy changes even if there are weak links between commodities and their supplier or output sectors (Perali, 2003). Secondly, partial equilibrium analysis provides useful information on the impact of trade and policy changes at very detailed product and sectoral levels, hence allowing for the utilisation of widely available trade data (Thurlow & Holden, 2005; Wubeneh, 2006; Lang, 2008).

Zimbabwe's maize market can be conceptually illustrated as shown in Figure 2. The illustration below depicts that Zimbabwe's domestic prices are influenced by regional price trends, as discussed. This goes along with Takavarasha (1994), who argued that Zimbabwe's maize markets since the 1980s were influenced by regional parity price trends that informed price negotiations, in addition to weather issues. In this case, prices are modelled as a function of parity prices as discussed, and net trade is thus used to close the model in the form of an identity equation.

A typical partial equilibrium model, as outlined in Figure 2, consists of domestic supply, demand, trade and price components. Total supply consists of: *beginning stocks* plus *imports* plus *production*. Total demand consists of: *domestic consumption* plus *exports* plus *ending stocks*. The components of the model contain a set of simultaneous equations, which solve for an equilibrium price in the maize market (see equations in Appendix A).

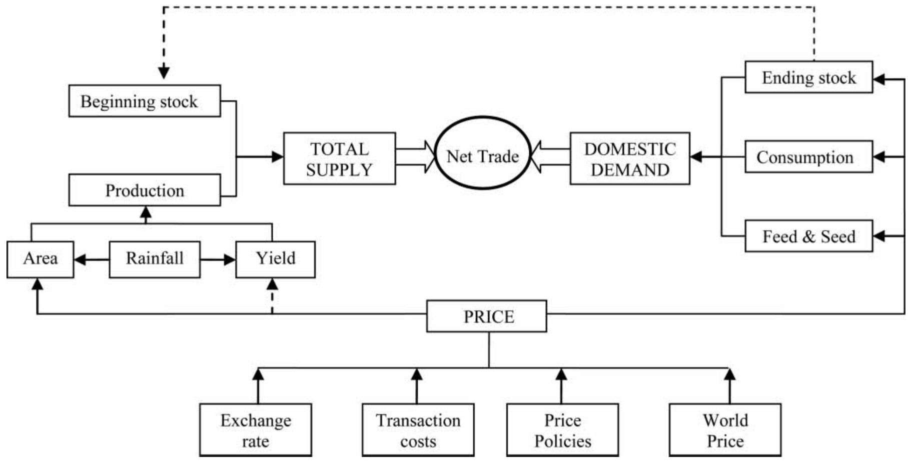

Figure 2: Diagram illustrating Zimbabwe's maize market model
Source: Adapted from Meyer et al. (2006).

The estimated results of eight behavioural equations derived from generalised least-squares and ordinary least-squares estimations in SPSS software. Having estimated the equations, the simulation model was constructed in an EXCEL spreadsheet, calibrated to the base year 2000 and then validated by examining its predictive ability for the period between 1992 and 2000. To enable the generation of a baseline, the model was 'solved' in EXCEL for a period during which the land reform policy was implemented. Using the multipliers generated from the regressions, the exogenous variables were held constant at the 2000 level so as to generate solutions for the endogenous variables.

Important to note is the fact that the results were examined for consistency with a priori knowledge on Zimbabwe's maize production, demand and trade conditions. At the researcher's discretion, and from literature that provided general information, maize market commodity knowledge was incorporated into the projection results. The consistency of the projection results was examined mainly by comparing the net trade position projected by production, demand and trading for maize with the actual export and import differences.

5.1 Model assumptions

A relevant counterfactual meant that assumptions be made concerning gross domestic product, inflation and exchange rate during the period the post-2000 land reform. The study therefore assumed that the agricultural policy and the macro-economic environment that existed in 1999 continued into the post-2000 period. The model's projections post 2000 therefore incorporated the pre-2000 willing-buyer/willing-seller land reform approach, and assumed this continued into the future. According to Global Insight (1999), the gross domestic product was projected to increase to ZW$28.21 billion in 2005. The exchange rate was projected to depreciate consistently to ZW$102.5/US$ in 2005. Projections from Global Insight (1999) were made at a time when the 'fast track' land reform was not anticipated, meaning that they assumed pre-2000 policy conditions. The World Bank estimated that population increased to 12.46 million in 2008. Table 4 displays the projections of the exogenous variables used in the model.

