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MAIZE AND SOYBEANS MARKETS IN THE SOUTHERN AND EAST AFRICAN REGIONS: THE CASE FOR A REGIONAL MARKET OBSERVATORY[1]

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Abstract

The agricultural sector is vital to fostering economic growth, reducing poverty, and improving food security in the southern and East African regions. Agriculture is key to economic development because it supplies basic foods and raw materials and, on the other hand, agriculture is considered a key driver of structural transformation in Africa. However, many Southern and East African economies have poorly developed agricultural value chains. This is due to a number of reasons including poor infrastructure, inadequate support services, and weak institutions, which all contribute to driving up transaction costs. In addition, climate change places significant pressure on food systems and rural livelihoods. Climate change is an increasingly persistent threat to food security and means greater volatility in rainfall with more frequent droughts and floods anticipated, placing further pressure on producers. Improved intra-regional trade, in broader and deeper markets in SADC is, therefore, an essential part of mitigating the risks associated with climate change. Understanding the impacts on markets and where mitigating steps for climate change can best be taken requires reliable market information including on prices. This study collates and reviews information on prices of maize and soya in countries across the regions to consider the ways in which changing supply and demand factors, including climate phenomena such as the recent Cyclone Idai, have influenced prices. However, one of the key insights is how poor the pricing data currently is. Therefore, the assessment points to the importance of establishing a Market Observatory in Southern and East Africa. A Market Observatory would also assist in identifying key trends. These include opportunities for cross-border trade between Southern and East African economies, as well as border and transport problems, and possible anticompetitive behaviour.

JEL Codes: N57, O13, O18, Q18, Q54

Keywords: agriculture, regional value chains, food prices, food systems, climate change, Africa

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1. Introduction

The agricultural sector is vital to fostering economic growth, reducing poverty, and improving food security in the southern African region. On the one hand, agriculture is key to economic development because it supplies basic foods and raw materials and, on the other hand, agriculture is considered a key driver of structural transformation[2] in Africa (McMillan et al. 2017). It offers great potential for the reduction of poverty and inequality as well as being a source of productivity and provider of employment opportunities for a large percentage of the African population where skill levels are very low.[3] More than 70 percent of southern Africa's rural population depend of agriculture for their livelihoods.[4] Since 1980, agricultural production in Africa has increased very substantially (NEPAD, 2013). However, many African countries, and sub-Saharan Africa as a whole, remain net food importers, due to demand growth, despite their potential for greater production (Bosiu, et al., 2019).

The SADC Industrialisation Strategy Roadmap (2015 – 2063) recognises the importance of regional value chains as a tool in driving structural change and industrialisation. Yet, many Southern and East African economies have poorly developed agricultural value chains with weak factor markets (Christiaensen & Demery, 2018). This is due to a number of reasons including poor infrastructure, inadequate support services, and weak institutions, which all contribute to driving up transaction costs, hampering productivity growth, and leading to price volatility (World Bank, 2008).

In addition, climate change places significant pressure on food systems and rural livelihoods (FAO and ECA, 2018). Climate change means greater volatility in rainfall with more frequent droughts and floods anticipated, placing further pressure on producers. The impact of climate change means a regional approach to agricultural production and markets is even more important than it would be otherwise. Climate change also further complicates governance of food systems in many African economies and regions (Smit, 2016). While there is projected to be lower rainfall in the southern-most areas, there will continue to be abundant water in the SADC region as a whole. Moreover, when there is drought in El Nino years (such as 2015/16) in South Africa, southern Mozambique, Swaziland, Zimbabwe, Malawi, Botswana and Namibia, there are good rains in much of Zambia, northern Mozambique, DRC and Tanzania. Regional trade can therefore assist in meeting demand alongside improvements in climate resilient agriculture reducing the impact on consumers. If appropriate steps are not taken to improve agricultural production and markets across Southern and East Africa, then the already high levels of food insecurity will become even worse.

Improved intra-regional trade, in broader and deeper markets in SADC, is therefore an essential part of mitigating the risks associated with climate change. Nurturing these markets requires facilitating investments in irrigation, storage, transport, insurance, financing and price discovery. The success of wider and more integrated markets requires improved transport and logistics networks in order to reduce costs and integrate suppliers and consumers across a

[2] The process of structural transformation is the movement of factors of production to higher productivity and more complex activities (see, for example, McMillan, et al., 2017). Changes in overall output per worker can be due to improvements within sectors and shifts in factors of production (labour and capital) across sectors, from lower productivity to higher productivity activities (McMillan & Rodrik, 2011).
[3] https://www.farmingportal.co.za/index.php/farminglifestyle/agri-tourism/195-the-importance-of-agriculture
[4] https://www.usaid.gov/southern-africa-regional/agriculture-and-food-security

wider geographic area (Bosiu, et al., 2019). This will become increasingly important as the effects of climate change become more severe. In the absence of these changes, regional markets will work poorly meaning that negative price shocks will be magnified. This includes the potential for cartels in local markets to manipulate markets to exacerbate the effects of supply shocks.[5] Such developments place vulnerable consumers under even greater pressure as food prices increase sharply, and will impact negatively on downstream industries using agricultural commodities as key inputs, such as the poultry industry which relies on maize and soya as the key inputs to animal feed.

Understanding the impacts on markets, and where mitigating steps for climate change can be taken, requires market information including on prices. This study collates and reviews information on prices of maize and soya in countries across the region to consider the ways in which changing supply and demand factors have influenced prices. However, one of the key insights is how poor the pricing data currently is. We assess information on prices for Mozambique, Malawi, South Africa, Tanzania, Zambia and Zimbabwe. However, because of the poor quality of much of the data collected in the region, the analysis will look more deeply into the dynamics within Tanzania, Zambia and Malawi.

In Southern and East Africa, maize is regarded as the most important cereal and accounts for a substantial percentage of caloric intake in the region. Production of maize is therefore a key factor in terms of the region's food security. Maize production in most countries in the region aside from South Africa is due largely to large numbers of small-scale farmers. Soybeans are an attractive crop as they are an important source of protein and are commonly used in animal feed, for which demand is growing strongly as higher incomes boost demand for meat. The Southern and Eastern African region is well-suited to produce soybeans and, in recent years, production has expanded substantially, although there is still a large regional deficit in soybean and derivative products such as oilcake.

The assessment points to the importance of establishing a Market Observatory in Southern Africa (SAMO). This is even more pressing with the effects of climate change. Global temperatures have been increasing at unprecedented rates over the past 40 years. Adverse weather conditions have unpredictable negative macroeconomic effects and often result in lower levels of productivity both in terms of labour and crop yields (Acevedo, et al., 2018). As well as reflecting on the effects on prices of low rainfall periods, the paper investigates the effects of Tropical Cyclone Idai on the prices of different markets in Malawi.

The paper proceeds as follows: Section 2 presents challenges related to the existence of economic power within agricultural value chains. Section 3 discusses the methodology used in the colleciton of the data which forms part of the SAMO. Sections 4 and 5 reviews data on maize prices across and within countries. Section 6 analyses soybean prices. Section 7 concludes.

2. Market information and the rationale for a Market Observatory in Southern and East Africa

The poor availability of data on prices of staple foods at different levels of the food value chain in Africa is notwithstanding a number of attempts to collate and disseminate agricultural prices

[5] Research on competition cases in the southern African region suggests quite a strong tendency on the part of food producers to engage in anti-competitive conduct (Burke, et al., 2013; Roberts, et al., 2017).

internationally. One example is the Agricultural Marketing Information System (AMIS)[6] launched in 2011 following global food price hikes in 2007/08 and again in 2010.[7] Funded by the Government of Japan, AMIS is aimed at increasing "market transparency and to enhance the availability of timely and accurate data to guide farmers, entrepreneurs and policy makers in their marketing and policy decisions" (Lizarondo, 2009, p. 2). Data on agricultural prices were collected at wholesale and retail levels, with wholesale prices quoted in terms of both buying at the farm-gate and the selling prices of traders. In the Philippines and Thailand AMIS has produced accurate statistics and is a now fully operational data repository on supply and demand, with market information collated and combined with data from other international data warehouses.

In East Africa, the Regional Agricultural Trade Intelligence Network (RATIN) follows a similar approach for eight Eastern and Central African countries, however, as we explain below, the RATIN presents challenges in terms of the consistency of the daily frequency and reliability.

There are also examples of national commodity exchanges that have been created in some countries to facilitate wholesale agricultural trade, and market and price information collection in Africa. A commodity exchange's primary objective is to facilitate the trading of commodity-linked contracts by multiple buyers and sellers (Santana-Boado & Gross, 2007). The success of a commodity exchange is largely dependent on economic order and the effective linking of key stakeholders (Küçükçolak, 2019). In many developed economies, these exchanges act as a platform for trade in futures contracts.

Whereas in most developing economies, commodity exchanges take on a broader range of tasks. These can include futures contracts, forward contracts, or repurchase agreements. In Africa, many countries see the development of a commodity exchange as being part of their development agenda. Other benefits of well-run commodity exchanges include efficient price formation, transparency improvement, decline in transaction cost and accumulation of expertise in the financial and agricultural sectors (Küçükçolak, 2019).

However, in countries where local markets are poorly linked and transport is expensive and unreliable, the overall effectiveness of a commodity exchange is limited. A second potential issue is that different countries have different regulations and rules governing the marketing of commodities which may differ dramatically from country to country. Third, an effective commodity exchange relies on the necessary stakeholders in the market to work together to ensure the necessary rules are in place.

Countries, such as South Africa, have well-established commodity exchanges. Yet, commodity exchanges outside the South African experience have largely failed to gain traction. Recent examples are the African Commodity Exchange (ACE) in Malawi, the Ethiopian Commodity Exchange (ECX), and the Zambian Agricultural Commodity Exchange (ZAMACE). ACE affords farmers a host of benefits such as warehousing, trade facilitation, and access to better inputs.[8] However, many African commodity exchanges have not met expectations. This is due to a range of factors such as limited success in the attraction of financial institutions; increased opportunistic behaviour in the form of non-compliance due to anonymous trading; conflicts of interest among brokers; market manipulation in an already

[6] There are other examples of data repositories that track commodity prices at the national levels. These are discussed in the next section.
[7] http://www.amis-outlook.org/amis-about/en/
[8] http://www.aceafrica.org/

thinly-traded market; and high fixed costs imposed on traders and farmers (Sitko & Jayne, 2012).

The poor results generated by commodity exchanges in Africa thus far in achieving their goals emphasises the need to better understand market trends in close to real time given volatility in production and prices, and motivates for a market observatory in the region. Possessing reliable and consistent data on prices, trade, production, and investment information is fundamental in purchasing negotiations to understand market conditions and trends (specifically local and regional supply and demand flows) and also to evaluate transport plans and requirements.

A Market Observatory would also assist in identifying key trends. These include opportunities for cross-border trade between Southern and East African economies, as well as border and transport problems, and possible anticompetitive behaviour.

3. Methodology and Data Collection

This study builds on an earlier review (see Bosiu, et al., 2019). We utilised data on prices collected from various international sources and databases which report them on a daily, weekly, or monthly basis. We draw on data from RATIN, SAFEX, Zambian National Farmers Union, ACE Africa, and the Food and Agriculture Organisation of the United Nations. However, the consistency of the data is subject to these sources making the data publicly available. The area under study of this paper is South Africa, Zambia, Malawi, Tanzania, and Mozambique. The period of this study is from January 2010 to September 2019.

