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Impact of trade controls on price transmission between southern African maize markets

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ABSTRACT

Maize is an important staple crop in southern Africa that has often been prioritised from a policy perspective, particularly in the imposition of export controls under periods of perceived uncertainty. This tendency has been particularly relevant in Zambia, which has also emerged as an important surplus producer in southern Africa in recent years. Its favourable transport differential and non-GM maize has helped Zambia grow its share in Zimbabwean maize imports at the expense of South Africa, but exports into Zimbabwe remains competitive between the two countries and particularly during periods of export control in Zambia, South Africa typically steps in to supply the deficit. This study therefore evaluates the extent of price transmission between Zambia, South Africa and Zimbabwe under two exogenous regimes defined by periods of open trade and trade controls imposed by the Zambian government. It uses secondary data of monthly white maize prices in these three markets to quantify the long and short run price relationships under different regimes. While several authors have noted that trade is not a prerequisite for price transmission between markets, this study finds evidence that the imposition of policies that inhibit trade also influences the rate and nature of price transmission between markets. Periods of open trade were characterised by efficient transmission of prices from Zambia to Zimbabwe, which is in line with typical trade patterns, but during periods of trade controls, no relationship was found between Zambian and Zimbabwean markets, with prices being transmitted from South Africa to Zimbabwe instead.

KEYWORDS

price transmission; southern Africa maize; ARDL; trade control policy

1. Introduction

Maize represents a core food staple in southern Africa and between 2013 and 2015, average per capita consumption of 87 kg per person was more than four times the global average (OECD-FAO, 2016). Accordingly, the availability and affordability of maize has become synonymous with food security in the region and its nature as a strategic political crop has also prioritised the maize sub-sector from a policy perspective. The perceived need to stabilise prices and supply has been offered as justification for continued government intervention in the sector, despite the international drive towards liberalisation (Jayne & Tschirley, 2009; Minot, 2014). Particularly in Africa, it has been argued that interventions aimed at managing volatility reduce price risks for multitudes of consumers that spend a large share of their incomes on food products. At the same time, it prioritises the

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sustainability of producers in a region where a significant share of the population depends on agriculture for their livelihood (Minot, 2014).

In the past, such interventions have been highly discretionary and unpredictable, often characterised by the sudden implementation of trade controls, unanticipated changes to tariff policy and inconsistent pricing policies for government purchases (Haggblade et al., 2008; Jayne & Tschirley, 2009; Jayne, 2012). The ad-hoc and unpredictable nature of government activity in these markets has increased the associated risks and costs for the private sector, impeding investments that would otherwise improve access to markets and services for multitudes of small scale producers. Accordingly, it has not been effective in supporting agricultural productivity growth in the region (Jayne & Tschirley, 2009) and it has been suggested that, contrary to the stated objectives of stabilisation, observed volatility over the past decade has been higher in markets where governments intervene most actively (Chapoto & Jayne, 2009; Jayne, 2012; Minot, 2014). In other cases, the consistent use of strategic grain reserves were found to be successful in stabilising prices, but at higher average price levels (Jayne et al., 2008; Mason & Myers, 2013) and at significant cost to government.

Export controls in particular have been used extensively across the region, with the objective of ensuring domestic supply and keeping prices at tolerable levels. Numerous studies have considered the impact of such controls on price differences between markets (Porteous, 2012), volatility (Chapoto & Jayne, 2009; Porteous, 2012) and producer decisions (Makombe & Kropp, 2016). However, the extent to which such controls influence the efficiency of price transmission between different markets in the region has not been sufficiently explored (Kabbiri et al., 2016).

Early analysis of price transmission in southern African markets focused on the extent to which international reference prices are transmitted into domestic markets in the region. Conforti (2004) noted that relative to other developing markets in Asia and South America, transmission from world to domestic prices in Africa is much poorer, which was later confirmed by Minot (2011) who evaluated 62 markets in Africa, finding evidence of long run relationships to world prices in only 13. Of all maize markets tested only 10 per cent of domestic markets were found to be co-integrated to world prices.