Table 4: Projections of exogenous variables

Variable	2001	2002	2003	2004	2005	2006	2007	2008
GDP (ZW$ billions)[b]	25.64	26.17	26.61	27.36	28.21	28.83[a]	29.46[a]	29.46[a]
Exchange rate (ZW$/US$)[b]	82.50	87.50	92.50	97.50	102.50	108.06[a]	113.92[a]	120.09[a]
Rainfall (mm)[c]	728.6	465.7	602.0	712.3	529.0	821.9[a]	884.2[a]	662.0[a]
Population (millions)[d]	12.50	12.52	12.51	12.50	12.48	12.46	12.45	12.46

Note: [a]Estimates based on the Global Insight (1999) outlook. Gross domestic product (GDP) and exchange rate are given at 2000 prices.
Sources: [b]Global Insight (1999). [c]AIAS (various issues). [d]World Bank (2010).

To isolate the influence of droughts on maize markets, the baseline model incorporated ‘actual’ rainfall. Human consumption was calculated based on actual population values since the data for the period of the post-2000 land reform were available. This would allow for the determination of droughts that occurred in the projection period, which also improved the performance of the model.

The definition of communal (smallholder) versus commercial pre 2000 is maintained in the post-2000 simulation. The resettled A1 and A2 farmers in the post-2000 land reform are grouped under the communal sector by virtue of their scale of production. The grouping of A1 and A2 farmers under the communal sector in the post-2000 era is meant to simplify the analysis and to allow us to draw comparisons over time. However, at the time this paper was written, available data after 2008 only gave aggregate national maize production levels and did not distinguish between communal sector and commercial sector contributions. Because the object of the paper is centred on assessing the salient features of how this structure would have evolved against what actually happened, the paper’s analysis of the structural evolution of communal sector versus commercial sector is restricted to assessing markets from 2000 up to 2008 only.

5.2 Empirical results

5.2.1 The re-simulated baseline

Based on the assumptions discussed in the preceding section, the model generated a market baseline of ‘would be’ outcomes without the post-2000 land reform. This market outlook of the Zimbabwean maize sector is technically referred to as a re-simulated baseline. The outlook reflects the counterfactual picture of the Zimbabwean maize sector if no post-2000 land reform occurred. The re-simulated baseline reflects the outcome of a pre-2000 willing-buyer/willing-seller land reform in a post-2000 era, assuming that stable political and macro-economic conditions prevailed. Therefore, the re-simulated baseline versus the actual market values essentially shows the pre-2000 land reform policy versus the post-2000 land reform policy, respectively. The post-2000 land reform policy decision can be assessed by looking at the differences between the re-simulated baseline and the actual market values of what occurred during the post-2000 land reform era.

5.2.2 The pre-2000 versus the post-2000 land reform policy scenario

A comparison of the ‘actual’ outcomes versus the re-simulated baseline is displayed in Tables 5, 6 and 7. In the tables, the re-simulated baseline is stated as ‘baseline’ – these

Table 5: Impact of the 'fast track' land reform policy on maize area harvested

	2001	2002	2003	2004	2005	2006	2007	2008
Commercial area (×1000 hectares)								
Baseline	145.63	122.66	124.85	131.38	118.40	138.83	147.28	150.25
Actual	155.89	128.83	126.58	93.01	70.44	62.84	55.68	n/a
% Change	7.04	5.04	1.39	−29.21	−40.50	−54.73	−62.19	–
Communal area (×1000 hectares)								
Baseline	1 350.42	1 319.26	1 382.96	1 474.91	1 463.72	1 606.94	1 713.14	1 793.43
Actual	1 084.10	1 199.02	1 225.79	1 400.80	1 659.42	1 650.16	1 390.13	n/a
% Change	−19.72	−9.11	−11.36	−5.02	13.37	2.69	−18.85	–
Total area harvested (×1000 hectares)								
Baseline	1 496.05	1 441.92	1 507.81	1 606.29	1 582.12	1 745.76	1 860.42	1 943.68
Actual	1 239.99	1 327.85	1 352.37	1 493.81	1 729.87	1 713.00	1 445.82	1 445.82
% Change	−17.12	−7.91	−10.31	−7.00	9.34	−1.88	−22.29	−25.61

Notes: n/a = means actual data were unavailable. From 2008, no data that distinguish communal and commercial area and yield were found.
Source: Model results.