We take a longer-term view from 2010-2019 to map the main trends and how the prices of maize and soya have responded to local and regional supply and demand conditions. The paper also examines trade flows and production figures over this longer period. We then take a shorter perspective to investigate the regional price dynamics in response to weather variability as well as speak to the effects that climatic shocks such as Tropical Cyclone Idai have had on prices and intra- and inter-country supply and demand. The data is collected from different data sources that each have their own methods of data collection. Thus, the quality of any assessment of maize and soybean prices in the region is severely weakened by inconsistencies within data sets and the differences across sources.

The Regional Agricultural Trade Intelligence Network (RATIN) collects price and trade data for a variety of agricultural commodities across eight African countries, by location via a smartphone application from three established traders and two randomly selected traders. Data quality assurance is provided by farmer groups, other traders, and associations who are connected to the system.[9] However, the use of data reported by RATIN presents challenges in terms of the consistency of the daily frequency, which are disrupted by infrequent responses by traders in Tanzania and Malawi, and differences with other data sources which are difficult to understand, as we discuss below.

The Food and Agricultural Organization and World Food Programme also collect data on food prices. These are the FAO's Corporate Statistical Database (henceforth, FAOSTAT) and the WFP's Vulnerability Analysis and Mapping database (henceforth, VAM). Both of these collect and present food price data at a national and regional level at monthly and annual frequencies,

[9] https://ratin.net/site/about/3033

where possible. However, there are significant inconsistencies between these standardised databases used by many researchers for policy analysis despite the data being reported at the same time periods.

The data presented at the national level from FAOSTAT are producer prices. These prices are received from farmers for primary crops, live animals and livestock primary products as collected at the point of initial sale (i.e. prices paid at the farm-gate).[10] However, there are inconsistencies in data due to differences in the collection infrastructure and capacity of reporting countries. This means that some data are either wholesale[11] or local market prices rather than farm-gate prices.[12] FAOSTAT notes that "while these may be good proxies of farm-gate prices when the marketing chain is very limited, they tend to be poorer proxies in economies where transport and commercial margins constitute a significant share of the final product price" (FAO, 2019). In addition, FAOSTAT also notes that, at "the far extreme, some countries report retail prices, which are typically very poor proxies for producer prices" (FAO, 2019). This was the case for prices for Zimbabwean soybeans and maize, as well as maize in Malawi and Zambia.[13]

The VAM database reports price data from national and regional statistical offices at the national and local-level. This has relatively good coverage of maize prices, yet is also subject to inconsistencies regarding wholesale and retail prices, and by different pack sizes. Price data for soybeans is sparse for our countries of interest.

We also note that these different data sources report data in different volumes, such as metric tons and kilograms, as well as in differing currencies, US dollars and local currency units. These had to be converted to ensure that the data set used in the analysis was measured for the same weight, and expressed in a common currency (which we chose as USD/MT).[14] Another issue that arises when using different data sources is that the national average of a given country will differ where different sites have been used in the country. These differences are noted where appropriate throughout.

Mapping the Regional Market

Countries and local markets that suffer from persistently low levels of agricultural production are required to import in order to meet their local demand. In most cases, these countries and markets will have prices above the average. The distances between markets in the region are important to note in terms of the link between production levels, cross-border trade, and price volatility. These, along with transport and related costs at borders, add to the price differences

[10] FAOSTAT Metadata, accessed on 12 December 2019.

[11] In a primary wholesale market, the wholesale price may also refer to the price at which the wholesaler offers it for sale to the retailers. This price should be above the farm-gate price to account for the wholesaler's margin of profit (FAO, 2019). In a secondary wholesale market, the wholesale price of a product is the price at which the wholesaler sells it to the retailers (FAO, 2019). This price should exceed the farm-gate price plus transportation charges, incidental expenses and the traders profit margin.

[12] Farm-gate prices the prices received by farmers for their produce at the location of farm (FAO, 2019). These prices do not include the costs of transporting the products to the nearest market from the farm gate.

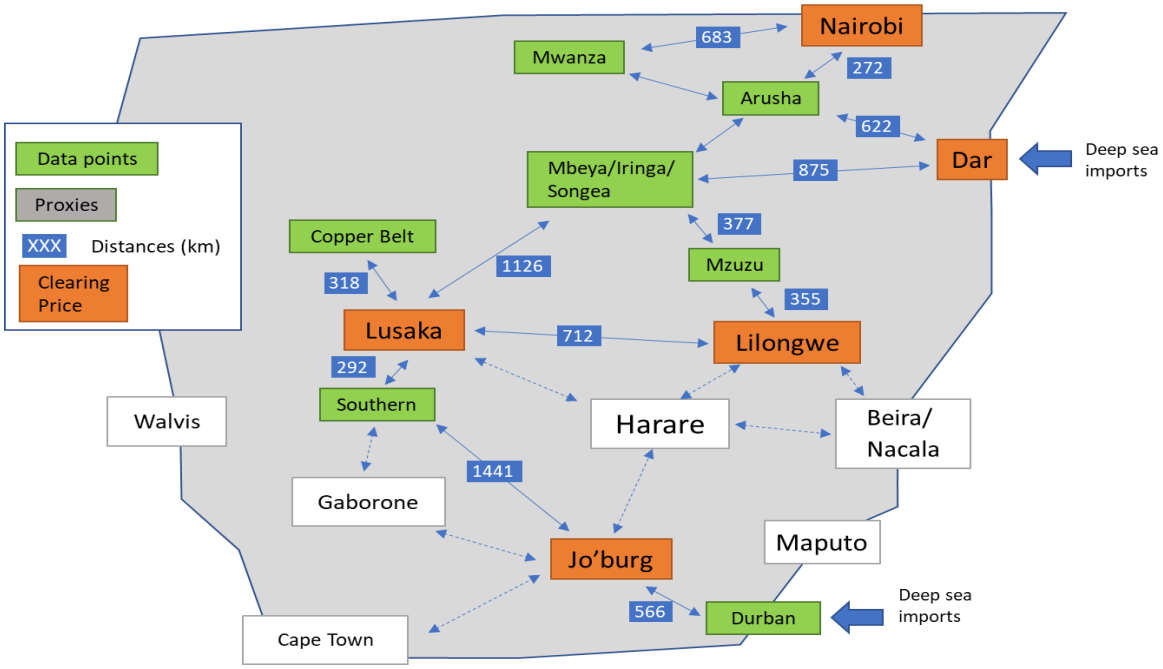
[13] Retail prices are theoretically the highest prices that can be paid for a product marked up above the farm-gate price by the farm-to-retail-price-spread (FTRPS). The FTRPS accounts for contributions to the final product by manufacturers, distributors, wholesalers, and retail firms (NAMC, 2019).

[14] We recognise that it is problematic to make a simple conversion for different volumes (pack sizes), as smaller pack sizes generally have higher prices on a pro rata basis.

we expect to see between surplus producing areas and deficit regions, depending on the sources which clear the markets given the potential for both intra-regional and deep-sea imports. The opposite is true for a net exporting country. We expect prices to be lower in the local market and linked to the export prices which can be achieved less the costs to these markets, for traders looking at these alternatives. In a well-functioning regional market, trade will result in prices which are aligned, with the differences due to factors such as transport and border related costs.

The Southern and East African region is linked by major transport routes which are effectively 'grain highways' that connect most of the countries analysed in this study. The main route runs from Durban in South Africa through Zimbabwe and Zambia and ends at Dar es Salaam in Tanzania (Figure 1 and Appendix 1). Having efficient transport links is crucial to enhancing integration of the Southern and East African region. Transport costs between locations depend on direct costs, led by fuel, and other indirect costs such as delays at borders and poor road infrastructure which causes further delays (Vilakazi & Paelo, 2017; Vilakazi, 2018).

Figure 1: Distances Between Main Centres within Southern and East Africa



Source: Authors

In previous research focusing on intra-regional transport costs, it was found that transport road freight prices in Africa are high relative to other regions in the world but that direct costs of transport (fuel, trucks and driver wages) were low (Vilakazi & Paelo, 2017). This points to issues relating to competition and market power in transport and trading, along with border obstacles. The unbalanced trade in the region also means uncertainty of return loads for hauliers. Some routes, for example between Lusaka and Johannesburg, have seen improvements with higher levels of trade and lower costs (Vilakazi & Paelo, 2017).

Data challenges

The poor availability of recorded data on agricultural products and markets for many African countries resulted in significant challenges. First, many African countries have poor statistical capacity to record agricultural price and trade data at high frequencies. Therefore, most of the available data is at the monthly, quarterly and annual levels. It is also often aggregated at the

national level rather than for individual markets. Especially for large countries, this reduces the explanatory power of the data. There have been attempts in recent years by large organisation such as the FAO and VAM to increase the number of markets with price data with some success. We have as far as possible made use of these repositories. Second, there are the inconsistencies in the reported data with, for example, one repository recording maize data but not soya and vice versa. Third, as mentioned above, there is the problem of the different methodologies employed by the various data repositories which introduces problems when trying to compare or combine different sets to get a longer-term view.

Table 1: Available Data

Maize			
Country	**Wholesale Prices**	**Retail Prices**	**Trade Data**
Malawi	Weekly, ACE, LCU/MT, 11-21 locations 6-month gap in 2017/8; 2-month gap, April 2019 after Idai	Monthly ~23 locations, VAM & FAO; LCU/kg. Food Security Analysis Unit via FAO: GIEWS/FPMA	Trade Map calculations based on National Statistical Office of Malawi statistics for annual and quarterly data
Mozambique	Monthly, VAM, from Sistema De Informação De Mercados Agrícolas De Moçambique (SIMA) via FAO, reported in LCU/KG 2 locations	VAM, from Sistema De Informação De Mercados Agrícolas De Moçambique (SIMA) via FAO, reported in LCU/KG 18 locations	Trade Map calculations based on Instituto Nacional de Estatística statistics for annual and quarterly data
Tanzania	-Weekly, RATIN, USD/MT, 7 locations, from Apr 2017 but with regular 2-4 week gaps, an 8 week gap Jun-Aug 2019 when collection locations changed. - Monthly, 23 locations, LCU/100KG, VAM from Ministry of Industry, Trade, and Investment and partly on RATIN data. - No data available from Tanzania Mercantile Exchange (TMX).	Weekly, RATIN, USD/MT, 7 locations, from Apr 2017 but with regular gaps.	Trade Map calculations based on National Bureau of Statistics for annual and quarterly data
Zambia	None	Monthly, VAM, LCU/KG, 33-40 / 50+ locations pre / post 2012, 3 gaps of up to 4 months in 2010-2012, from Zambia Central Statistical Office, FEWS (2011 only) and unidentified sources	Trade Map calculations based on Central Statistical Office statistics for annual and quarterly data
Soya			
Country	**Wholesale Prices**	**Retail Prices**	**Trade Data**

Malawi	Weekly, ACE, LCU/MT, ~15 locations 6-month gap in 2017/8; 2-month gap, April 2019 after Idai	None	Trade Map calculations based on National Statistical Office of Malawi statistics for annual and quarterly data
Mozambique	None	None	Trade Map calculations based on Instituto Nacional de Estatística statistics for annual and quarterly data
Tanzania	Weekly, RATIN, USD/MT, 6 locations, from Apr 2017 but with regular 2-4 week gaps. Limited data after June 2019.	Weekly, RATIN, USD/MT, 6 locations, from Apr 2017 but with regular 2-4 week gaps. Limited data after Jun 2019.	Trade Map calculations based on National Bureau of Statistics for annual and quarterly data
Zambia	None	None	Trade Map calculations based on Central Statistical Office statistics for annual and quarterly data

Data Quality

In Mozambique, the wholesale prices reported for Maputo and Nampula are questionable: Maputo wholesale prices being reported are far above the Maputo retail prices in 2016 and 2017; wholesale and retail prices for Nampula are very highly correlated and frequently overlap; and the US$200/MT difference between Maputo and Nampula wholesale costs is substantially more than would be justified by transport costs.

