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# The effect of drought on consumer welfare

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*South Africa is characterised by frequent drought periods with 2015 receiving the lowest annual average rainfall of 403mm since 1904. This has a negative impact on physical agricultural production with maize being the most affected by the recent 2015 drought. The effect of drought on maize production also influences its price formation along the maize marketing chain. This paper with the use of Cointegration and Error Correction Model (ECM) attempts to estimate the effects of drought on price formation in the white maize marketing chain. Maize meal is a staple food for most South Africans and it constitutes a large share of consumer's expenditure on food, particularly poor consumers. The study found that drought plays a significant role in the price formation of the white maize marketing chain. During a drought period, any price changes from the producers are transmitted faster than a recovery period. However, during the latter period, any cost savings from the producer price are not passed onto the consumers. This results in consumers paying more for maize meal during a recovery period when prices are expected to decline, with poor consumers being affected the most.*

*JEL Classification: D11, Q13, Q54*

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## 1. Introduction

Drought is one of the prevailing climate change challenges facing sustainable development and economic growth across the African continent. According to the Economic Commision for Africa (ECA), (2007), the African continent has experienced a high frequency and severity of drought. Since 1900, Africa recorded 291 drought events, which account for 45% of global reported drought events (Masih, Maskey, Mussa, & Trambauer, 2014). Given the advent of climate change, the continent is expected to become hotter and drier with drought also expected to be more frequent across Southern Africa (Stringer, Dyer, Reed, Doughill, Twyman and Mkwambisi (2009).

South African long term annual average rainfall for periods between 1970 and 2015 was approximately 600 mm (Weather SA, 2016). Thus drought is a recurring phenomenon in South Africa with a record of approximately 23 years where rainfall was below a long term annual average since 1970. According to Weather SA (2016) in 2015, South African rainfall was at its lowest annual average of 403mm since 1904.

Climate anomalies such as drought have an impact on commodity production and price changes (Ubilava, 2014). The recent drought in South Africa has had an initial negative physical impact on primary agricultural production (AgriSA, 2016) and led to food price hikes. A decline in rainfall led to approximately 30% of total hectors damaged in the summer

of 2015 (Willemse, Strydom, & Venter, 2015) particularly in white maize production areas (African Centre of Biodiveristy, 2016). Between 2014 and 2015 there was a decline in annual average rainfall from 581 mm to 403 mm (30% decline) which can be related to a 28% decline in South African maize production. Basic food staples were most affected by drought (Bereau of Food and Agricultural Policy, 2016), however maize was severely impacted by the recent drought in comparison to other agricultural products (AgriSA, 2016). South African white maize market is vulnerable to drought effects given that 83% of the country's white maize is produced under dry land (AgriSA, 2016).

Data from DAFF (2016) shows that commodity and retail price movement respond differently during drought and recovery period. Commodity prices on average show an upwards price trend during a drought period. This is expected as drought leads to a decline in production and therefore an increase in prices. During a recovery period, increases in national annual average rainfall lead to increases in commodity production and subsequently price decline. Therefore, commodity prices respond as expected according to the market forces (Mohr & Fourie, 2008). Data from DAFF (2016) also highlight that retail prices show periods where the response is contrary to market forces in a competitive market. Recovery periods are characterised by increases in retail prices than during drought periods, suggesting the presence of asymmetric price transmission influenced by drought episodes.

Food price fluctuation caused by repeated drought incidences are not fully transmitted to consumers (Ubilava, 2014). This is more particular for cost savings from producer point of the value chain, while price increases are transmitted faster. Asymmetric price responses result in welfare losses due to basic food items remaining at high level than necessary i.e. prices remaining higher during a recovery period when they are expected to decline. High prices of basic food items affect poor consumers who spend approximately 33% of their income on food as compared to 10% spent by the non-poor consumers (StatsSA, 2017),(BFAP, 2016) (ACB, 2016). Poor consumers do not have adequate resources to deal with price increases (ECA, 2007). This implies that they will spend a large share of their income on food while sacrificing non-food items making them worse off in comparison to a drought period. This study will focus on the maize and maize meal prices as the expenditure (32%) of poor consumers who account for 55% of the population is dominated by staple foods (BFAP, 2016).

## 2. Literature Review

### 2.1. Drought

Variability in rainfall and its timing are some of the characteristics of regional climate change and these have been increasing over the last 50 years. Hence drought has become a topic of interest to researchers and policy makers, particularly its history, frequency and impact on different economies (Wilhite & Glantz, 1985). Meterological definitions of drought are specific to a particular place with the use of a threshold differentiating drought periods from non-drought periods. ECA (2007) used annual rainfall average to define drought as a

condition wherein annual rainfall of that region for an observed period, such as a season, a year or several years is below the long term annual average.

Primary impact of drought is seen through the reduction of agricultural production with vast secondary effects given the connectedness of the agricultural sector with other sectors of an economy. Drought takes place for a particular period, however its effects on a society lingers for a longer period. Thus, drought cannot only be viewed from a meteorological perspective, societal effects are also very important.

Drought takes place for a particular period leaving some immediate impacts while others will be transmitted long after the drought period. The impacts of drought largely depend upon a society's vulnerability to drought (Wilhite & Glantz, 1985). Thus, economies whose agricultural sector contributes a large share into the Gross Domestic Product (GDP) will be more affected by drought than developed economies, which have a relatively smaller agricultural GDP share. Drought periods are usually followed by negative physical impact on agricultural production (Benson & Clay, 1998), this immediate impact is however translated to other section of an agro-system or an economy as shown in **figure 1.**