Table 6: Impact of the 'fast track' land reform policy on production (2001–08)

Total production (×1000 tonnes)	2001	2002	2003	2004	2005	2006	2007	2008
Baseline	1 759.97	1 420.65	1 593.07	1 791.45	1 574.08	2 039.26	2 234.16	2 198.10
Actual	1 526.48	604.67	1 058.98	1 686.02	916.06	1 485.04	1 161.10	471.00
% Change	−13.27	−57.44	−33.53	−5.89	−41.80	−27.18	−48.03	−366.69

Source: Model results.

Table 7: Long term impact of the 'fast track' land reform policy on production (2009–12)

Total production (×1000 tonnes)	2009	2010	2011	2012
Baseline	1 984.10	1 959.19	1 967.48	1 873.65
Actual[a]	1 240.00	1 192.40	1 452.00	968.00[b]
Actual change	−744.10	−766.79	−515.48	−905.65
% Change	−37.50	−39.14	−26.20	−48.34

Source: Baseline model results. [a]FAO (2012). [b]FAO/GIEWS (2012).

two terms are used interchangeably because they technically hold the same meaning. A baseline is a market benchmark against which various policies are analysed. In this paper, the term 're-simulated baseline' implies that the benchmark is re-set against a retroactive market scenario ex-post facto. The percentage change displayed in the table represents the difference between the re-simulated baseline (willing-buyer/willing-seller land reform regime) and what actually occurred in the maize market ('fast track' land reform regime). This difference represents the 'fast track' land reform policy's impact on the maize sector. It is important to note that the 'baseline' outlined in Tables 5 to 7 for area and production variables reflects the benchmark of Zimbabwe's maize market and the model's full response to rainfall and pre-2000 policy conditions under a pre-2000 land reform, but not any other policy shock. The authors are of the opinion that the deviation between the re-simulated baseline and the actual output gives an empirical basis upon which one can separate the 'fast track' land reform policy effects from the impact of droughts over the simulation period.

5.2.3 Production structural evolution: Communal area versus commercial area

The precise impact of the 'fast track' land reform on the total sectoral maize area harvested is difficult to gauge due to the restructuring and shifts of land between and across the communal and commercial sectors. However, the model can infer how the sector would have evolved under the pre-2000 land reform policy, which is intrinsic in the model's projections. As a simplifying assumption, the pre-2000 definition for commercial and communal sector areas harvested holds over the pre-2000 and post-2000 eras for ease of comparison over time, as discussed. The key question then is how the production structure would have evolved over time if pre-2000 policy conditions had been maintained in a post-2000 era. While the land area for the commercial sector was declining even under the pre-2000 scenario, it would be interesting to compare the extents to which this sectoral area would have evolved under pre-2000 versus post-2000 land reform systems. The evolution of the communal sector versus commercial sector structure under pre-2000 and post-2000 land reform frameworks can only be compared up to 2007 due to data limitations. From 2008 onwards, data on sector-based production information could be obtained.

The results of the re-simulated baseline shown in Table 5 indicate that the actual total area harvested was consistently below the re-simulated baseline in all of the first seven seasons except in 2005, in which the actual area harvested was 9.34% above potential. This implies that, overall, the 'fast track' land reform programme negatively affected the total maize area harvested. In particular, the negative effect was especially severe on the commercial sector maize area harvested between 2004 and 2007, where the expropriation of commercial farms led to an impact of a commercial maize area decrease of 29.21% in 2004. The impact became more severe each year with the commercial maize area declining consistently to 62.19% below what it could have been by 2007 (see Table 5). It is the considered view of the authors that this precipitous decline in commercial maize area harvested by way of the 'fast track' land reform policy shift could be explained by two underlying reasons. Firstly, land transfers from the commercial sector to the communal sector perhaps led to much of the loss in area planted being attributed to the stalling of farming operations as a result of the unrest and uncertainty experienced during the reform period. Secondly, the decline in commercial maize area, which produced the sector's maize seed input, led to seed shortages that were then experienced during the reform period and this led to the overall decline in yields. This vicious cycle is therefore argued on the grounds that the expropriation of commercial farms severely reduced the total maize area planted compared with what it could have been under a pre-2000 system.