There are two sets of wholesale data available for Tanzania, from VAM and RATIN. While the overall trends reflected in the data series are comparable, there are large absolute differences. Comparing the producing areas of Mbeya and Iringa to prices in Dar es Salaam, as would be expected prices in Dar es Salaam are higher, often by large amounts. The RATIN prices reflect differences of US$100-150/MT. The VAM wholesale prices indicate prices in Mbeya and Iringa higher than Dar es Salaam in the second half of 2017. Trade data is available on a quarterly basis until Q4 of 2017 and annually for 2018.

Table 2: Improved Data Required

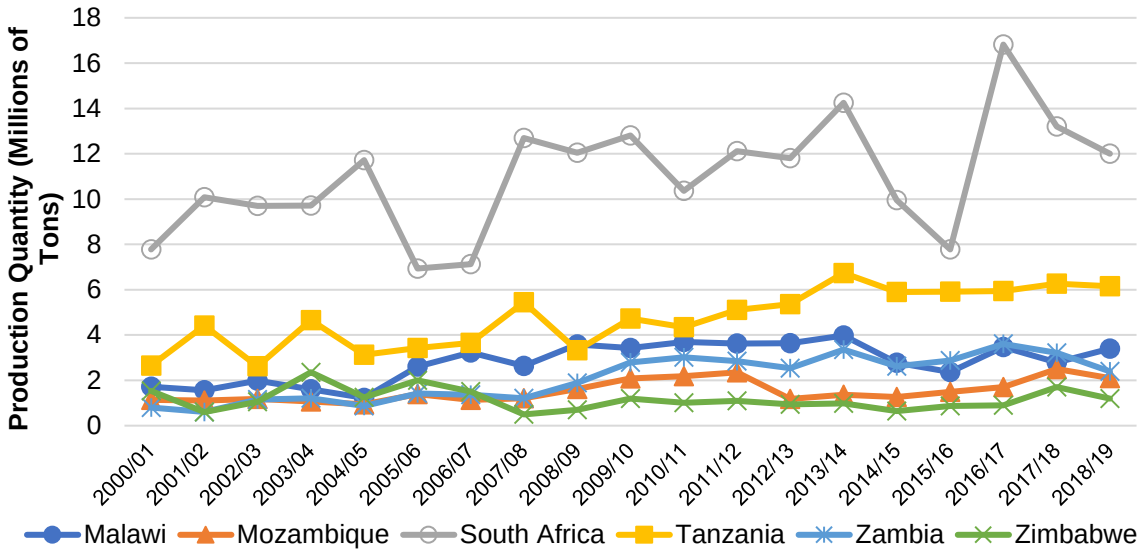
Country	Data objectives further to current availability
Malawi	Continuous dataset for wholesale maize and soya. Better regional coverage.
Mozambique	Expand the wholesale dataset for maize Initiate wholesale data collection for soya
Tanzania	Continuous dataset for wholesale maize and soya

4. Trends in maize markets in Southern and East Africa

The maize industry contributes significantly to the economies in the region as a major agricultural crop, produced by smaller farmers in most of the countries across large areas of land, and in milled form it is the main staple food (white maize) and an important input to

animal feed (yellow maize) (Appendix 2). Since 1970, maize production in the Southern and East African region has almost quadrupled reaching over 48 million tons harvested in 2018. At a country-level, there has been strong growth in production in most countries although Zimbabwe's production has faltered (Figure 2). Mozambique's production levels have also reduced from 2012. There have also been major variations in production in other countries, including due to poor rainfall. This affected South Africa in 2005-07 and 2014-16, with Malawi also recording reductions in the latter years. Between 2005 and 2006 maize production decreased by 40% in South Africa and between 2014 and 2016, during another El Niño drought, South Africa's maize production fell by 45% to just over 7.7 million metric tons (Figure 2).

Figure 2: Maize Production in Selected Southern African Countries, 2000/01 – 2018/19



Source: FAOSTAT (2000/01-2016/17), Knoema (Malawi, Mozambique, Tanzania in 2017/18), Grain SA (South Africa in 2018/19), FAO GIEWS (Malawi in 2018/19, Zambia and Zimbabwe in 2017/18), Farming Portal (Zambia and Zimbabwe in 2018/19), USDA (Tanzania in 2018/19)

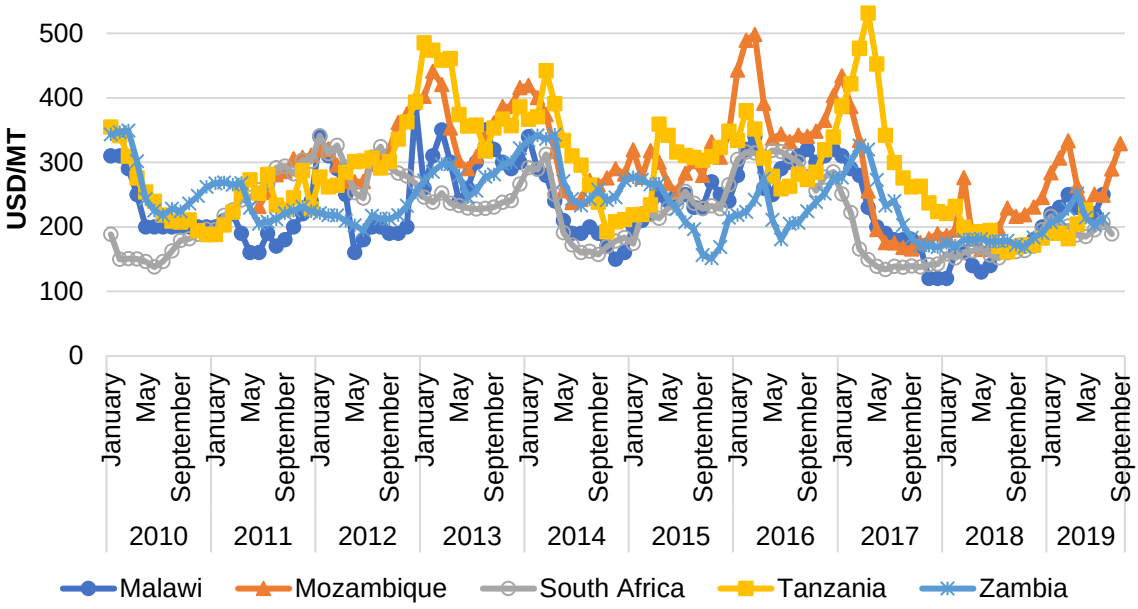
Notes: Figures for 2018/19 production data are estimates

The 2015/16 drought meant South Africa's maize world trade balance shifted from a US$500 million surplus to a deficit of US$295 million, implying substantial imports to meet demand (Appendix 4). These imports were mainly from deep sea sources, and prices moved from export parity to import parity levels. South Africa's market is dominated by large and internationalised traders who have networks of silo storage, are integrated into global markets, and trade on the South African Futures Exchange (SAFEX). South Africa continued to be an exporter (overland) to other countries in southern Africa 2014 and 2015. During the worst years of drought, South Africa's maize prices rose to around US$300/MT in early 2016 before the start of the harvest period, double the price levels in mid-2014 (Figure 3).

Zambia and Malawi have seen similar variations, although at different times, while the price changes in Tanzania and Mozambique are much greater, with much higher price spikes. However, it should be noted that there are not consistent sources for the prices across countries, nor for whether they are wholesale or retail prices. In contrast to South Africa, Tanzania's production levels have tripled over the period, growing from around 2 million tons to around 6 million tons, although it remains a net importer. The output growth reflects

Tanzania having a large endowment of diversified sources of agricultural water supply and suitable land (Kimaro, 2019). However, as much as 80% of small-scale farmers have to rely on rainfall in order to water their crops. Yet, rainfall in Tanzania varies across the localised areas and differs significantly from the other regional markets. For example, in some years there exists a 2 400mm difference in average yearly rainfall. This significantly limits the output in affected regions such as Dodoma, Singida, and Shinyanga (Kimaro, 2019). Yet, despite these climatic differences, as well as its maize value chain being fragmented and lacking effective coordination with many layers and limited ability to connect producers and consumers (Bosiu, et al., 2019), Tanzania's maize production growth was the strongest of all the countries.

Figure 3: Monthly Maize Prices in Southern and East African Economies (Excluding Zimbabwe), 2010-2019



Source: FAOSTAT (Malawi, Tanzania, Zambia), SAFEX (South Africa), VAM (Mozambique)

Note: Price data for Mozambique was reported in as retail prices in LCU/KG and was transformed through author calculations. Price data for Malawi and Zambia is retail in US$/MT while South Africa and Tanzania are wholesale prices US$/MT.

As noted, the strong growth in production was not enough to meet the country's domestic demand as Tanzania has been a persistent net importer of maize from the Southern and East African region. Most of Tanzania's maize is imported from Zambia. As a net importer, Tanzania's maize prices were generally higher than the other economies, by very large margins at times, and they exhibited greater fluctuations throughout the period. After the peak in early 2017 the prices have converged somewhat with other countries although the time period is too short to infer this is a trend. We assess the prices in the recent period, and for locations within countries, below.

Most of Tanzania's maize production comes from small-scale farmers and is usually grown under low-input and, very often, rain-fed conditions (Wilson and Lewis, 2015). This means it is more at risk of drought. This may be the cause of Tanzania's price escalation during a nine-

month period between July 2016 and April 2017. Maize prices in Tanzania rose from 263 USD/MT in July of 2016 to a six-year high of 531 USD/MT in April of 2017 (Figure 3). There are also concerns about possible market manipulation by traders, coupled with barriers to trade and transport costs meaning a fragmentation of regional markets such that large differences can be maintained across borders. Poor regulations mean that traders can artificially raise the price of maize in response to various events, be it government intervention or climate change (PesaCheck, 2017). The Tanzanian government has intervened extensively in the market including imposing export bans, which were subsequently lifted in 2018 after high maize harvests. There are, however, also questions about the reliability of the data.