In maize markets, the lack of long run co-integrating relationship between domestic and world prices may stem from the nature of the products consumed. The preference for white maize free of genetically modified (GM) technology in Africa limits procurement opportunities in the world market (Davids et al., 2016). This increases the importance of intra-regional trade and apart from South Africa, which has imported significant quantities of yellow maize in deficit periods for use in animal feed, on average less than 10 per cent of total imports have originated from outside of the region over the past five years (ITC, 2016). The prevalence of informal trade (FEWSNET, 2015) further indicates that the actual share is most likely smaller than that computed from the officially reported trade data. Thus more recent evaluations of price transmission have focused on the extent to which South African prices are transmitted into the rest of the region.

Whilst noting that price transmission may still take place in the absence of trade based on the flow of information between markets, various authors have linked trade-flow to price transmission analysis in the region. Trade volumes have been applied as a threshold variable to allow for multiple thresholds and price transmission regimes between South Africa and Mozambique (Traub et al., 2010), as well as South Africa and Zambia (Myers & Jayne, 2012). Essentially the efficiency of price transmission between different markets is allowed to differ depending on the magnitude of trade-flow between markets. Traub et al. (2010) confirmed co-integration between prices in South Africa and Mozambique under a high import regime, but no evidence of a long run price relationship in a low import regime. Conversely, Myers and Jayne (2012) found evidence of price transmission from South Africa to Zambia during periods of low imports, but no transmission during periods of high imports (typically when government is heavily involved in importation). Therefore, they concluded that government imports sold at subsidised prices effectively break the price-link with the South African market.

The focus on the impact of policies on price transmission patterns was extended by Burke and Myers (2014), who evaluated price transmission patterns between markets where informal trade dominates. This provides an environment of largely unregulated trade-flow and long-run price equilibrium was found to be consistent with competitive trade patterns and price transmission rapid. The combined findings of Myers and Jayne (2012), as well as Burke and Myers (2014) suggest that government involvement in markets does have a significant impact on efficiency, but given that the studies consider different markets, multiple other factors can also contribute to the findings. Whilst linked to trade volumes, the different regimes were not explicitly linked to direct policy interventions. Both suggest, however, that trade-flows are an important consideration in evaluating price transmission between markets.

In evaluating the efficiency of price transmission between different markets in southern Africa under different regimes specified as periods of trade restrictions and periods of open trade, this study aims to quantify the impact of export controls on the long run relationship between maize prices in Zambia, Zimbabwe and South Africa. Zambia has become an increasingly consistent surplus producer in recent years, but has also shown a tendency to impose export controls. While its favourable transport differential and non-GM status has made Zambia the preferred supplier to Zimbabwe in recent years, South Africa has stepped in when (a) its prices were more favourable or (b) Zambian exports were controlled (Figure 1). These three markets therefore provide an ideal platform to test the hypothesis that (a) Zimbabwean prices are derived from Zambian prices during periods of open trade, but from South African prices when Zambian exports are restricted and (b) that price transmission is more rapid and efficient under an open trade regime.

In its use of monthly data from January 2005 to October 2016, this study applies more recent data than that of Myers and Jayne (2012), which was based on a price series ending in 2009. Notably, this implies that the analysis includes the period following Zambia's emergence as a surplus producer, which was still excluded from the earlier work by Myers and Jayne (2012). The paper is structured as follows: This introduction is followed by a brief contextual overview of maize markets in southern Africa, a description of the data and methodology used, a description of the empirical results and concluding remarks.