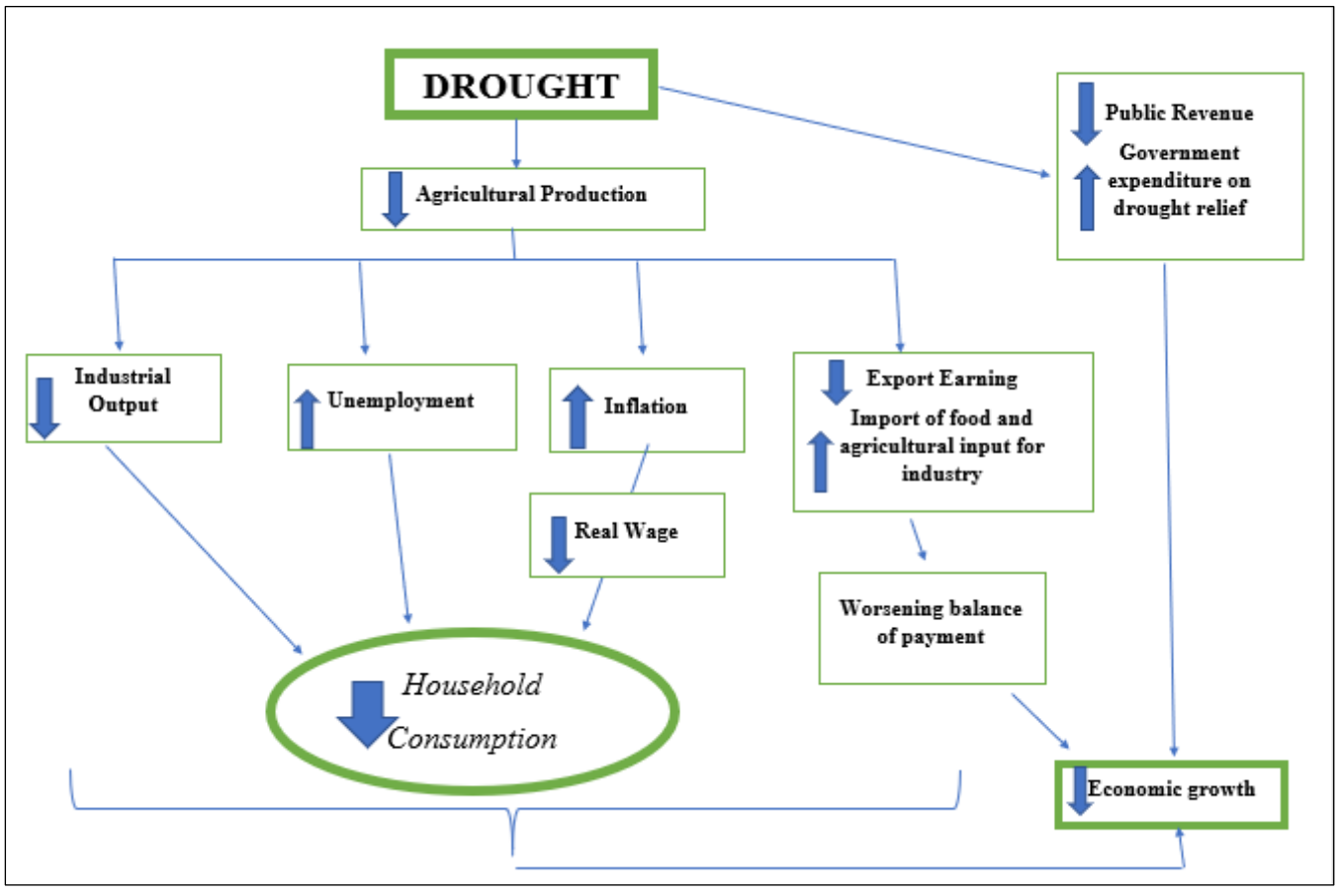


**Figure 1: Transmission of drought shock**
Source: Adapted from AgriSA (2016)

As highlighted in **figure 1,** drought periods are associated with low agricultural production. A decline in agricultural productions implies that a country needs to rely on import so as to

meet its domestic demand while it loses on export earnings. In addition, a decline in agricultural production leads to higher food prices and subsequently a decline in real income. High food inflation rates impact on poor consumers more than the affluent thus worsening income inequality. Also, poor consumers do not have adequate resources to meet their food shortages, thus leading to food insecurity. Drought also has a negative impact on agricultural employment, exacerbating poverty. All these factors shrink the agricultural sector's contribution to the GDP along with other industries which depend on agriculture for raw material and this undermines economic development **(see figure 1)**. The impacts of drought show that interaction between drought shocks and the economy are complex instead of direct and straightforward (Benson & Clay, 1998).

### 2.2. Drought in South Africa

South Africa is a semi-arid to arid country with constrained fresh water resources (Water Research Commission., 2015). Limits in the water resource are further affected by climate variability and change. When a country experiences highly variable climate and extreme weather changes, drought then becomes a recurrent characteristic feature. South Africa is prone to recurrent droughts due to its long term annual rainfall averaging at approximately 600 mm (Weather SA, 2016). This is an average value for the periods between 1904 and 2015. Thus, in the South African context, drought is defined as any period where annual average rainfall is below 600 mm. South Africa also goes through periods where there is more rainfall above the normal average and periods where it receives below normal average rainfall, these drought events are known as the La Nina and El Nino respectively.

Historical South Africa annual average rainfall for periods between 1970–2015 is highlighted in **figure 2.** During this time, South Africa has a record of 25 years wherein rainfall was below the normal average since 1970. **Figure 2** also shows that over the years, drought has become more frequent. Between 1970 and 1992, South Africa recorded 11 years of drought as compared to 14 years observed between 1993 and 2015. Also, in the latter period, there were 2 occurrences where annual rainfall was below 600 mm for four consecutive years i.e. 2002-2005 and 2012-2015. While between 1970 and 1992, South Africa recorded only 1 period of 3 consecutive drought years.