In Zambia's case, maize production has grown strongly from 2007. This has been attributed to a combination of increasing input subsidies as well as better marketing of its maize. The amount spent on input subsidies and maize marketing as a share of the total agricultural budget grew from below 40% in 2002 to over 90% in 2013 (Bosiu et al., 2019). The Zambian State committed to the development of its maize industry through its subsidy programme, granting subsidies to approximately 900 000 small-scale farmers (Bosiu, et al., 2019). However, Zambia's maize production reduced somewhat to stand at 2.3 million tons in 2018/19 from 2.6 million tons in 2016/17.

Zambia has consistently been a net exporter of maize from 2014, and has been an important source for maize imports by other countries in the Southern and East African region, especially Zimbabwe, Malawi in 2016, and Tanzania in 2017 (Appendix 4). Trade with regional neighbours is consistent with Zambia's maize price being within the regional price band, while prices move somewhat differently to the other countries, emphasising its large maize producing capacity and the different rainfall experienced compared with other countries in the region. Notably, between January 2015 and October 2015, Zambia's maize price dropped by 44.5% while, over the same period, Malawi, South Africa, and Tanzania all saw maize price increases of 35%, 34%, and 41%, respectively. Immediately after its decline throughout 2015, Zambia's maize prices rebounded, converging to the average of the other economies. However, these economies were already in the midst of price declines given bumper harvests.

Malawi's large rise in imports was because of its maize production falling by half from around 4 million tons to around 2 million tons in this drought period (2014-16). While Malawi's maize prices were above US$300/MT in 2015/16, prices have at times between 2010 and 2019 been the lowest of the five economies analysed, during periods in which its production increased. This was the case in 2018 and was consistent with small net exports in this year, compared with net imports in preceding years.

Zimbabwe's maize production has declined since 2010 by almost half to around 900 000 tons in 2017. This low production affects the region as a whole as it continues to require imports as a means to meet its domestic demand. The increasing need for imports by Zimbabwe, as is seen in the trade data, should cause its price to remain close to the regional average plus transport costs. However, Zimbabwe's national average maize price was at times 4 times higher than the next highest economy and has risen sharply since late-2018 from US$504/MT to US$2843/MT in April of 2019 (Appendix 6).[15] The prices are due in part to currency factors as the official rate diverges from the rates in the parallel market, as well as government interventions. It also points to a possibility of severe supply shortages, which could be as a result of market power issues, an unstable market, or climatic shocks. Recent regulations to

[15] This is a result of the overvaluation of the Zimbabwean dollar by the Official Exchange.

control the sale of maize reflect a tightening of maize supply conditions in the country (WFP, June 2019). These have all combined to dramatically raise the price of this staple food leading to growing food insecurity in the country.

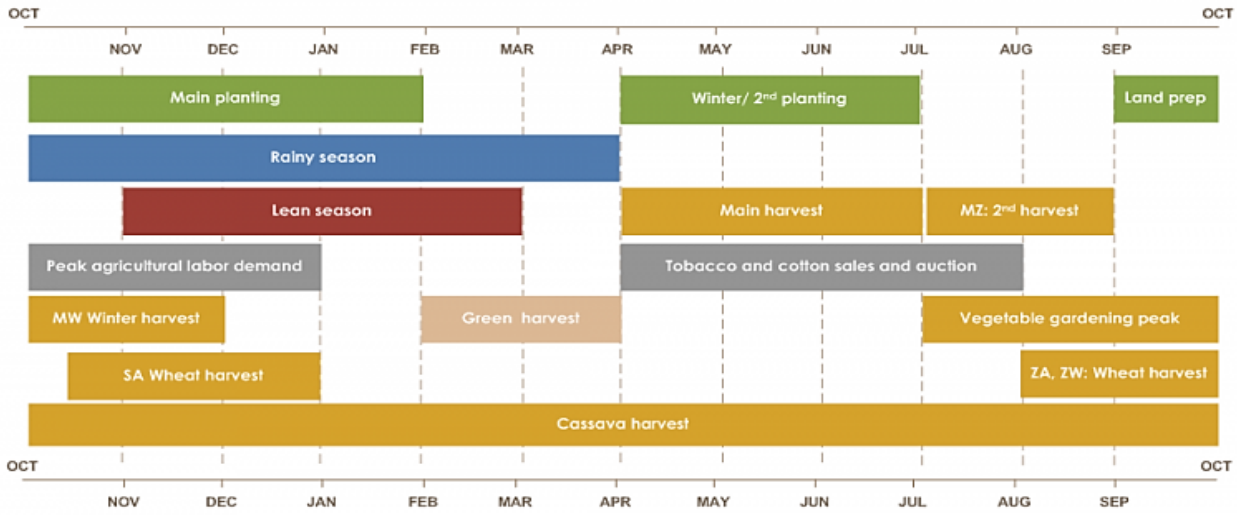
The effects on maize prices of the El Niño phenomenon during 2015 and 2016 are evident in most of the economies. In the period after the main impact beginning in early 2017, maize prices in the region increased before declining as production recovered. Prices for the countries converged somewhat within a range from the lower prices of US$167/MT in South Africa to the higher of US$255/MT in Tanzania. Malawi's average maize prices during this period was US$189/MT and Zambia's was US$210/MT. However, analyses at the national level fail to account for the nuances and idiosyncrasies at a local level.

5. Review of maize prices within and across countries in 2016-2019

This section investigates how climatic changes and shocks have affected prices over 2016 to 2019 in more detail through examining within and across country prices in Malawi, Mozambique, Zambia and Tanzania. This period covers the end of El Niño drought in 2016, the impact of Tropical Cyclone Idai (Idai henceforth) in March 2019, and relatively poor rainfall once again in some countries towards the end of 2019.

The countries of interest have similar trends in terms of their harvests, lean periods, rainy season, and planting season (Figure 4). Within Tanzania, the southern part of the country has one harvest (similar to the study countries), whereas the north has bimodal annual rainfall and different crop timing. As such, we would expect there to be similar seasonal trends in prices in areas with similar harvest cycles. For example, during the growing season when grain stocks from the previous harvest are drawn down, prices typically rise in response to falling stock levels. Prices are also influenced by information on the quality of the current growing season and likely future stock levels. Prices also generally decline after harvest when supply increases. These trends are strongly evident in national price trends in the last 5 years.

Figure 4: Typical Agricultural Season in Southern and East Africa



Source: FEWS.NET (https://fews.net/southern-africa)

After an overview of the pricing trends across countries, we start with Malawi as it is located between our other countries of interest, with the three regions (North, Central and South) of

Malawi economically connected through the main transport routes to Tanzania in the north, Zambia in the west, and Mozambique in the south. Imports have, however, come predominantly from Zambia.

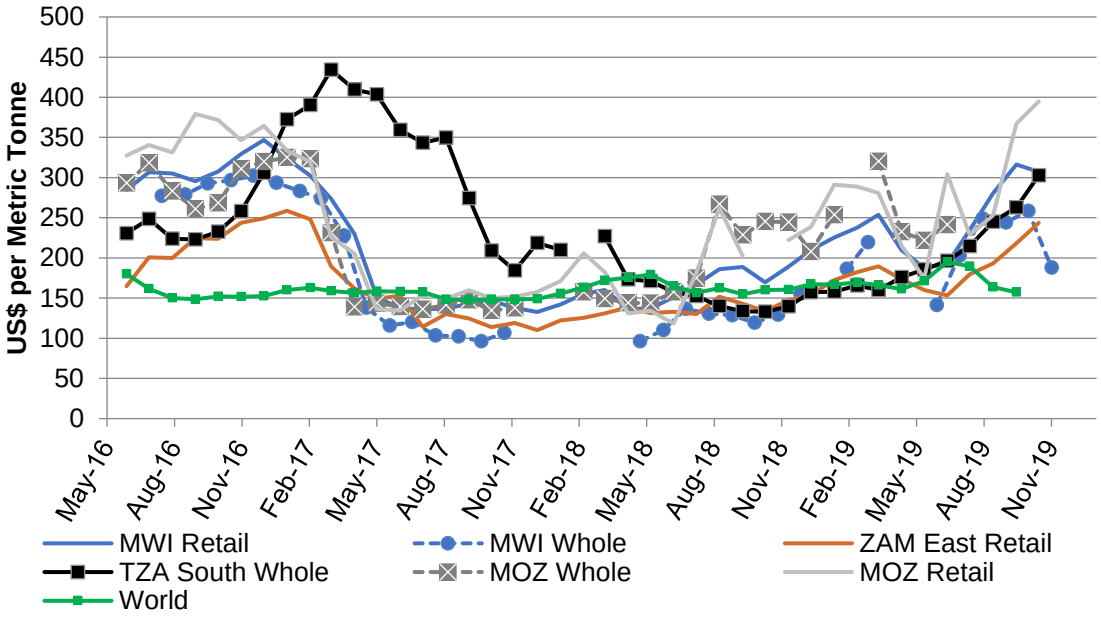
A. Regional Overview

There are significant deviations in wholesale maize prices away from world prices, particularly in periods of poor harvests, as shown in Figure 5. In the period since 2016, serious rainfall deficits have led to reductions in the cereal production in at least one of the two 2017 / 2018 harvests in each of the study countries, and worsened food insecurity. The major price differences across borders (and within some countries), for example, the increased prices in 2017 in Tanzania and Mozambique in 2018 are not justified by transport costs. Trade is intermittent, linked to changing supply and demand balances and the imposition and lifting of restrictions.

In the poor growing season of the 2016 El Nino period, retail prices increased significantly and differences between national prices widened. This price variation decreased again after harvest in 2017, such that by mid-2017 the average retail price difference between eastern Zambia and central Mozambique had fallen from US$130/MT to US$20/MT, whilst Malawian wholesale prices fell from being above Zambian retail prices, to US$50/MT below. The harvest around April 2017 resulted in a sharp drop in prices across the region, with the exception of southern Tanzania, where prices stayed high until August 2017.

In the 2018 growing season by contrast, prices in Mozambique, and to a lesser extent in Malawi, were notably higher than adjacent national markets with, for example, wholesale prices in central Mozambique US$130/MT above the Malawi wholesale average in Aug-Nov 2018. Mozambique prices stayed high throughout the growing season, peaking at over US$300/MT in March 2019 during Idai. Prices in Malawi were also badly affected during Idai but prices only registered a short spike for around two weeks in March 2019 before falling back below US$150/MT once again in May. There is no clear effect on prices due to Idai in the regions adjacent to Malawi, namely southern Tanzania or eastern Zambia. Overall, prices in Malawi, Tanzania and Zambia in 2018 until late 2019 were close to or below international prices in 2018 until late 2019. Tanzania prices in fact are aligned relatively closely with those in Kenya, reflecting their common membership of the East African Community, even while Tanzania is simultaneously in SADC.

Figure 5: Regional maize wholesale and retail prices



Source: All prices from VAM except Malawi wholesale prices from ACE and World prices from World Bank. MWI Retail and MOZ Retail are averages of national prices. MWI Wholesale is average of Central and North regions. ZAM East Retail is average of prices in Eastern Region. TZA South Whole is average of prices in Mbeya and Iringa. MOZ Whole is Nampula region.