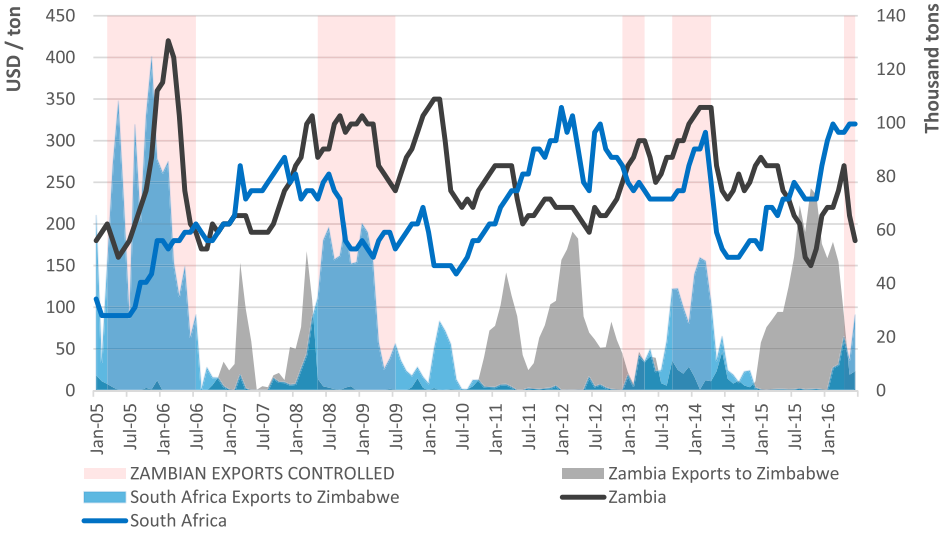

Figure 1. Zimbabwean maize imports from Zambia and South Africa, with relative wholesale prices in Randfontein and Lusaka and export control periods in Zambia. Source: ITC Trademap (2016), FAO GIEWS (2016), Davids et al. (2016).

2. Overview of the southern African maize market

Southern African maize production has expanded swiftly over the past 10 years and notwithstanding the drought conditions experienced in 2015, which led to a marked reduction in the regional crop, aggregate production from South Africa, Zambia, Zimbabwe, Malawi and Mozambique has increased by an annual average of 3.4 per cent[1] p.a. since 2000 (Figure 2). More than 60 per cent of total production between 2013 and 2015 is attributed to South Africa, which remains the single largest producer in the region. Rapid growth has, however, also been recorded in Zambia and Malawi, where maize production expanded by 10.2 per cent p.a. and 5.9 per cent p.a. respectively. Growth in these countries is attributed to both area expansion and significant improvements in yield levels (Mason *et al*., 2011; Burke *et al*., 2010). Total consumption across the five countries has also expanded by an annual average of 3.1 per cent, supported by a growing population and rising income levels (Figure 2).

At aggregate level, production growth has exceeded that of consumption and as a result, net exports from the region have expanded significantly. In fact prior to the 2015 drought, total exports from the five countries exceeded imports every year from 2008 to 2014 (Figure 3). In addition to total trade, significant shifts have also occurred at individual country level. South Africa is still the largest and most consistent maize exporter in the region, but in Zambia, production growth has exceeded demand and having been in a net importing position in the early 2000's, it has become a reasonably consistent exporter since 2007 (Figure 3). Export controls aimed at ensuring availability and reducing price volatility have affected the consistency of exports through periods of 2008–2009 and 2013–2014. In Mozambique, maize markets are very regional in nature; the southern region is typically in deficit and dependant on South African imports, whereas the Central and Northern regions such as Beira and Nampula often produce a surplus. High costs of transportation have been shown to inhibit maize trade between the Northern surplus regions to the deficit markets in the South (Tostao & Brorsen, 2005), resulting in a net import position at national level. Malawi has traded closer to self-sufficiency, often switching between net imports and net exports based on weather conditions. Whilst co-integration with global markets is accepted as infrequent, the prevalence of intra-regional trade suggests that the extent of market integration within the region is higher (Davids et al., 2016).