From an aggregate perspective, the re-simulated baseline shows an upward trend in the total maize area harvested that was going to fluctuate between 1.441 million hectares and

1.860 million hectares between 2001 and 2007. Higher levels of overall total area harvested would have presumably been driven by the steady commercial maize area harvested levels of 118 000 hectares that would be underlined by the increase in the importance of the seed and feed markets. Presumably, feed use was set to increase following the increase in stock feed prices that necessitated the need for farm-based feed production. Additionally, the growing significance of feed demand from beef and other livestock exports within the region and to the European Union market was expected to play a greater role in driving the increase in commercial land area under maize, which would, in turn, indirectly contribute to higher total maize area harvested.

The lower levels of total maize area harvested actually realised under the post-2000 land reform policy may suggest that the pre-2000 ongoing land transfers under the then land acquisition framework would have achieved greater levels of aggregate maize area harvested than the 'fast track' land reform policy. This is argued because the projections from 2001 to 2007 for the area harvested are based on trends that the model captures in area harvested between the communal and commercial sectors of the pre-2000 dual system.

5.2.4 Total national-level maize production

Case 1: Pre-2008 trends – Period of economic instability and structural change

Total production was 13.27% less than what could have been produced in 2001, the year that the 'fast track' land reform policy was formally implemented (see Table 6). A cautionary note is sounded, however, about misreading this 2001 percentage difference as there is a risk of misplacing the production impact on the 'fast track' land reform policy. The 'fast track' land reform policy, due to lagged effects of agricultural production, would appropriately have taken at least a season after implementation for its effects to be clearly visible. Therefore, in 2001, it is too early to ascertain the impact of the 'fast track' land reform policy. The year 2002 is an empirically better and stronger starting point to observe the marked effects of the 'fast track' land reform policy. In 2002, output was 57.44% less than what could have actually been produced. Although other scholars argue that a drought had more to do with the decline in output in 2002, the rainfall variable in the model allowed for the delineation of the 'fast track' land reform policy impact, which was −57.44%. In the 2005 drought season, total maize production was 41.8% less than what could have been produced without the 'fast track' land reform. In 2007, the baseline showed that the maize sector could have produced almost 48.03% more than what was actually produced.

From the 2005 drought, maize output was expected to recover more strongly in 2006 to reach output levels above 2 million tonnes, this against a drop in 'actual' output of the 'fast track' land reform policy scenario. The drop in actual output to 471 000 tonnes in 2008 (which was 367% below potential output that could have been produced) was arguably attributed to widespread input shortages caused by the weakening of the previous commercial sector–communal sector structural link that strengthened the seed and input supply base for the entire maize sector. The drop in production, apart from being affected by marginally less rainfall, may also have been exacerbated by the deepening political and economic crises that were arguably triggered by the 'fast track' land reforms.

Case 2: Post-2008 trends – Period of economic recovery

It has been argued by scholars and policy analysts that the much of the production decline between 2001 and 2008 was more because of input shortages and adverse macro-economic conditions than the post-2001 land reform programme. Because of the logic of this argument, the model is then extended further for the period 2009–12 in which Zimbabwe's economy stabilised. Zimbabwe's inflation has slowed down to single-digit levels after adopting a multi-currency regime that essentially restored price stability in commodity markets.[7] An interesting question then is whether, as production recovers from economic regression, comparisons can one draw between a 'new look' structure under a post-2000 versus the 'dual' pre-2000 land reform system to see how they perform under the same conditions. This means that the model's assumption concerning macro-economic conditions are re-set to 'real world conditions' and benchmarked against actual trends. The model's parameters remain unchanged to reflect the pre-2000 structure. Comparing a pre-2000 land reform picture in a post-2008 situation helps us to draw some insights on long-term impacts of the post-2000 land reform and the response to policy shocks under the two reform systems. Thus, preserving the parameters of the model would help to infer on how a pre-2000 structure would have responded to a post-2008 environment. This also allows us to draw out the land reform impacts under stable versus unstable economic conditions. Table 7 shows the model simulation in the post-2008 scenario, and essentially compares the performance of the 'new look' structure against the pre-2000 structure from 2009 to 2012.

Actual data show production recovered from 1 240 000 tonnes in 2009 to 1.45 million tonnes in 2011. However, at the time of writing this article, output was projected by the GIEWS to fall to under a million tonnes in 2012. The model results show that output would have been fairly stable above 1.9 million tonnes, sufficient to meet human demand. In the long term, post-2000 land reform, impacts are estimated to remain negative and fairly high even though output trends are showing signs of a slow recovery. Production was 37.5% less than the baseline projection in 2009. Production is expected to be 48.35% below the baseline given GIEWS projections for the 2012 output. This shows that production under a pre-2000 land reform system (with all its demerits) would have performed better than the post-2000 land reform system.