Note: Original price data unit as per Table 1

From June 2019, prices in all the study countries begin to rise sharply, and deviate from the international maize prices. Zambian prices, which are the least volatile of the group, saw retail prices increase from US$150/MT to US$240/MT between June and October in mid-2019, the start of the 2019 growing season. Similarly, the other countries experienced a near doubling of wholesale prices by October/November 2019, the end of our data series. Data on national storage suggests that these price rises in part reflect the after-effects of Idai. Despite near average national production in Malawi in 2018, stocks in the Strategic Grain Reserve were very low at the start of the 2019 season (25,000 MT versus the recommended 200,000 MT). The reduction in stocks was due to lessening the impact on food supply stemming from Idai in March. This is supported by news reports of high prices in Malawi in 2019 referring to lower than average national supply.

In 2019 in Mozambique, agricultural output was down mainly due to the impact of two tropical cyclones (Idai and Kenneth) in March and April, although annual production still exceeded the previous five-year average. These two climate events caused extensive losses of standing crops in the highly productive central provinces and prices remain high in these central markets (see Mozambique national analysis). Production losses also occurred on a smaller scale in southern provinces due to severe rainfall deficits.

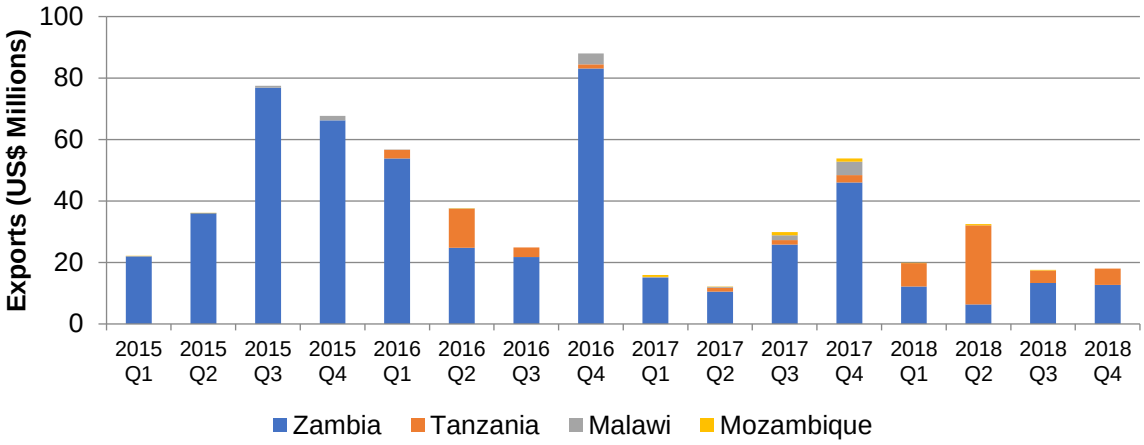
To recap, a combination of climate events (changes in rainfall and exceptional tropical storms) weakened food security in some countries, notably Mozambique and Malawi. Production in the adjacent countries was subject to this regional demand (including Malawi and Mozambique but also from East African markets outside the scope of this study) and put upward pressure on maize prices, observed in the rising prices across all study countries. Production in

Tanzania in 2019 was average and it had an above-average exportable maize surplus while Zambian production was down. The regional demand affected even the prices in southern Tanzanian markets shown in Figure 5.[16]

Trade

Exports from the four countries are dominated by Zambia (Figure 6). Zambia is the only country with consistent net exports – Tanzania was a net exporter on the basis of this data only in 2016 and 2018.

Figure 6: Regional Maize Exports

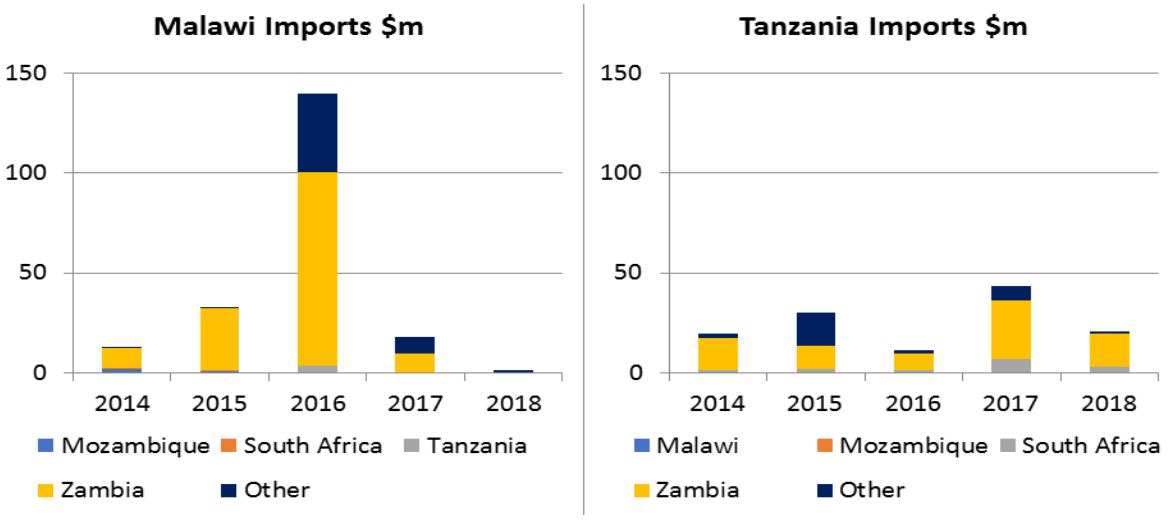


Source: Data from Trade Map calculations based on Central Statistical Office statistics and UN Comtrade.

Imports into Malawi and Tanzania are limited and mainly originate from Zambia (Figure 7). Trade data indicates that imports to Malawi from Zambia peaked in the 2016 El Nino growing season and reduced prices, with the balance of "Other" imports being international (from Mexico and Singapore). Tanzanian imports are static and low, coming mainly from Zambia. Imports from Zambia peaked in 2017 when the price differential between Tanzania and adjacent countries was highest.

16 https://reliefweb.int/sites/reliefweb.int/files/resources/East%20Africa%20Maize%20Market%20Supply%20Outlook_20191106.pdf

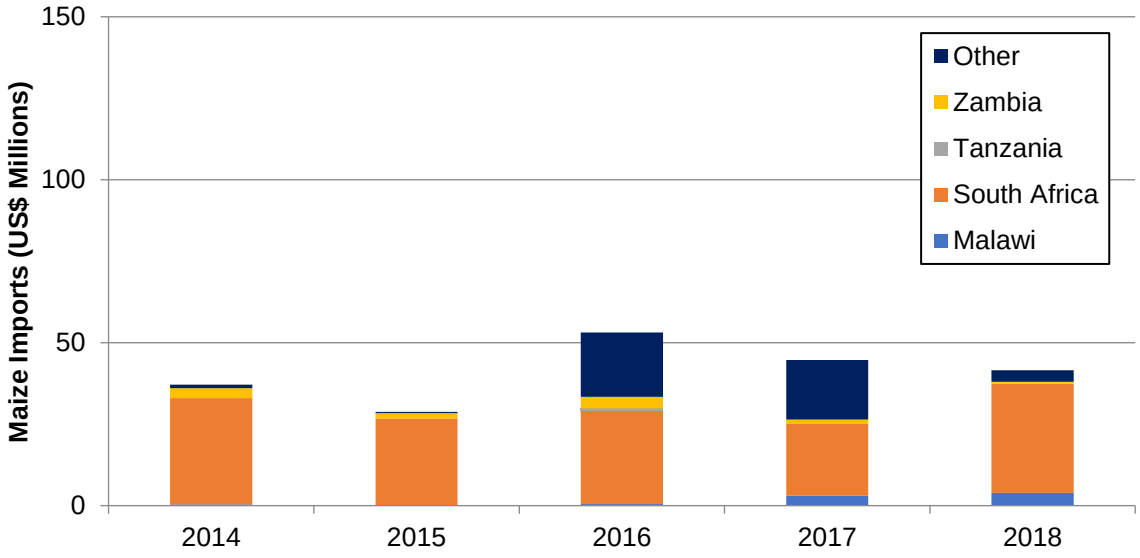
Figure 7: Imports from Selected Countries



Source: Data from Trade Map calculations based on Central Statistical Office statistics and UN Comtrade.

Imports to Mozambique are mainly from South Africa and have remained relatively constant with slight increases in 2016 and again in 2018 when international price differences were greatest (Figure 8). Imports from Malawi have increased over this period from a very low base.

Figure 8: Imports to Mozambique from Selected Countries



Source: Data from Trade Map calculations based on Central Statistical Office statistics and UN Comtrade.

The lower production in central Mozambique in 2019 due to the tropical cyclones affected cross-border trade into Malawi.[17] This is consistent with reports of informal cross-border imports into Malawi being below average in 2019, due to below-average production in neighbouring countries such as Mozambique, as a result of Idai. Tanzania supplies around a third of the tradable maize surplus in East Africa and Tanzania benefits from this higher farm

[17] https://fews.net/southern-africa/mozambique/food-security-outlook/october-2019

income and production.[18] Tanzania has in the past utilised export bans in order to lessen the impact of poor harvest years on consumers.

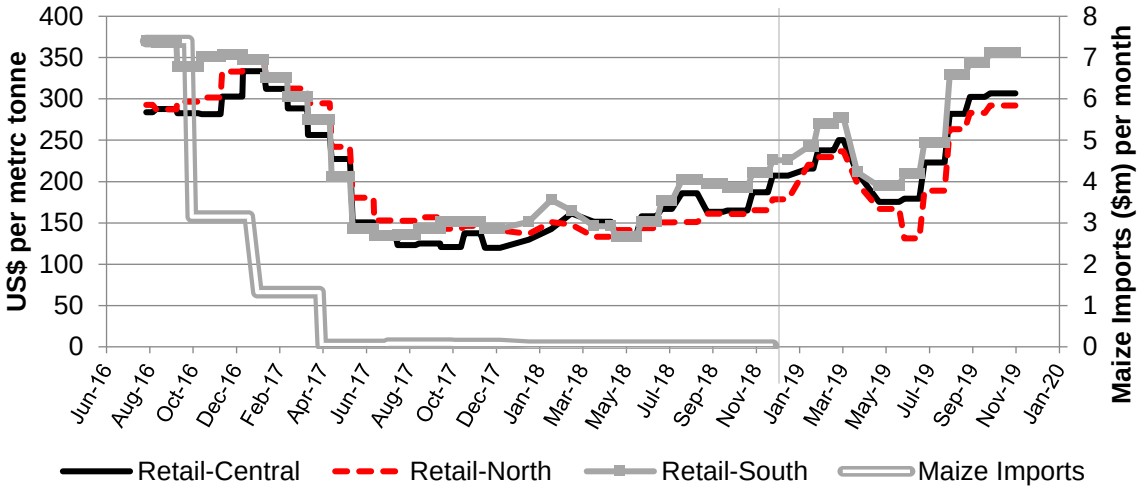
Cross-border trade therefore has dampened prices somewhat through exports from areas less affected by low rainfall, especially Zambia, to those most affected. We note also that there will have also been unrecorded/informal trade flows, suggesting that actual trade is substantially more than reflected here.