The shift in Zambia's position to a fairly consistent net exporter in recent years is important in that its role in terms of price formation in the region has changed. The size of its crop often determines the extent of the regions surplus and its non-GM maize is preferred in the region to the alternative, mostly GM maize produced in South Africa. Particularly in the Zimbabwean and Malawi markets, it

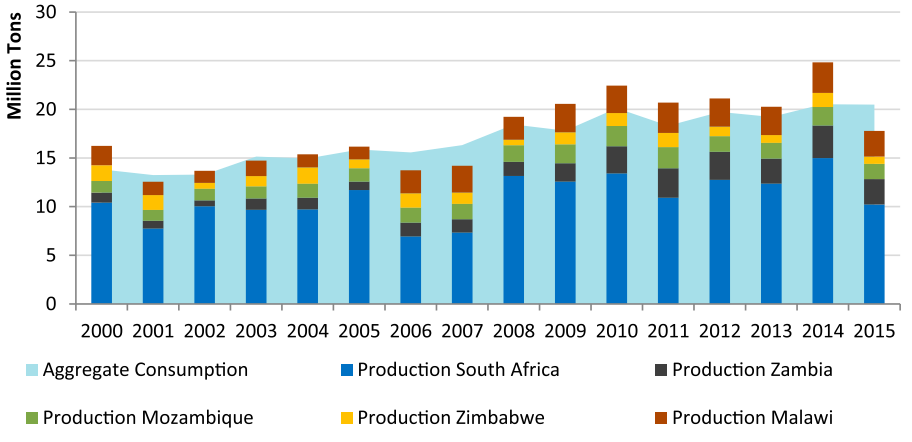

Figure 2. Production and consumption of maize in five countries in southern Africa. Source: ReNAPRI (2015), Davids et al. (2016).

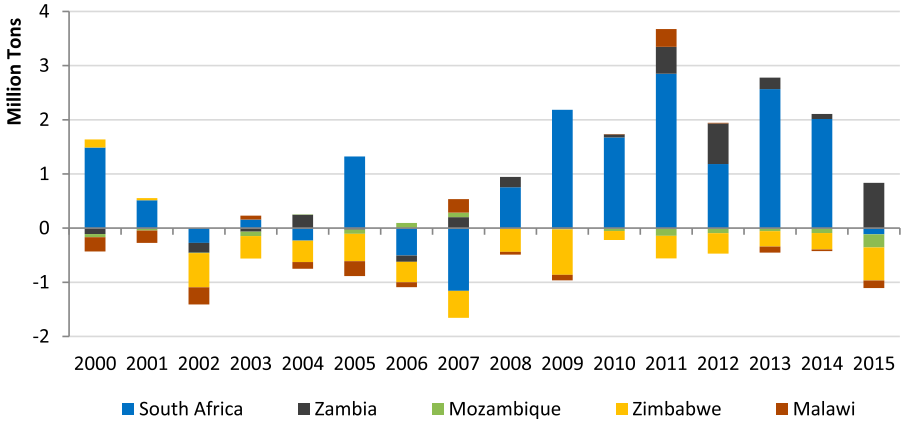

Figure 3. Net trade for maize in five countries in southern Africa. Source: ITC (2016) and FEWSNET (2015), Davids et al. (2016).

also has a favourable transport differential and hence it tends to supply these markets under normal trade conditions. At the same time, the tendency to control trade volumes during times of perceived shortage has forced these key importers to look elsewhere from time to time (Figure 1). Such inconsistent trade flow could, however, also result in inconsistent price transmission in the region.

3. Data and Methodology

The concept of co-integration and price transmission is underpinned by the Law of One Price (LOP), which states that, in the absence of trade restrictions, uniform products in an efficient market have only one price when accounting for transportation costs (Isard, 1977). The LOP holds on the condition of spatial arbitrage, which indicates that if two identical goods have different prices in different locations, the higher prices will attract arbitrageurs to take advantage of the existing profits, to the point where prices equalise across the different locations. Thus, despite deviations in short run price movements, long run prices will be the same across regions after accounting for transportation costs. In practice, researchers have recognised that the strong assumptions associated with the LOP, as well as difficulties in measuring total transportation costs result in empirical tests rarely supporting it fully and instead have focused on testing for co-integration – a long run relationship between prices for a single product in different markets.