6. Conclusion

Zimbabwe agricultural production has been sub-optimal as a result of a poorly orchestrated land reform programme. The main aim of the article was to re-assess and model the impact of the 'fast-track' land reform on the maize market in Zimbabwe. We have tried to address this issue from the viewpoint that analysing land reform impacts is complex given the intricacy of agricultural markets. A plausible counterfactual picture was generated by simulating maize market performance under the pre-2000 set of economic and policy conditions in post-2000 scenarios. This was

[7] While formal markets quote prevailing import parity South African Future's Exchange prices, the informal markets operated within localised and segmented rural and urban sub-markets that were devoid of sufficient market information from formal market trends (Kapuya et al., 2010). Kapuya and his co-authors further indicated that since farmers in rural Zimbabwe had limited access to foreign exchange, they resorted to barter exchange as an alternative arrangement in which farmers used grain as a form of payment for goods and services.

used as a benchmark against which actual production was compared over the period 2000–08, a crucial pre-implementation and post-implementation period of the 'fast track' land reform policy. Another simulation assumed post-2008 economic conditions and compared a pre-2000 versus post-2000 land reform structure. Although these simulated effects are not what actually took place because they are fundamentally counterfactual, they give a basis to argue what could have happened if Zimbabwe had continued on the pre-2000 willing-buyer/willing-seller land reform policy path. The results for the land reform simulations show that a well-planned land reform exercise would have resulted in higher output levels, even during drought years. The main lesson from this exercise is that while land reform can be an important tool to restructure land ownership disparities, it can lead to costly and damaging impacts if improperly managed. For the post-2008 period, the paper offers key lessons for proper land reform implementation for Zimbabwe whose relevance lies in the pending land audit, as (and when) authorities attempt to correct for past mistakes made in implementing the post-2000 land reform. Lessons for proper land reform implementation go to countries in the sub-region (such as South Africa and Namibia) that are attempting to find solutions to the current land distribution disparities.

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Appendix A

A.1 Estimated results of the maize model

Although the partial equilibrium model consisted of four main blocks (namely supply, demand, price and trade), only the supply (production structure, i.e. area and yield equations) and price blocks are outlined here. The coefficients are given and equations explained, with the *t*-values given in parentheses.

A.2 Communal area equation

Some analysts believe that Zimbabwe's communal sector maize production has, on the one hand, been driven more by non-market factors (such as culture and tradition rather than profit) while on the other the sector suffered from segmented markets, information deficiency and institutional constraints. Communal farmer's response to market prices would expectedly be impaired by a combination of these factors, most of which are difficult to model. By way of a two-stage least-squares technique, the communal maize area harvested was modelled as a function of the lagged area harvested, rainfall, a dummy variable in 1987, real maize price, real soybean producer price to fertiliser price ratio (a competing crop and input cost, respectively), the real sorghum producer price (a substitute crop) and a trend. The trend variable was used to capture the incremental levels of area over time, believed to have been influenced by more land becoming available through progressive market-based land reform.

$$\begin{aligned} \mathrm{SSC} = {} & \underset{(1.64)}{849.7} + \underset{(2.33)}{0.13}\mathrm{SSC}(-1) + \underset{(2.42)}{0.27}\mathrm{RAIN} + \underset{(-2.32)}{195.1}\mathrm{DUM87} + \underset{(1.60)}{12.8}\mathrm{MZP} - \\ & \underset{(-2.32)}{172.2}(\mathrm{SBNP/FERTP}) - \underset{(-1.38)}{5.3}\mathrm{SGMP} + \underset{(4.10)}{0.4}\mathrm{TREND} \end{aligned}$$

Adjusted $R^2 = 0.62$, $T = (1980–2000)$.

The dummy variable DUM87 was meant to capture the two-tier price policy that seemed to have contributed to increases in area planted.