B. National Price Trends

Malawi

Within Malawi, the major retail price trends are correlated across the different regions (Figure 9). Differences between regions can be as much as US$50/MT which is more than would be expected even after accounting for local transport costs. In poor rainfall periods (July-Nov 2016 and again in the second half of 2019), prices in the South are noticeably higher than in the Central and Northern regions. Regional prices dropped significantly and in parallel at the end of the El Nino drought, falling from around US$340/MT in January 2017 in the three regions to around US$145/MT in June 2017. Maize imports fall, in line with the price trend, from a high in Q3 in 2016 to a negligible level in 2018 Q2 and remaining low until the end of the trade data series in December 2018.

Figure 9: Regional Average Retail Prices versus Imports in Malawi



Source: VAM and Trade Map calculations based on Central Statistical Office statistics.

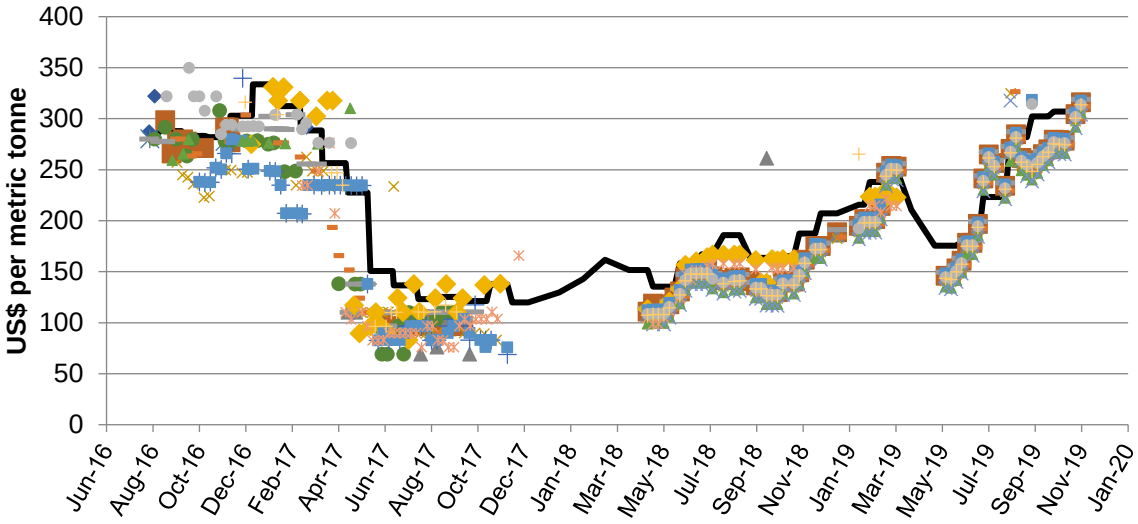
Note: VAM regional data are averages based on individual locations. Trade data ends at 2018 due to availability.

Comparing the wholesale and retail prices within the Central region (Figure 10), individual wholesale prices are lower than the retail prices, for example following the good April 2017 harvest through to March 2019. However, in times of poor local production, the retail prices are more in line with wholesale prices suggesting they are also being constrained by imports. For example, during Idai, wholesale prices rose above the median retail price in the Central

18 https://reliefweb.int/sites/reliefweb.int/files/resources/East%20Africa%20Maize%20Market%20Supply%20Outlook_20191106.pdf

region as buyers, anticipating scarcity, bid up local prices to farmers by around $40/MT in the first two weeks of March 2019 when news of Idai came out. This occurred again when production concerns due to poor rainfall became evident in the second half of 2019.

Figure 10: Retail and Wholesale Prices in Central Malawi



Source: VAM (retail – black line) and ACE (wholesale – dots, for various locations).

Note: VAM regional data are averages based on individual locations. Wholesale data are as reported by ACE, with time gaps in the original series.

Figure 10 also shows a convergence of wholesale prices. Whilst different bidders come into and leave the market, the range of wholesale prices decreases markedly in 2018 and through to 2019. The divergent pricing seen in the 2016/17 growing season is not seen during the rapid increase in prices in the 2019 growing season.

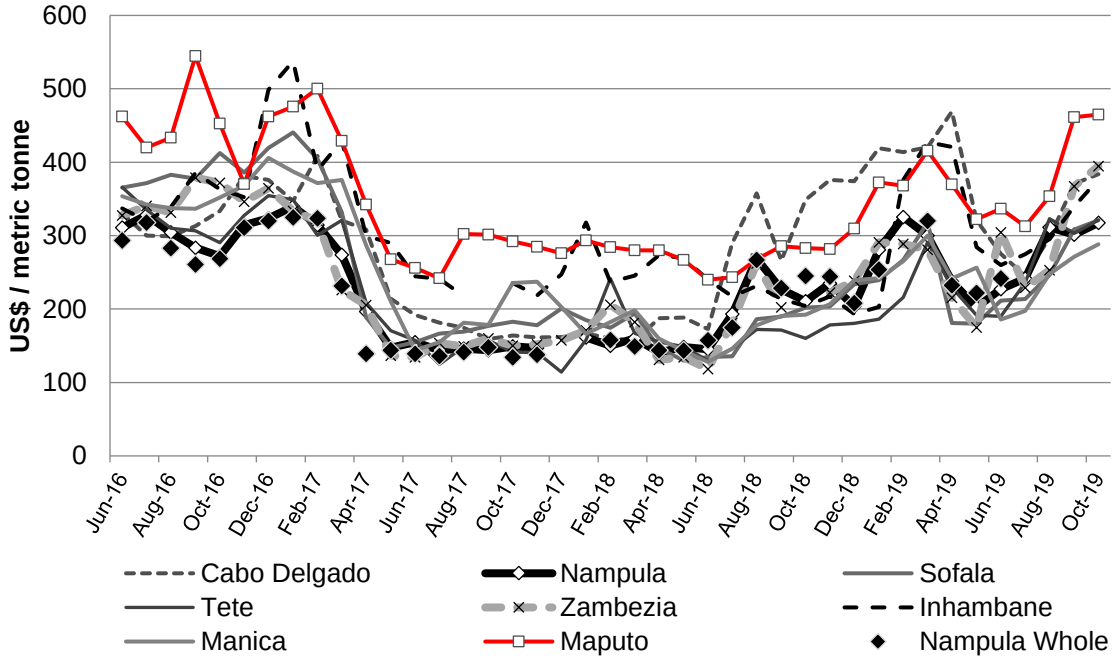
Mozambique

There are very large differences in prices between regions of Mozambique reflecting the size of the country and the large distances between the main producing regions and locations of consumption. Difficulties in transport within the country mean that imports have historically come predominantly from South Africa to supply the largest market in Maputo. Retail maize prices show substantial differences across regions (Figure 11), which reflect the logistics in Mozambique. Maputo retail prices are generally higher reflecting the demand needing to be met by supplies elsewhere in the country and by imports. Apart from periodic excursions, the price is reasonably consistent between regions and the overall trend reflects the regional picture.

The 2018/19 rainy season in Mozambique was late to start and then was hit by below average rainfall, early cessation of rains, and heavy late season rainfall and flooding associated with Tropical Cyclones Desmond (in February), Idai (March), and Kenneth (April). In most of the south, this resulted in a reduction of area planted and poor crop establishment. Additionally, mid-season dryness resulted in crop failure in localized areas. Desmond caused localized flooding in central and northern provinces. Heavy rainfall associated with intense tropical cyclone Idai resulted in widespread flooding in Sofala and parts of Manica and Zambezia

provinces.[19] Poor households in these areas exhausted their food stocks earlier than normal, despite the above average 2017 harvest, and relied on market purchases for food[20]. This is reflected in regional markets through 2018/19 season, with central region prices rising towards the Maputo price.

Figure 11: Regional average prices in Mozambique



Source: VAM (retail) and Trade Map calculations based on Instituto Nacional de Estatística statistics.

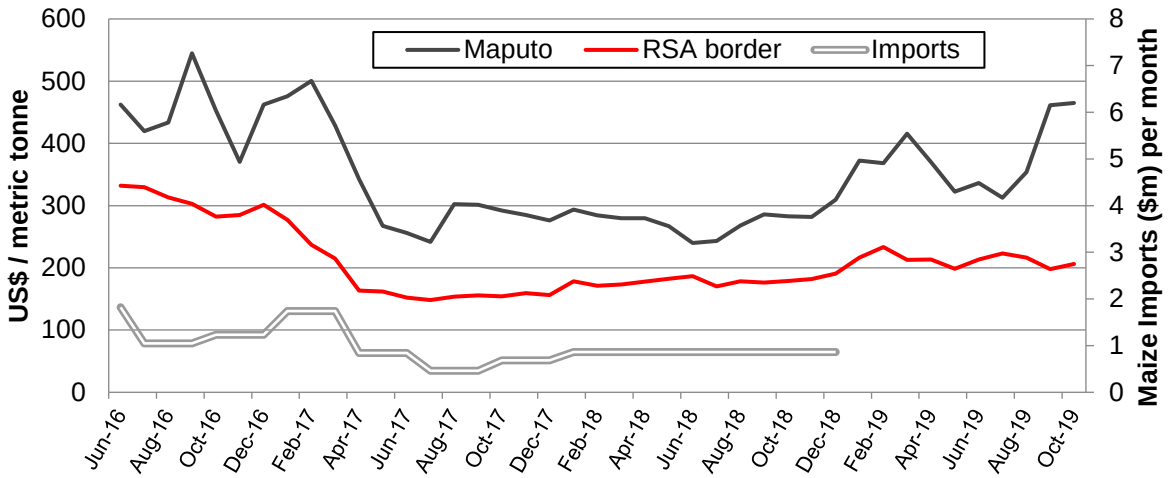
Note: VAM regional data are averages based on individual locations.

Prices of maize spiked immediately following the landfall of the cyclones in March and April, as the destruction of infrastructure and stocks resulted in supply shortages. Prices stabilized in May as newly harvested crops eased supply pressure. Maize prices, however, remained higher on a yearly basis in the major markets on account of the reduced 2019 output.[21]

In the absence of good wholesale prices in Mozambique, Figure 12 compares retail prices in southern Mozambique with South African wholesale prices, adjusted for transport to the border. Despite import availability, the Maputo prices diverge from the South African prices. An increase in Mozambique imports coincides with the increased price differential between the countries in Q1 and Q4 of 2017. The national prices diverge, starting in the growing season in 2018 Q3, reflecting supply shortages from poor harvests in 2018 and 2019.