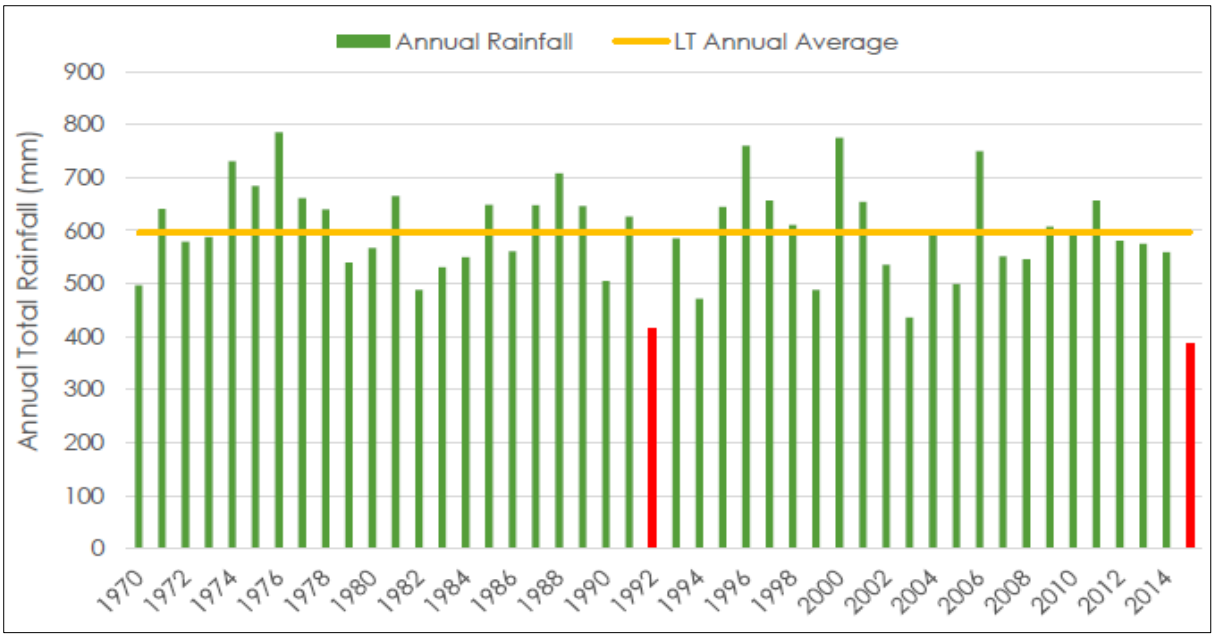


**Figure 2: South African long term annual average rainfall**
Source: Weather SA (2015) and BFAP (2015)

Between 1991 and 1992, South Africa experienced an El Nino induced drought which was regarded as the worst in the 20th century. Weather SA (2016) stated that in 2015, South Africa received its lowest annual average rainfall of 403mm since 1904 making it worse than the 1991 and 1992 drought period. Its impact started in the Western Cape and Kwa-Zulu Natal regions in winter then escalated in November and December towards the inland provinces (BFAP, 2016). The impact of this drought was felt through agriculture and through the reduction in the water supply and water quality. The agricultural sector is not only affected by drought, but it also affects other sectors of the economy through its agricultural linkages (Pretorius & Smal, 2012).

## 2.3. South African Consumers

This section gives an overview on poor consumers in South Africa and their food consumption patterns in comparison to non-poor consumers. As highlighted in **figure 3** the majority of South Africans are poor, even though the figure has decline in comparison to 2006. According to StatsSA (2017) using 2015 prices the poor are those who earn below an average of R992 Per person per month (pppm). StatsSA (2017) attributes the decline in poverty to government social grants, which are increasingly becoming a source of income for poor households.

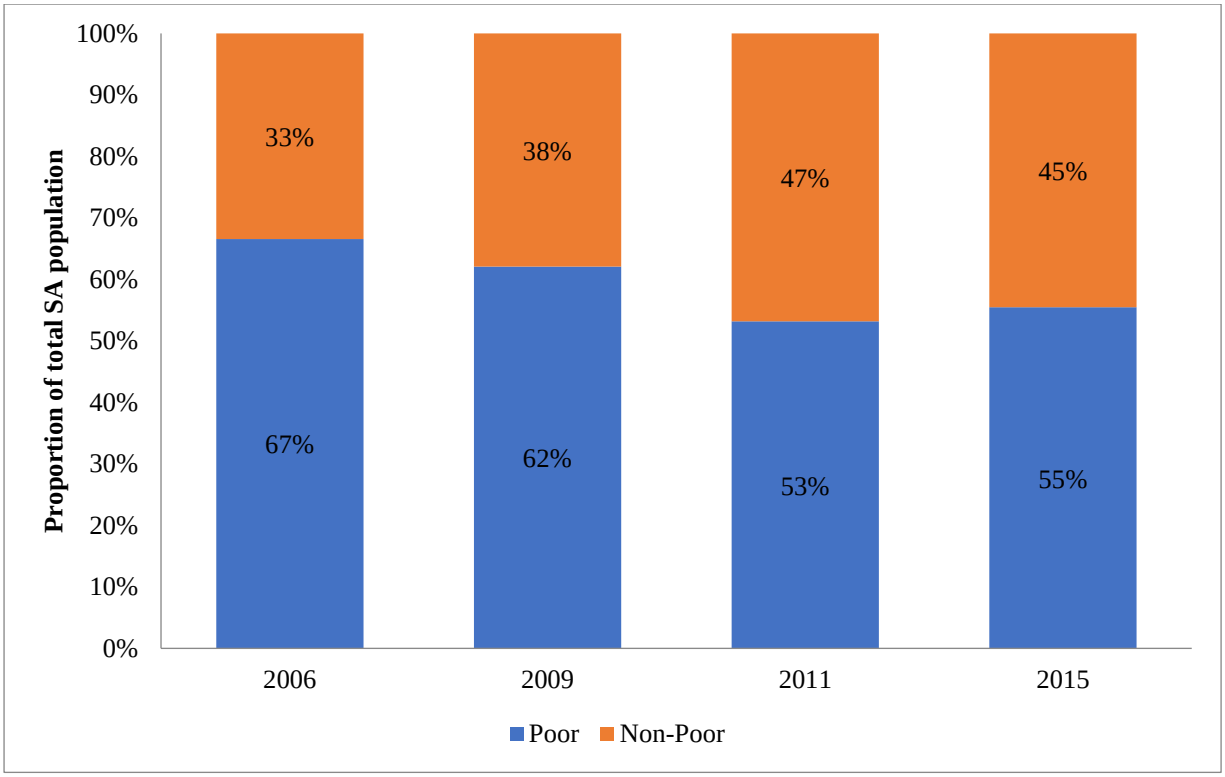


**Figure 3: Proportion of poor and non-poor South African persons**
*Source: StatsSA (2017)*

StatsSA (2017) uses three poverty lines to capture the degrees of poverty in the country. These poverty groups are known as the food poverty line (FPL), lower bound poverty line (LBPL) and upper bound poverty line (UBPL). The food poverty line indicates households which are unable to purchase adequate food to meet their minimum daily energy requirement. The remaining poverty groups use FPL as a base and also consider non food items. Therefore lower bound poverty line households do not have purchasing power to buy both adequate food and non-food items. Therefore, some households sacrifice food items to purchase essential non-food items. Households which fall under the the upper bound poverty line are able to purchase both food and non food items.