Price transmission analysis is often used to evaluate the extent to which prices are transmitted from one market to another (Myers & Jayne, 2012; Baquedano & Liefert, 2014). The essence of such analysis is to determine whether prices share a long run relationship, and if they do, to estimate this relationship, along with the dynamic process which leads the prices to return to this long run equilibrium following an external shock. Two principal approaches have been adopted:

1. The 2-step residual based test for co-integration first proposed by Engle and Granger (1987), or
2. The system based reduced rank regression proposed by Johansen (1991).

These approaches have been refined in recent years, resulting in multiple sophisticated methodologies to evaluate price transmission, but they remain based on the assumption that the underlying variables are integrated of order one, which must be established through pre-testing.

Noting the possible uncertainty associated with such pre-testing, Pesaran, Shin and Smith (2001) proposed an alternative methodology, which is applicable regardless of whether the underlying series are purely I(1), purely I(0) or mutually co-integrated. Combined with the autoregressive distributed lag model (ARDL), they developed a bounds test, which was found to be consistent on both I(1), I

(0) and a mix of I(1) and I(0) series. This methodology has the advantage of being able to employ an error correction estimation process, maintaining the ability to draw inference on long term relationships and short run dynamics, but also yield inference on the results regardless of the series underlying order of integration. These attributes have popularised it as an alternative methodology for price transmission analysis.

Preliminary tests conducted on the datasets used in this analysis to evaluate the time-series properties include the Augmented Dickey Fuller (ADF), Phillips Peron (PP) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests. The null hypothesis of both the ADF and PP test assume non-stationarity, whereas the KPSS test is based on the null hypothesis of stationarity. In light of the differences in design, the tests are good compliments and when the ADF and PP tests fail to reject the null hypothesis whilst the KPSS rejects it, strong evidence of the presence of a unit root can be assured. In many instances, however, the results from the ADF, PP and KPSS tests did not support each other, yielding somewhat inconclusive evidence related to the presence of a unit root. Results of the tests performed in levels and first difference form are provided in the Appendix. Given the nature of the results, this study proposes the use of an ARDL specification, combined with the bounds test proposed by Pesaran et al. (2001) enabling inference to be drawn regardless of the uncertainty associated with the unit root properties of the underlying data series.

The theoretical specification of the ARDL model can be presented as follows:

$$Y_t = c_0 + \ c_{1t} + \sum_{i=1}^{p} \emptyset_i Y_{t-i} + \sum_{i=0}^{q} \beta_i x_{t-i} + \mu_t$$

The variables x_t and Y_t are allowed to be I(1), I(0) or co-integrated. Re-parameterisation yields the error correction specification below:

$$\Delta y_t = c_0 + c_{1t} - \alpha(y_{t-1} - \theta_{x_t}) + \sum_{i=1}^{p-1} \omega_{yi} \Delta y_{t-i} + \sum_{i=0}^{q-1} \omega'_{xi} \Delta x_{t-i} + \mu_t$$

$\alpha = 1 - \sum_{j=1}^{p} \emptyset_i$ represents the speed of adjustment and the long run coefficient $\theta = \frac{\sum_{j=0}^{q} \beta_j}{\alpha}$.

The coefficient on the error correction term α gives an indication of the length of time required for a shock that causes dis-equilibrium to dissipate through the system. A negative coefficient confirms convergence back to equilibrium conditions following an external shock, while the magnitude of the coefficient is indicative of the time required to return to equilibrium and is used to calculate the half-life.

The analysis is based on secondary data of nominal white maize wholesale prices of monthly frequency from 2005 to 2016. In order to test for differences between open trade and trade controlled regimes, the series is divided exogenously into two regimes, based on periods of trade controls as imposed by the Zambian government. The sources of the relevant data as well as the summary statistics of the different regimes, is presented in Table 1.