[19] https://fews.net/southern-africa/mozambique/food-security-outlook-update/april-2019
[20] https://fews.net/southern-africa/mozambique/food-security-outlook-update/september-2018
[21] https://reliefweb.int/report/mozambique/giews-country-brief-mozambique-9-september-2019

Figure 12: Retail Prices in Maputo and National Imports



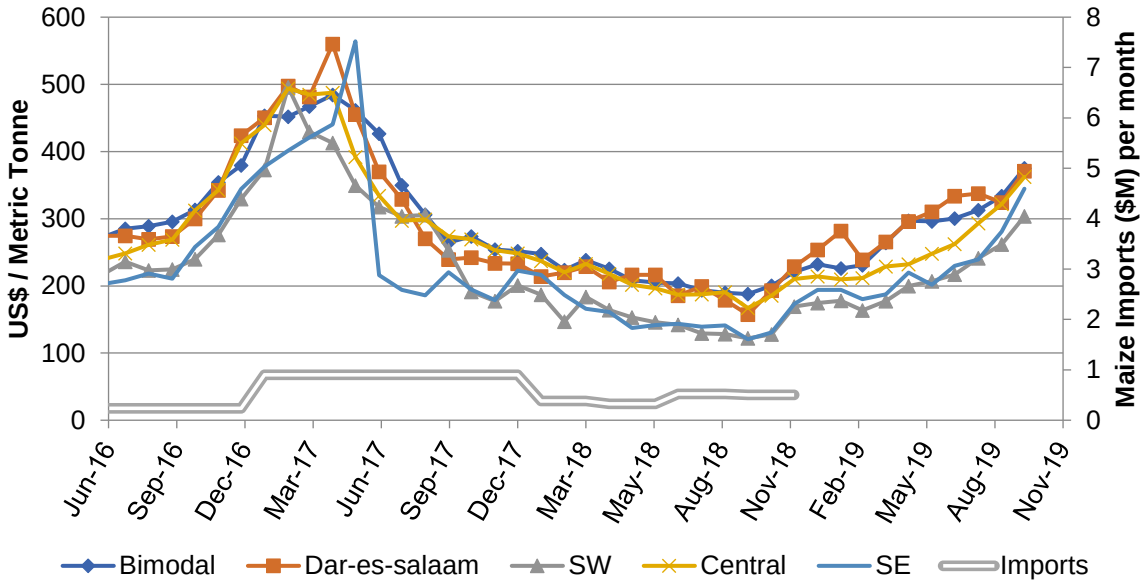
Source: VAM (retail) and Trade Map calculations based on Instituto Nacional de Estatística statistics.

Note: The RSA price is the SAFEX price plus transport cost to Komatipoort (445km @ US4c/tkm). Import tariffs are excluded.

Tanzania

In the north of Tanzania, rainfall and therefore harvests are bi-modal, whereas in central and southern areas there is one "Msimu" harvest in June. The difference in timing of harvests does not appear to influence the wholesale prices, as shown in Figure 13. There is no significant difference in the timing of the seasonal rains between regions.

Figure 13: Regional Wholesale Prices versus Imports in Tanzania



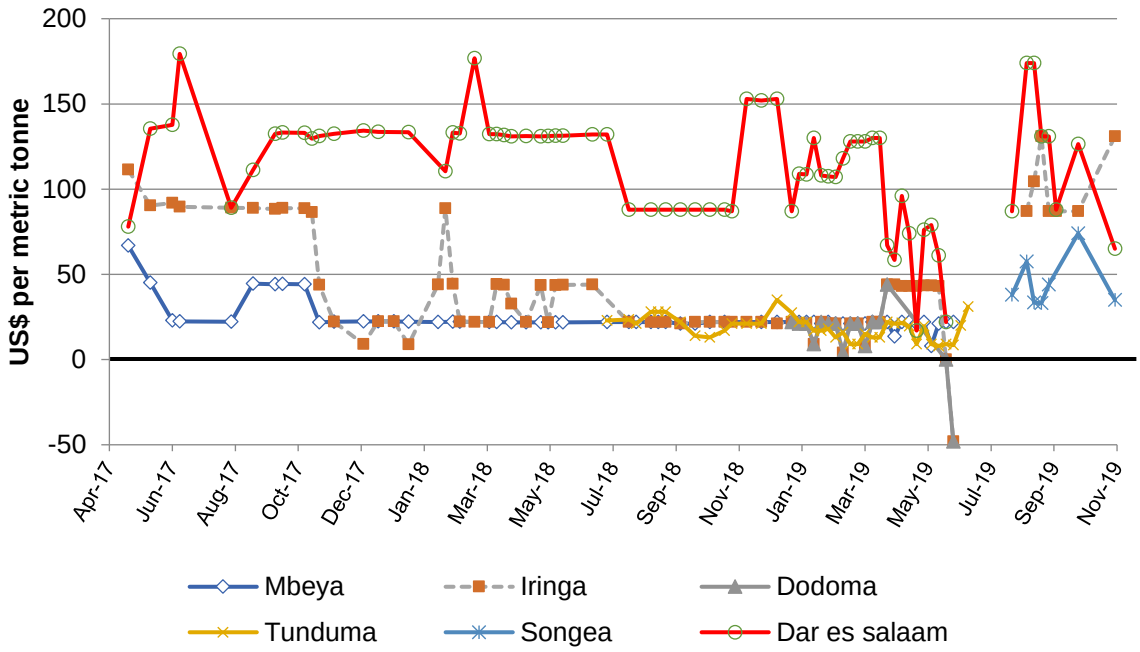
Source: VAM (wholesale) and Trade Map calculations / UN Comtrade.

Note: The bimodal areas are regions in the north with some bimodal rainfall. SW = average of Mbeya, Iringa and Rukwa. SW = average of Mtwara and Songea. Central = average of Dodoma, Kigoma, Morogoro, Singida and Tabora.

Comparing regional prices, the productive SW regions (Iringa, Mbeya and Rukwa) and the more isolated SE regions consistently have lower prices whereas the bimodal northern regions have the highest prices. The bimodal northern regions are closest to the major Tanzanian export markets. The average difference of $60/MT in price between the SW/SE and Dar es Salaam is about twice the efficient transport cost.

Retail data for maize in Tanzania is available from RATIN. The data series is discontinuous and only available from April 2017. However, to ensure data consistency, Figure 14 shows the wholesale margin for selected southern regions from RATIN data only. The margin varies significantly, from an average of US$108/MT in Dar es Salaam to US$12/MT in Dodoma but for most locations, the wholesale margin is relatively static. There is no evidence of margins materially changing during Idai and in 2019 the only significant change is the increasing margin in Iringa (although the data series is intermittent).

Figure 14: Wholesale Margin in Tanzania for Selected Regions

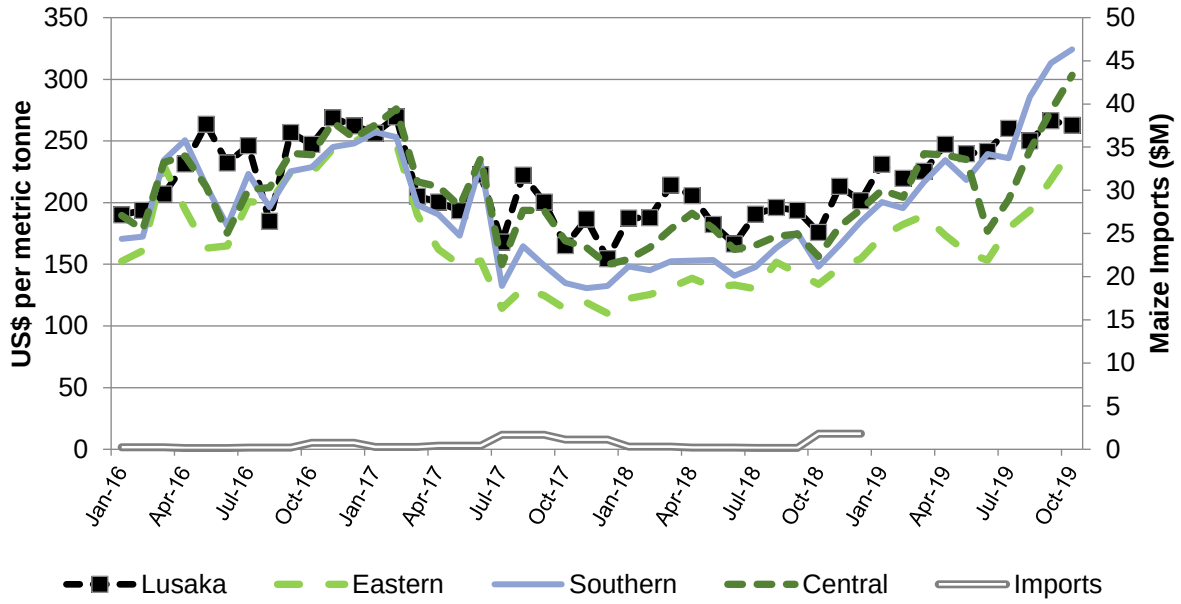


Source: RATIN daily prices. Average of median weekly prices by location.

Zambia

Within Zambia, retail prices are well correlated across the main production regions (Figure 15). Regional price differences average over 50%, greater than accounted for by efficient transport costs, with the lowest prices normally in the Eastern region (adjacent to Malawi). Prices follow the regional trends described above and drop at the end of the 2016 El Nino drought. Maize imports are very minor throughout the period. In the 2019 growing season, prices have risen sharply since June. Lusaka prices are consistently lower than the Central and Southern regions since August, which is very atypical of the period since 2016.

Figure 15: Retail Prices in Zambia – Main Production Regions



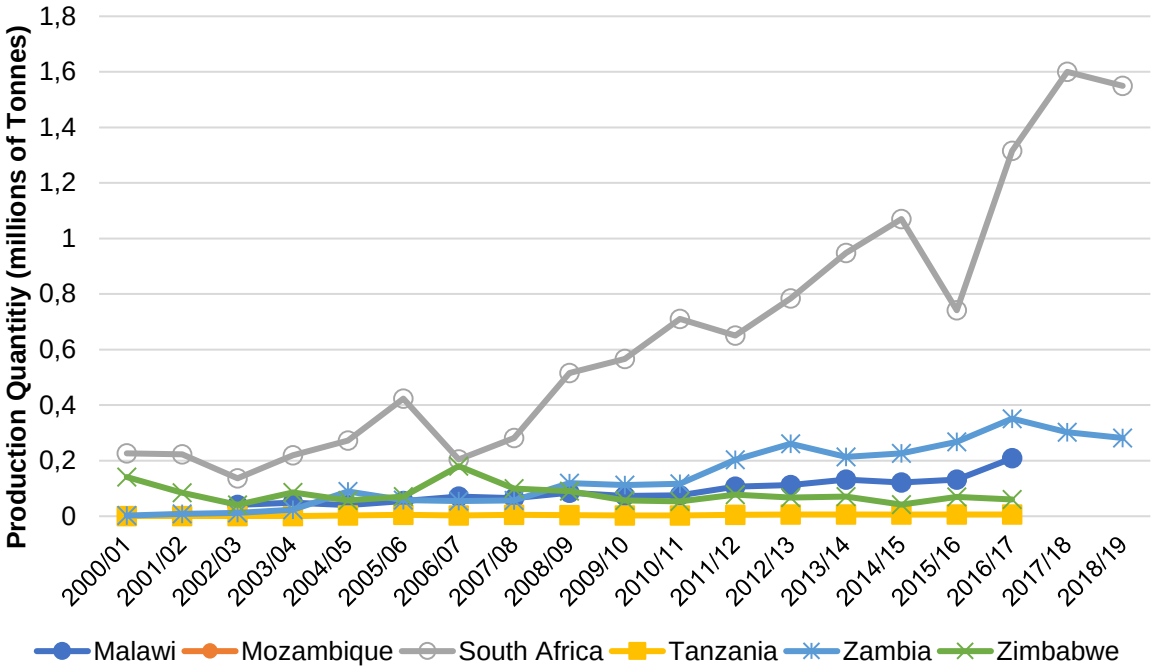
Source: VAM regional averages and Trade Map calculations based on Central Statistical Office statistics.