**Figure 4** therefore highlights the proportion of poverty groups in South Africa. The majority of poor South Africans, approximately 13.8 million persons do not have adequate income to purchase adequate food items, earning an average of R441 pppm in 2015. Individuals whom fall within the LBPL decreased from 10.7 million persons in 2006 to R8.1 million persons in 2015, earning an average of R647 pppm. Approximately 8.5 millions poor South Africans fall under the UBPL, receiving an average income of R992 in 2015.

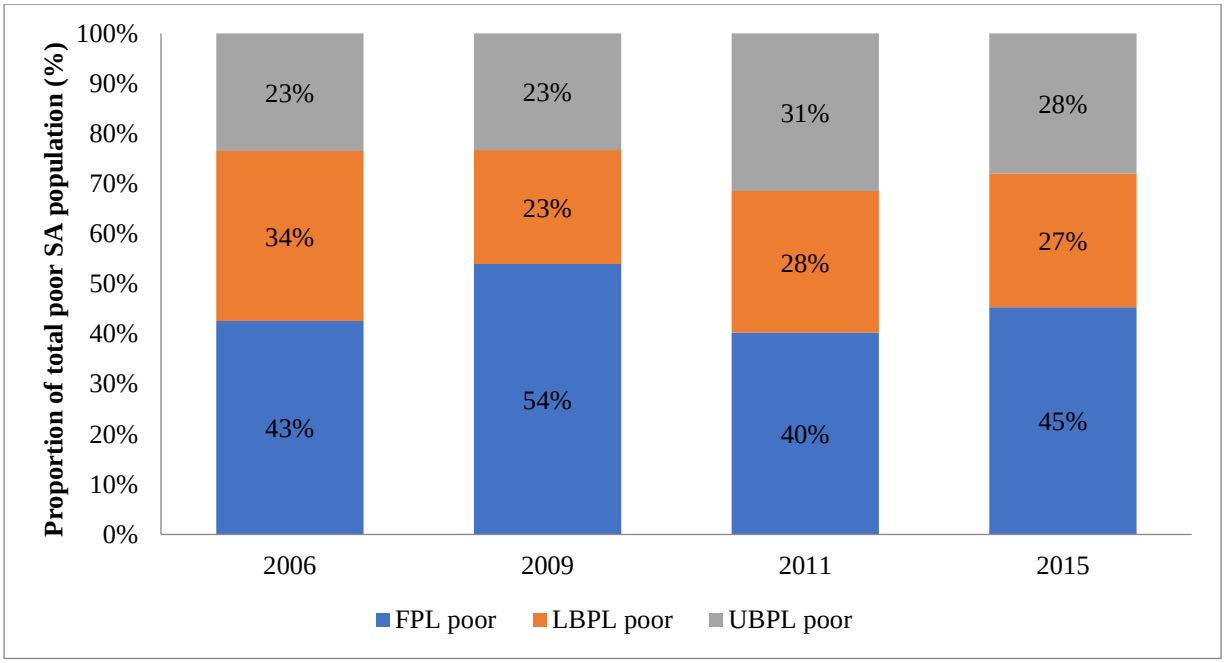


**Figure 4: Proportion of Poor South African persons**
*Source: StatsSA (2017)*

StatsSA (2017) highlight that between 2011 and 2015 due to the economic pressure that South Africa faced, more households were pulled into poverty. Also, the rapid change i.e.zig zag movements in the household poverty levels indicate the importance of policies directed at addressing food security challenges, especially when a country is faced with climate change and water shortage challenges (StatsSA, 2017).

Poor and non-poor South Africans have different expenditure trends as highlighted in **figure 5.** In 2015, poor households spent approximately 30% of their income on food, and this has increased by 7% since 2006. However, non poor households spend only approximately 10% of their income on food, and this has remained unchanged since 2006. Poor households spend the largest share of their income on bread and cereals (spending approximately 11% on maize meal), while non poor household spend a large share on meat and fish.