A.3 Commercial area equation

The large-scale commercial sector area harvested equation was modelled using the same variables as the communal sector model using a two-stage least-squares technique. The explanatory variables were lagged large-scale commercial area harvested, time trend, average annual rainfall, maize prices, soybean prices, fertiliser prices and a dummy variable (DUM87) for the two-tier price policy. The results of the model are shown below:

$$\underset{(1.29)}{\mathrm{LSC}=122.2}+\underset{(1.70)}{0.11\mathrm{LSC}(-1)}+\underset{(-3.57)}{0.06\mathrm{RAIN}}-\underset{(-4.02)}{195.1\mathrm{DUM87}}+\underset{(2.03)}{3.77\mathrm{MZP}}-\underset{(-1.57)}{0.07\mathrm{SBNP}}-\underset{(-1.95)}{0.5\mathrm{FERTP}}-\underset{(-1.08)}{8.3\mathrm{TREND}}$$

Adjusted $R^2 = 0.67$, $T = (1980–2000)$.

Two variables in the model had very low *t*-values and these include soybean prices and fertiliser prices. It was, however, necessary to include them in the model because they gave the model the correct signs that conform to a-priori theory.

A.4 Communal sector yield equation

Communal yield was modelled as a function of rainfall and a dummy variable. The estimation results are presented below:

$$\mathrm{YEILD} = \underset{(6.23)}{0.5} + \underset{(4.25)}{0.03\mathrm{RAIN}} + \underset{(8.78)}{\mathrm{DUM89}}$$

Adjusted $R^2 = 0.84$, $T = (1980\text{-}2000)$.

The dummy variable in 1989 was in essence included to capture the unusual response behaviour of yield in that particular year. In 1989, national average communal yield increased to 1.54 tonnes/hectare (from 1 tonne/hectare in 1988) when rainfall had actually declined from 744 mm/year to 60 5mm/year that season, a level that is below the normal average of 662 mm/year. This unusual behaviour represented an outlier given the positive relationship between rainfall and yield, with both variables appearing to be moving together each season over time.

A.5 Commercial yield

Commercial sector yield was expressed as a function of rainfall. The estimation results are presented below:

$$\mathrm{YEILD} = \underset{(3.32)}{1.41} + \underset{(6.24)}{0.03\mathrm{RAIN}}$$

Adjusted $R^2 = 0.58$, $T = (1980–2000)$.

A.6 The price equation

The price model was given as a linear estimation of the real domestic maize price against export parity prices ex-Harare (quoted from the South African Futures Exchange Randfontein prices):

$$\underset{(10.38)}{\mathrm{MZP} = 31.2} + \underset{(2.41)}{0.07\mathrm{EXPP}} + \underset{(4.60)}{0.61\mathrm{TREND}}$$

Adjusted $R^2 = 0.87$, $T = (1980-2000)$.

The elasticity of local prices with respect to the parity prices was calculated and found to be 0.1758. This means that a 1% increase in regional price would only induce a 0.18% increase in local maize prices.

Appendix B

Table B1: Maximum farm sizes per resettlement model by agro-ecological region (hectare)

Agro-ecological zone	A1	A2			
		SSC[a]	MSC[b]	LSC[c]	Peri-urban
I	12	20	100	250	
IIa	15	30	200	350	
IIb	20	40	250	400	
III	30	60	300	500	2 to 50
IV	50	120	700	1 500	
V	70	240	1 000	2 000	

Notes: [a]Small-scale commercial sub-sector. [b]Medium-scale commercial sub-sector. [c]Large-scale commercial sub-sector.
Source: Government of Zimbabwe (2009).

Appendix C

Table C1: Zimbabwe's farm structure

Farm class	Land tenure	Farm households		Area		
		Numbers	% of total	Hectares	% of total	Average farm size (hectares)
Smallholder	Communal	1 100 000		16.4		15
	Old resettlement	72 000		3.7		51
	A1	141 656		5.7		40
	Sub-total	1 313 656	98	25.8	75.6	20
Small- to medium-scale commercial	Old SSCF	8 000		1.4		175
	Small a2	14 072		1		71
	Sub-total	22 072	1.6	2.4	7	109
Large-scale commercial	Medium-large A2	1 500		0.9		600
	Black LSCF	1 440		0.9		625
	White LSCF	1 377		1.2		871
	Sub-total	4 317	0.3	3	9	695
Corporate estates	Company	657		1		1 522
	Church	64		0.04		641
	Parastatal	253		0.6		3 922
	Sub-total	874	0.1	1.64	4.8	1 878
Transitional	Unallocated			1.3	3.8	
Total		1 340 919		34 141.00	100	

Notes: LSCF = large-scale commercial farm; SSCF = small-scale commercial farm.
Source: MAMID (2009); Moyo & Yeros (2009).