Table 1. Summary statistics, source and time period of price data used in the analysis.

	Regime	Mean	Min	Max	CV	Source	Observations
Zambia: Lusaka	Open	236.56	150.00	350.00	17.93	FAO GIEWS	90
Zambia: Lusaka	Closed	274.42	160.00	420.00	22.38	FAO GIEWS	52
South Africa: Randfontein	Open	225.89	90.00	340.00	23.06	SAFEX	90
South Africa: Randfontein	Closed	208.65	90.00	320.00	31.43	SAFEX	52
Zimbabwe: Harare	Open	236.47	20.00	390.00	43.81	FAO GIEWS	90
Zimbabwe: Harare	Closed	295.26	60.00	860.00	60.74	FAO GIEWS	52

4. Empirical Results

The ARDL is estimated in error correction (ECM) form, using Stata software. Under each regime, the ARDL model is used to estimate the extent of price transmission between Zambia and Zimbabwe, as well as South Africa and Zimbabwe. The results from the open trade regime (Regime 1) are presented in Table 2, which shows the number of included lagged dependent variables, the short run adjustment coefficient and the half-life correction period. The trend specification was used only when significant.

In both instances, the negative coefficient on the short run adjustment parameter is indicative of an equilibrium correcting process. The long run parameter (θ) is, however, not significant when the South African price is used as independent variable. Application of the bounds test, results of which are presented in Table 3 and Table 4 and confirm a long run relationship between Zimbabwean and Zambian prices under this regime, as both the *t*-test and the *F*-test proposed by Pesaran *et al.* (1991), reject the null hypothesis of no relationship. Conversely, when the South African price is used as independent variable, both the *F*-test and the *t*-test accept the null hypothesis of no relationship.

The results obtained under the open trade scenario are in line with prior expectation and confirm a long run co-integrating relationship between prices in Zimbabwe and Zambia. The half-life correction period suggests that it takes 2.77 months for half of the disequilibrium caused by an exogenous shock to decimate through the system. Repeating the same tests on the alternative regime of trade controls (Regime 2) yields the results presented in Tables 5, 6 and 7. In this instance, the model is specified without a trend owing to its insignificance at conventional levels.

Under the restricted trade regime, the long run co-integration coefficient is no longer significant when Zambian prices are used as independent variable to estimate Zimbabwean prices. The short run adjustment coefficient remains significant, but the adjustment process is marginally slower than that of the open trade regime. This is reflected in a half-life of 3 months as opposed to 2.77 months for the open trade regime. The long run co-integration coefficient when Zimbabwean prices are estimated as a function of South African prices is also not significant at conventional levels, though it is worth noting that it would be significant at 15 per cent. The rate of adjustment presented by the short run adjustment coefficient is, however, faster with a calculated half-life of 2 months. In both instances, the short run adjustment coefficient remains indicative on a convergence towards equilibrium following a shock.

Table 2. Results of the ARDL model estimation in the open trade regime.

Dependent	Independent	Number of lagged dependant variables	Long run coefficient (θ)	Short run adjustment coefficient	Half-life	Trend
Zimbabwe: Harare	Zambia: Lusaka	0	1.03***	−0.25***	2.77	0.79***
Zimbabwe: Harare	South Africa: Randfontein	1	0.12	−0.16***	4.33	0.45*

Asterisks denote the level of significance (*10%, **5%, ***1%).

Table 3. Results of the Pesaran Shin Smith Bounds F test under an open trade regime.

			F-stat Bound (10%)			
Dependent	Independent	F-statistic	Lower	Upper	F-statistic decision	Implication
Zimbabwe: Harare	Zambia: Lusaka	6.77	5.59	6.26	Reject	Co-integration
Zimbabwe: Harare	South Africa: Randfontein	4.17	5.59	6.26	Accept	No co-integration

Table 4. Results of the Pesaran Shin Smith Bounds T test under an open trade regime.