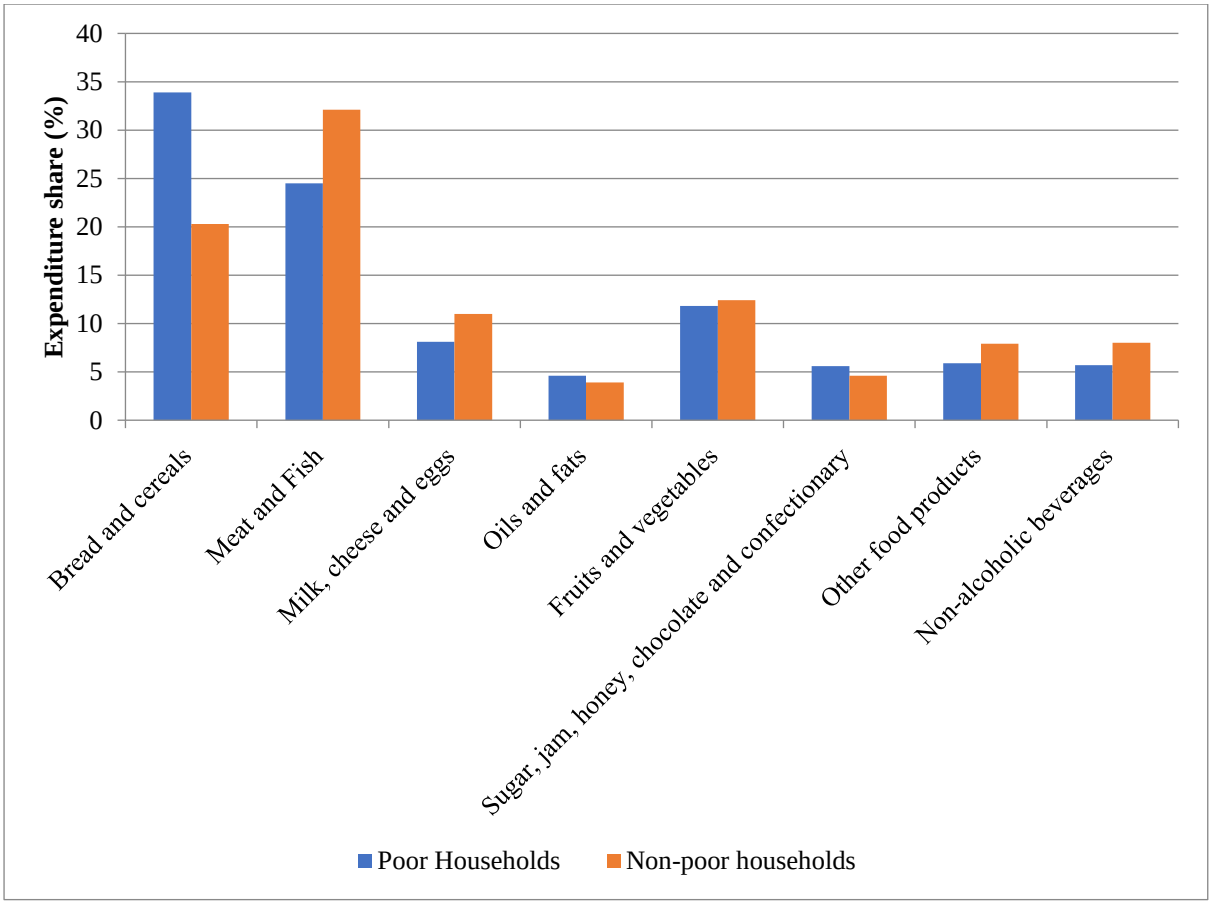


**Figure 5: Proportion of average spending on food items by poverty status**
*Source: StatsSA (2017)*

Maize meal ranks second on the list of food items that the poor spend their income on, after poultry (BFAP, 2016). It ranked third after poultry and beef for the upper middle class, while it ranked 13$^{th}$ for the wealthy 20%.

Further, **Table 1** highlights that maize meal is more important to poor households. This group comprises of approximately 55% of the South African adult population, with an income share of 32% (BFAP, 2016) (StatsSA, 2017).

**Table 1: Top three average proportion of expenditure on food by poverty status**

| **Poor Households** | **Non-Poor Households** |
|---|---|
| Poultry 13.8% (11.1%)* | Poultry 11.1% (13.8%) |
| Maize meal 11.3% (3.8%) | Beef 8.2% (3.6%) |
| Brown bread 8.1% (4.4%) | Other food products 7.1% (4.7%) |

*Source:* (StatsSA, 2017)
**Figures in parenthesis show the share of the other group i.e poor (non-poor)*

Poor households spend approximately 11% of their food expenditure on maize meal. This is a significantly high share in comparison to other cereals. Thus, any factors that cause a change in the price of maize meal, greatly affects poor consumers more than non-poor consumers.

## 3. Theoretical Framework

The theoretical framework of the study is represented in **figure 6.** The period before drought is an equilibrium point of the framework. Point A represents the equilibrium point, showing the level of food and nonfood prices before a drought period. At equilibrium, consumers are maximizing their utility as they are at the highest isoquant. It is assumed that at this point (A), a consumer can share income to purchase adequate both food and non-food items. An equilibrium period is then followed by a drought period, wherein prices of both food and non-food items increases. This causes a shift from point A to B. At point B, a consumer will share expenditure towards the same quantity of food items as in Point A. Based on the assumption of the study, consumers, and more particularly poor consumers will ensure that they purchase the same level of food items while sacrificing non-food items and spending less on non-food items. This price change and adjustment moves consumers for a higher indifference curve, $U_0$ to $U_1$, making them worse off in comparison to an equilibrium period.

After a drought period i.e. a recovery period, prices are expected to decline due to a higher crop yield. Consumers are expected to return to Point A, however due to the presence of asymmetric price transmission (Cutts & Kirsten, 2006) where "players with market power transmit slowly price changes that benefit them while transmitting faster price changes that are a cost to them" (Mabaya, 1998) prices do not return to their pre-drought level i.e. they move from point B to Point C. During a recovery period which is characterised by cost savings, prices may decrease because of the presence of an asymmeric price transmission. As a result, they may not return to the original budget line i.e. move from $Q_0$-$Q_1$ to $Q_0$-$Q_2$. Thus a consumer is still at a lower indifference curve, $U_2$ in comparison to the original indifference curve at $U_0$. Thus, when prices take longer in adjusting to equilibrium (i.e. returning to pre-drought conditions), the poor will remain much longer in the lower indifference curve with a reduced purchasing power. Price adjustment periods after a crisis particularly those triggered by farm price increases result in welfare losses for consumers, leaving them worse off.