			T-stat Bound			
Dependent	Independent	T-Statistic	Lower	Upper	T-statistic decision	Implication
Zimbabwe: Harare	Zambia: Lusaka	−3.67	−3.13	−3.40	Reject	Co-integration
Zimbabwe: Harare	South Africa: Randfontein	−2.77	−3.13	−3.40	Accept	No co-integration

Table 5. Results of the ARDL model estimation in the restricted trade regime.

Dependent	Independent	Number of lagged dependant variables	Long run coefficient (θ)	Short run adjustment coefficient	Half-life	Trend
Zimbabwe: Harare	Zambia: Lusaka	2	2.17	−0.23**	3.01	N/A
Zimbabwe: Harare	South Africa: Randfontein	0	1.35	−0.34***	2.04	N/A

Asterisks denote the level of significance (*10%, **5%, ***1%).

Table 6. Results of the Pesaran Shin Smith Bounds F test under a restricted trade regime.

			F-stat Bound (10%)			
Dependent	Independent	F-statistic	Lower	Upper	F-statistic decision	Implication
Zimbabwe: Harare	Zambia: Lusaka	3.54	4.04	4.78	Accept	No co-integration
Zimbabwe: Harare	South Africa: Randfontein	5.35	4.04	4.78	Reject	Co-integration

Table 7. Results of the Pesaran Shin Smith Bounds T test under an open trade regime.

			T-stat Bound			
Dependent	Independent	T-statistic	Lower	Upper	T-statistic decision	Implication
Zimbabwe: Harare	Zambia: Lusaka	−2.52	−2.57	−2.91	Accept	No co-integration
Zimbabwe: Harare	South Africa: Randfontein	−3.25	−2.57	−2.91	Reject	Co-integration

The results from the bounds tests presented by Pesaran et al. (2001) are presented in Tables 6 and 7. These results suggest that contrary to the open trade regime, Zimbabwe and Zambian prices are no longer co-integrated under the controlled trade regime. Instead, co-integration is found between Zimbabwean and South African prices under the controlled trade regime.

The findings from the bounds tests conducted under both the open and controlled trade regimes are significant in that they point to the influence that discretionary trade policies from government can have on the efficient operation of markets. Though multiple authors have found that trade-flow is not necessary for price transmission between markets, findings suggest that price transmission patterns are influenced by policies that inhibit trade.

5. Concluding Remarks

Maize is a critical food staple in the southern African region. Due to its connotations with food security, governments have shown a tendency to implement trade controls aimed at stabilising prices at tolerable levels. Such discretionary trade policies could, however, hamper market efficiency, but the extent to which they influence price transmission patterns between different markets in the region has not been sufficiently explored. Thus the purpose of this study was to evaluate the impact of such trade controls on long and short term price relationships between Zambia, Zimbabwe and South Africa. More specifically, the study aimed to test for the presence of a long-term relationship between prices in Zambia and Zimbabwe, as well as South Africa and Zimbabwe and if this relationship, as well as the rate of price transmission between the relevant markets changes under different, policy based regimes.

Methodology is based on the application of an ARDL model, combined with the bounds test of Pesaran et al. (2001), which allows inference on long run relationship between prices, as well as the short run equilibrium correcting process, regardless of the order of integration in the underlying series. Monthly prices were separated exogenously into two different regimes based on periods of open trade and the implementation of trade controls in Zambia, which allows comparison of price transmission under each regime.

Results indicate that, under an open trade regime, a long run relationship exists between Zimbabwean and Zambian prices, but not between South African and Zimbabwean prices. Furthermore, price

transmission from Zambia to Zimbabwe was found to be fairly efficient, with a half-life of 2.77 months. Conversely, under a trade controlled scenario, no long run relationship was evident between Zambian and Zimbabwean prices, but instead a relationship was found between South Africa and Zimbabwe under this regime. Interestingly, price transmission from South Africa to Zimbabwe under periods when Zambia imposed export controls was found to be more efficient than that between Zambia and Zimbabwe under periods of open trade. A possible reason could be that most trade from South Africa to Zimbabwe occur through the private sector, whereas a large share of trade from Zambia to Zimbabwe often occurs through the government's food reserve agency. Transmission from Zambia to Zimbabwe was, however, found to be faster under an open trade regime.