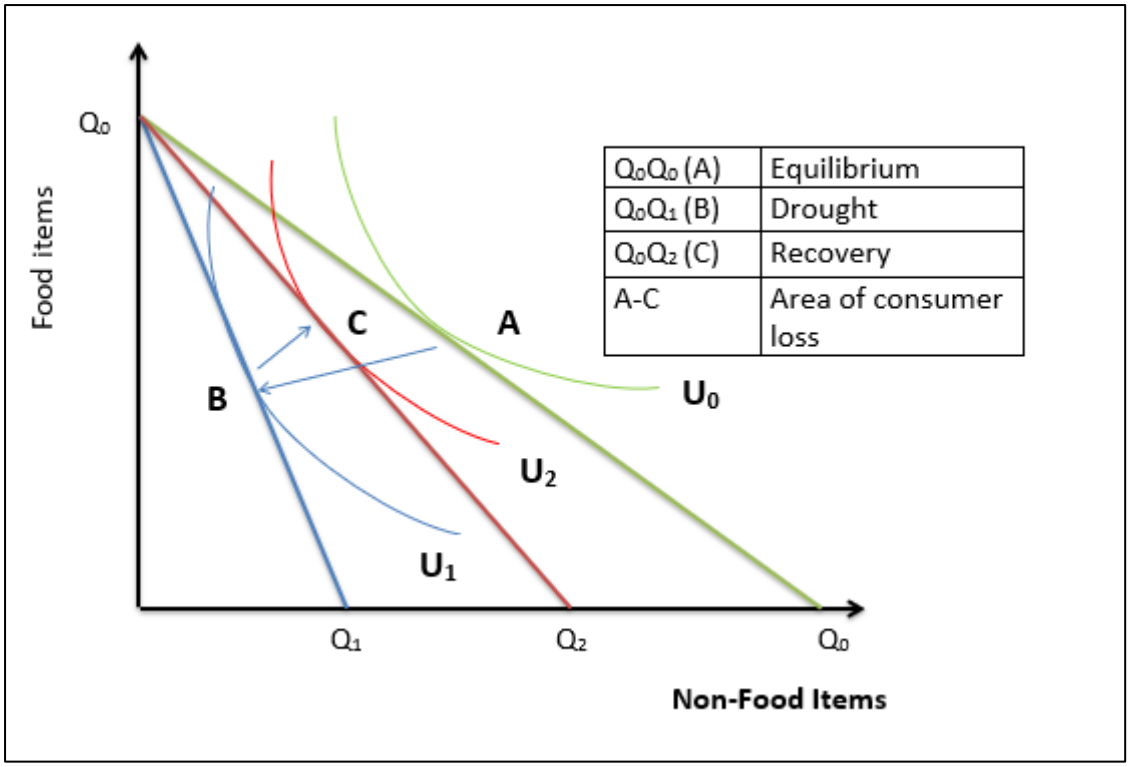


**Figure 6: The Impact of price change during a drought and recovery period and the derivation of the demand curve**

Changes in consumer spending due to asymmetric price transmission are summarised in Table 2.

**Table 2: Change effect of price change during equilibrium and adjustment period**

| | Equilibrium | Drought period | Recovery Period | Net Effects |
|---|---|---|---|---|
| Budget Line | $Q_0$-$Q_0$ | $Q_0$ $Q_1$ | $Q_0$ $Q_2$ | Money Income remains the same, however the consumers spend more of their income on food i.e same quantity of food items and reduced spending on non-food items. |
| Utility | $U_0$ | $U_1$ | $U_2$ | Consumer is at a lower indifference curve |

*Adapted from Mohr and Fourie (2008)*

For all the periods, pre-drought, drought and recovery, consumers, particularly poor consumer's income remains unchanged. Thus, inflation would require them to adjust their expenditure patterns. For this study framework, a net effect of drought is that a consumer will shift from spending income on more non-food items to purchasing more food items. Also, drought leaves consumers at a lower utility.

## 4. Methodology

### 4.1. Data sources

This study used monthly white maize and maize meal prices from January 2008 until December 2015. White maize prices were sourced from the South African Futures Exchange (SAFEX) and maize meal prices were sourced from Statistics South Africa (StatsSA). White

Maize meal were originally sourced as daily prices and averaged to monthly values. White maize prices were averaged to monthly prices from weekly averages. Prices for 2.5kg maize meal were used due to the availability of the data for the analyzed period in comparison to other quantities i.e.10kg, 12.5kg that most poor households are most likely to purchase. Using data from Weather SA(2016) dummy variables were used to separate drought from recovery period as follows;

D=1 if annual average rainfall is below 600mm and,

D=0 if annual average rainfall is above 600mm

### 4.2. Cointegration

Unit root tests, the order of integration is essential for cointegration tests. This ensures that regressed relationships of variables are integrated of the same order (Enders, 2010). After which, long run equilibrium relations for pair variables were estimated given:

**Equation 1:**

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t$$

Where $y_t$in the study is maize meal retails price, while $x_t$ is the Maize Safex price for the maize agro industry. While for the wheat agro industry $y_t$ represents wheat flour retails price, while $x_t$ is wheat SAFEX price. Given that pair variables are cointegrated, then an OLS regression yields consistent estimators of the cointegrated parameters; $\beta_0, \beta_1$. To further determine if the variables in equation are cointegrated, it was essential to denote the residual $\acute{\varepsilon}_t$ sequencing for equation which is the estimated residual series of the long run relationship.

ADF test was performed on the $\acute{\varepsilon}_t$ to test whether the residuals were stationary and to determine the order of integration. Thus given;

**Equation 2:**

$$\Delta\acute{\varepsilon}_t = a_1\acute{\varepsilon}_{t-1} + \epsilon_t$$

Where if $a_1$ = 0 then the conclusion is that the residual series does not contain a unit root, thus confirming that $y_t$and $x_t$ are cointegrated.

### 4.3. Error Correction Mechanism

According to Meyer and von Cramon-Taubadel (2002) **equation 3** is a translation of a supply response into a price transformation equation.

**Equation 3**

$$y_t = \beta_0 + \beta_1^+ D_t^+ x_t + \beta_1^- D_t^- x_t^+ + \varepsilon_t$$

$D_t^+$ and $D_t^-$ are dummy variables; where:

$D_t^+$ = 1 ; if $x_t \geq x_{t-1}$ and

$D_t^+$ = 0 if otherwise

$D_t^-$ = 1 ; if $x_t < x_{t-1}$ and

$D_t^-$ = 0 if otherwise

The use of dummy variable in **Equation 3** splits the retail price variable into two variables, wherein one caters for increasing commodity prices (SAFEX maize and wheat price) and the other for decreasing commodity prices. Also, two commodity price adjustments are estimated, with $\beta_1^+$representing increasing commodity prices phases and $\beta_1^-$representing decreasing commodity price phases. In a case where $\beta_1^+$and $\beta_1^-$ , asymmetric adjustment obtains when they are significantly different. A F-test was used to test this asymmetric adjustment.

The lagged commodity prices can also be split further leading to (Meyer & von Cramon-Taubadel, 2002):

**Equation 4**

$$\Delta y_t = \beta_0 + \sum_{j=1}^{k}\left(\beta_1^+ D_t^+ \Delta x_{t-j+1}\right) + \sum_{j=1}^{L}(\beta_1^- D_t^- \Delta x_{t-j+1}) + \varphi^+ ECT_{t-1}^+ + \varphi^- ECT_{t-1}^- + \gamma_t$$

Where the coefficient $\beta_0$measures the adjustment to deviation from the long run equation, and *K* and *L* are lag determined lag lengths. ECT is then segmented into $ECT^+$ (positive) and $ECT^+$ (negative) deviations from the long run (Meyer & von Cramon-Taubadel, 2002).