The study considered only price relationships, implying that transaction costs are assumed at a fixed proportion of prices. Nonetheless, findings remain important from a policy perspective, as they suggest that discretionary application of trade policies impact market linkages and efficiency of price transmission within the region. Whilst multiple authors have noted that trade is not necessary for prices to be transmitted from one market to another, findings suggest that policies that inhibit trade periodically do indeed influence price transmission patterns.

Note

1. Growth rate calculated using the least squares method.

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Appendix

Table 8. Results of stationarity tests in levels.

		Test statistics			
	Model	ADF	PP	KPSS	
Regime 1: Open trade					
South Africa: SAFEX Randfontein	Drift	−2.73*	−2.53	0.20	Inconclusive
	Trend	−2.68	−2.55	0.08	Inconclusive
Zambia: Lusaka	Drift	−3.06**	−2.77*	0.13	Stationary
	Trend	−3.06	−2.74	0.13*	Non-stationary
Zimbabwe: Harare	Drift	−1.45	−1.36	1.0***	Non-stationary
	Trend	−2.46	−2.57	0.24***	Non-stationary
Regime 2: Trade controls					
South Africa: SAFEX Randfontein	Drift	−1.84	−1.85	0.79***	Non-stationary
	Trend	−2.21	−2.57	0.08	Inconclusive
Zambia: Lusaka	Drift	−3.62***	−2.61*	0.12	Stationary
	Trend	−3.48*	−2.51	0.12	Inconclusive
Zimbabwe: Harare	Drift	−1.83	−2.65*	0.49**	Inconclusive
	Trend	−1.90	−3.27*	0.15**	Inconclusive

Notes: Asterisks denote the level of significance (*10%, **5%, ***1%). The 5% and 10% critical values for ADF and PP tests with a drift are −2.90 and −2.59 respectively; for the tests with a drift and a trend are −3.46 and −3.16 respectively. Critical values were obtained from MacKinnon (1991). The 5% and 10% critical values for the KPSS test in levels are 0.463 and 0.347 respectively; for the KPSS tests with a trend they are 0.146 and 0.119 respectively.

Table 9. Results of stationarity tests in first difference.

		Test statistics			
	Model	ADF	PP	KPSS	
Open trade regime "Open"					
South Africa: SAFEX Randfontein	Drift	−10.20***	−10.19***	0.10	Stationary
	Trend	−10.16***	−10.14***	0.09	Stationary
Zambia: Lusaka	Drift	−6.23***	−7.66***	0.06	Stationary
	Trend	−6.23***	−7.62***	0.04	Stationary
Zimbabwe: Harare	Drift	−10.34***	−10.52***	0.06	Stationary
	Trend	−10.28***	−10.45***	0.06	Stationary
Export control regime "Closed"					
South Africa: SAFEX Randfontein	Drift	−7.99***	−7.99***	0.11	Stationary
	Trend	−8.02***	−9.03***	0.06	Stationary
Zambia: Lusaka	Drift	−3.84***	−4.32***	0.08	Stationary
	Trend	−3.90***	−4.28***	0.03	Stationary
Zimbabwe: Harare	Drift	−6.87***	−10.56***	0.07	Stationary
	Trend	−6.83***	−10.50***	0.05	Stationary

Notes: Asterisks denote the level of significance (*10%, **5%, ***1%). The 5% and 10% critical values for ADF and PP tests with a drift are −2.90 and −2.59 respectively; for the tests with a drift and a trend are −3.46 and −3.16 respectively. Critical values were obtained from MacKinnon (1991). The 5% and 10% critical values for the KPSS test in levels are 0.463 and 0.347 respectively; for the KPSS tests with a trend they are 0.146 and 0.119 respectively.