## 5. Results and discussion

### 5.1. Long Run Relationship Analysis

This section presents long run regression results of the respective retail and commodity regression results as summarized in Table 3. The author is unable to report on long run relationships variables due to the sampling distribution of non-stationarity data which are non-standard and thus asymptotic theory becomes violated. Long run regression was estimated to analyse the trend of their respective residuals.

**Table 3: Long run relationship analysis**

| Dependent Variable | Independent Variable | Coefficients |
|---|---|---|
| Maize Meal 2.5kg | White Maize (-2) | 0.26*** |
| | $R^2$ | 0.49 |
| | Adj $R^2$ | 0.49 |

*(**)[***] Statistical significant 10(5)[1]% level

To confirm long run relationship of the equation regressed in Table 4, the residual ought to be stationary. Two tests for stationarity were used namely, the Augmented Dickey Fuller and Phillips Perron. Both tests were significant and confirm the residuals are stationary.

**Table 4: Stationarity test of the long run regression residuals results**

| | τ, τμ and ττ | ADF | PP |
|---|---|---|---|
| Maize Meal – Maize residual | No Trend &intercept τ | -3.31*** | -3.11*** |
| | Intercept τμ | -3.29** | -3.09*** |
| | Trend and an intercept ττ | -4.33*** | -4.33*** |

*(**)[***] Statistical significant 10(5)[1]% level

We can thus conclude that there is a long run and equilibrium relationship between white maize and maize meal prices.

## 5.2. Short Run Relationship Analysis

The residuals of the long run relationship as mentioned in the methodology section are used as error correction terms in the estimation of short run relationships. The results of the short run relationship between farm and retail prices are summarised in table 5. The goodness of fit ($R^2$)of 0.16 indicates that approximately 16% of short run variation in maize meal prices is explained in the model. According to Capps and Sherwell (2007), a low magnitude of $R^2$may be largely due to the fact that the dependent variable corresponds to changes in the independent variable. Maize meal and maize prices have a positive relationship significant at a 5% level. This implies that any increase (decrease) in the white maize is followed by an increase (decrease) in maize meal prices. The results presented in Table 5 allow a distinguishing between price increases during a drought and a recovery period. The results suggest that the absolute values of ECTD+ are greater than ECTR-. This implies that price increases during a drought period are transmitted faster than price increases during a recovery period. An ECT of -1 means that 100% of disequilibrium is corrected completely in the same time period to price changes in white maize. Both ECTD+ and ECTR- show a slow rate of correcting disequilibrium. The difference in the two ECT suggests that rainfall levels play a significant role in asymmetric price transmission in the white maize industry.

**Table 5: Short run relationship results for price increases during drought and recovery periods**

| | Dependent Variable | Coefficients |
|---|---|---|
| D(Maize Meal 2.5kg) | D(Maize(-2)) | 0.07** |
| | ECTD+(-1) | -0.27*** |
| | ECTR+(-1) | -0.10* |
| | $R^2$ | 0.18 |
| | Adj $R^2$ | 0.17 |

*(**)[***] Statistical significant 10(5)[1]% level

Table 5:8 highlights results for price decreases during a drought and recovery period. ECTD- statistically suggesting that retail prices respond to deviations in the long run equilibrium parity. Following a decline of white maize prices in the long run, only 21% of error is corrected per month during a drought period. In absolute values, ECTD- is greater than that the ECTR-. This implies that cost savings during a drought period are passed more rapidly

than during a recovery period. However, ECTR- is not statistically different from zero, meaning that any cost savings triggered from white maize prices results in no significant changes in maize meal prices. A recovery period is characterised by a rapid decline of white maize prices, due to increased production volumes. However, these are not passed onto retail prices.

**Table 6: Short run relationship results for price decreases during the drought and recovery period**

| | Dependent Variable | Coefficients |
|---|---|---|
| D(Maize Meal 2.5kg) | D(Maize(-2)) | 0.06** |
| | ECTD-(-1) | -0.21*** |
| | ECTR-(-1) | -0.08 |
| | $R^2$ | 0.16 |
| | Adj $R^2$ | 0.15 |

*(**)[***] Statistical significant 10(5)[1]% level

The speed of adjustment for price changes for both periods indicate asymmetric price with regards to speed, as their values are closer to 0 than they are to -1. Slow price transmission also suggests that the white maize market is weakly integrated. The difference in price adjustment over the two periods suggest non-competitive markets that lead to market inefficiencies. There is price asymmetry in the white maize market due to the coefficients of the ECT not being equal. These findings are in line with those of Cutts and Kirsten (2006). Error Correction Terms are all negative, showing that the system returns back to equilibrium after triggered by an external shock (Davids, Schroeder, Meyer, & Chisanga, 2016). Their p-values are significant with the exception of the ECTD+, and according to Cutts and Kirsten (2006) this shows that maize meal prices do not react completely within one month to changes in white maize prices. The significance in the lag of the ECT may be due to the wholesale prices which are not captured in this study.

It is worth considering that response of retail prices to changes in farm prices is in most cases not instantaneous instead is distributed over time. According to Kinnucan and Forker (1987) some of the reasons for delayed response are;

- The food marketing industry functions with facilitation processes such as; storing, transportation and processing,
- There is a cost attached to repricing of products in retailers,
- The nature and sources of price data reporting and collection and
- Imperfection in the market such as; market structure diversification, information asymmetry and assimilation.

However, these responses should be almost equal regardless of the direction of price changes triggered from farm prices. Also, the delay in price adjustment should not only be to the favour of retailers, i.e. transmitting price increases completely and more rapidly than cost savings.

White maize price increases in both periods are transmitted faster than during a recovery period. Price decrease of white maize was transmitted faster during a recovery period than

during a drought period. It can thus be concluded that retailers react more rapidly to price changes during a recovery period. The results of the study suggest that South African rainfall levels contribute to the extent of asymmetric price transmission in the white maize industry. Given the foregoing, maize meal prices react differently during a drought and recovery period

### 5.3. The effects of drought on consumer welfare

The findings of the study are in line with the theoretical framework as discussed in section 3. The results suggest that rainfall levels in South Africa affects price formation along the white maize market. During a drought period, price changes are transmitted much quicker than during a recovery period, however during a recovery period cost savings are not transmitted to consumers. This implies that consumers are better off during a drought period than a recovery period even though (in the latter period) prices are expected to decline.

To further illustrate this, income levels of poor consumers and average maize meal prices were used and summarised as in **figure 7.** Between 2006 and 2015, during drought periods consumers spent lower shares of their income on maize meal in comparison to the recovery period. Poor consumers who fall within the FPL grouping spend approximately 0.6% more of their income to purchase maize meal during a recovery period, making them worse off in comparison to a drought period. Those who fall within the LBPL and UBPL spend approximately 0.25% and 0.14% more respectively on maize meal during a recovery period.

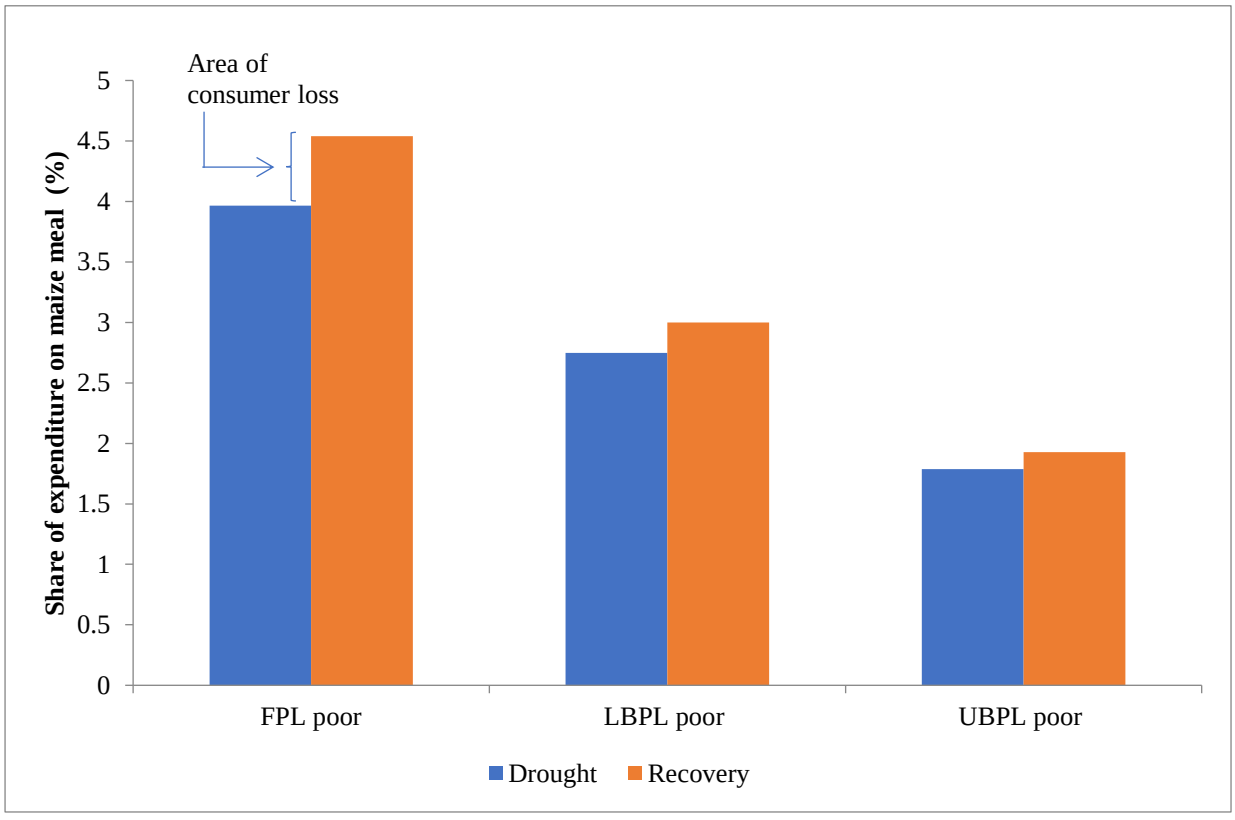


**Figure 7: Average expenditure share on maize meal by South African poor consumers: 2006-2015**
*Source: StatsSA (2017) and author's calculations*

The difference in the recovery and drought as plotted in **figure 7**, represents the area of consumer loss as consumers spend a larger share of their income on maize meal during a

recovery period. This difference only considered 2.5kg of maize meal. It is more likely that poor consumers purchase larger volumes of maize meal, i.e. 10kg or 12.5kg, therefore the area of consumer loss would be approximately four to five times larger for each poverty grouping when considering larger volumes of maize meal. Noteworthy is that, the poorer the consumers, the higher their share of expenditure on maize meal, also the higher their value of deadweight loss. Therefore, asymmetric price transmission resulting from drought results in consumer loss proportional to their income levels.

## 6. Conclusion

This study showed that drought is a recurring phenomenon in South Africa. Due to climate change it has become more frequent in recent years. As established, recurring drought periods cause disruptions in price formation along a value chain. While drought is an environmental phenomenon, policy analysts need to consider its effects on food security status of South African consumers, especially poor consumers as they constitute the majority. Also, consideration should not only be limited to a drought period but extended to how consumers adjust after such a period. This is of importance as this study found that during a recovery period, any cost savings from farm prices is not passed onto consumers, thus negatively affecting consumer welfare.

This study suggests that for any fiscal planning, especially for social welfare grant adjustments, consideration should be given to rainfall pattern projections before decisions are made. The study will also assist policy makers to consider coping strategies for poor households not only during a drought period but more especially after a drought period. This research recommends that possible non-competitive behaviour in the white maize market should be fully studied, understood and addressed. Also, wholesaler prices should be made available for public consumption and analysis to fully understand price formation transmission in the white maize market.

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