6. Assessment of Soybean Production, Trade, and Prices in Southern and East Africa

Soybeans are quite different from maize in that their main market is for processing into animal feed and oil. They are therefore part of a value chain with linkages into value added processing and crushing, given their high protein content (Meyer et al., 2018). Notwithstanding good potential for soybean production (see Appendix 3), production levels are very low in most countries aside from South Africa and Zambia. The attraction of the crop depends in large part on the local demand from commercial meat farming and the soybean price is a key factor in the competitiveness of local poultry production (Ncube, 2018).

With urbanisation in the region and rapidly growing demand for poultry, in particular, the production of soybeans in South Africa has grown strongly driven by animal feed requirements (Figure 16). South Africa, however, remains a net importer of soya when derivative products (oilcake) are taken into account, with demand being above 2 million tonnes per annum (Ncube et al., 2017). In addition, South Africa imports around 20% of its poultry requirements which represents derived demand for animal feed. Zambian production has also grown from a very low base and, given its demand (at around 200-250 thousand tonnes per annum), it has moved from being a net importer to be a net exporter.

Figure 16: Soybean Production in Selected Southern African Countries

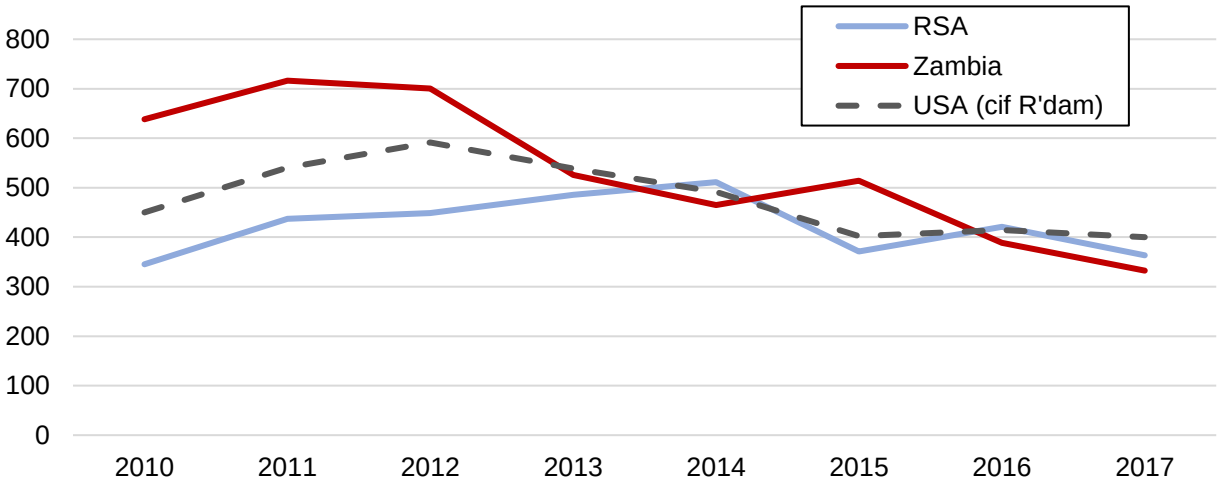


Source: FAOSTAT (2000/01-2016/17), Agribiz (South Africa in 2017/18 and 2018/19), Zambian Ministry of Agriculture (Zambia in 2017/18 and 2018/19)

Notes: No data was available for Mozambique for the period. Data was unavailable for Malawi, Tanzania, and Zimbabwe in 2017/18 and 2018/19. Figures for 2018/19 production data are estimates.

The production changes are reflected in relative prices. South African prices have been effectively set by imported oilcake from South America, while South Africa exports from inland areas to its neighbours (Ncube et al., 2017). As Zambian production increased and the country became a net exporter, mainly to neighbours such as Namibia, DRC, Zimbabwe and Botswana replacing South African exports, its prices have fallen relative to international prices and those in South Africa (Figure 17).

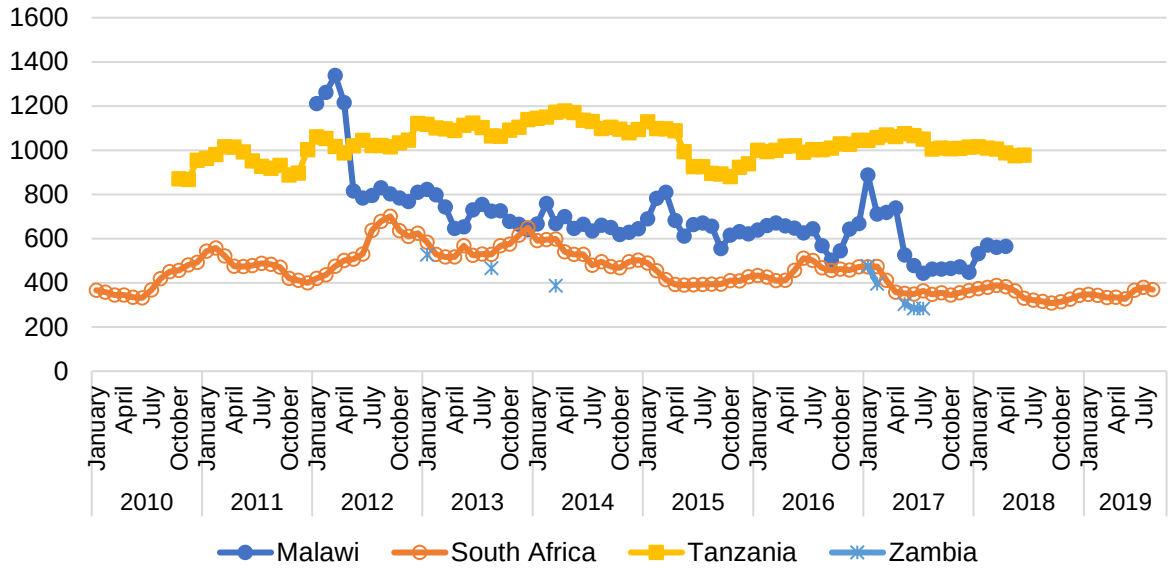
Figure 17: Soybean Bulk Wholesale Prices



Source: South Africa, SAFEX; World Bank commodity prices (World Price), Zambia - ReNAPRI (2018)

Monthly data are poor, however, with Zambian data only available for a few months overall. Tanzania prices have been consistently at very high levels (although with significant regional variations, see below), while Malawi prices have been lower, reflecting growth in production for the local animal feed industry, although the prices are still significantly above those in South Africa (Figure 18). Malawi has shifted its policy focus towards soybean production as its soil fertility declines from continued maize planting (Bosiu, et al., 2019). Malawi provides farmers access to credit and to fertilizers through its fertilizer input subsidy programme (FISP), which have supported increased production.

Figure 18: Soya Prices, monthly



Source: RATIN (Malawi and Tanzania), SAFEX (South Africa), FAOSTAT (Zimbabwe), Ministry of Agriculture and Cooperatives, Kabwe Market Information Services, and ZAMACE (Zambia)

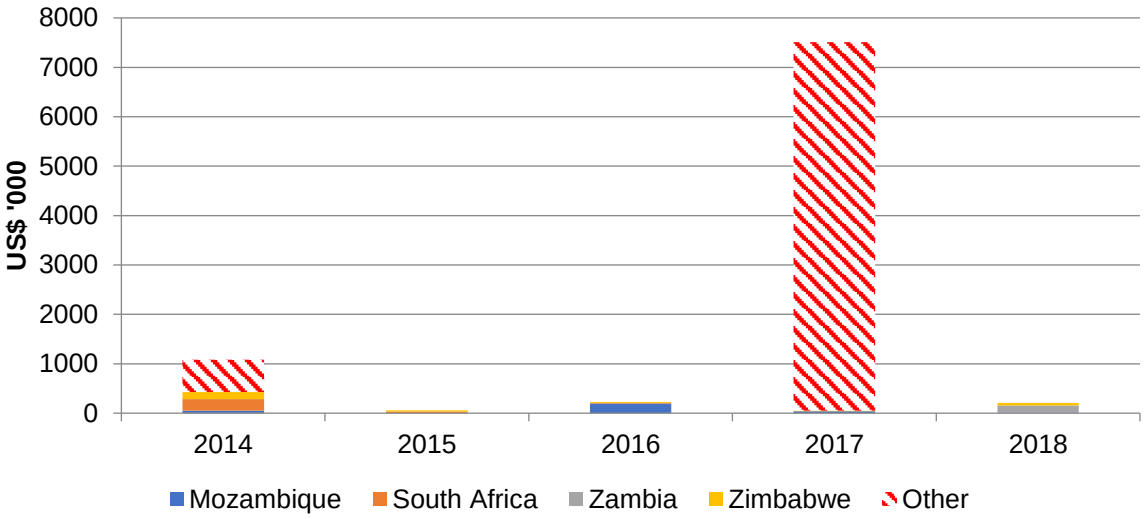
Notes: No price data for soybeans in Mozambique could be collected.

Zimbabwe, in contrast to the other economies, has seen its soybean production decline by two-thirds from 2007, as the Zimbabwean government encountered ever-increasing challenges surrounding its land reform process. Throughout the period, Zimbabwe has consistently been a net importer (Bosiu, et al., 2019). Reported prices for Zimbabwe are, surprisingly, lower than for other countries in the region, but this likely reflects issues with the data.

Trade

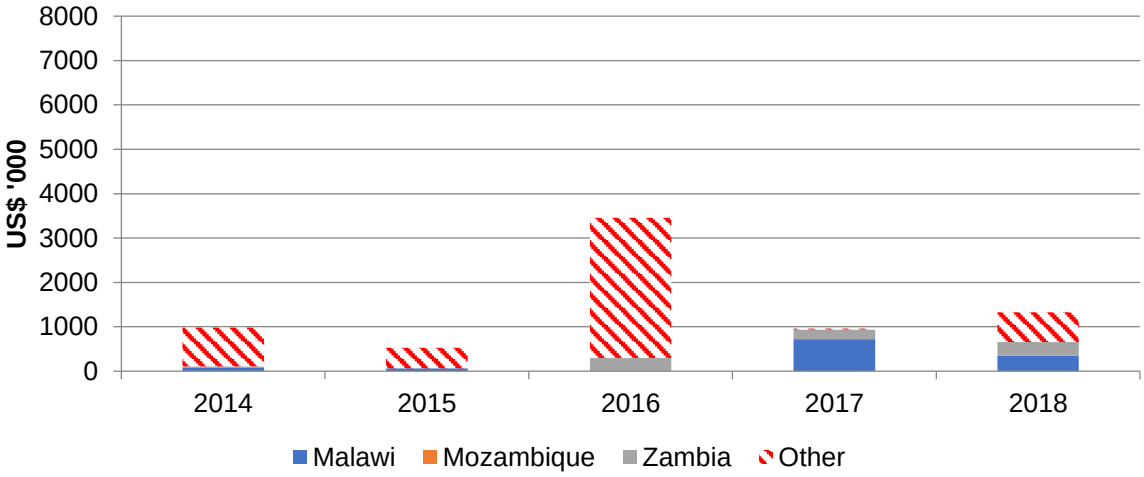
Notwithstanding very large relative price differences, the trade data reflect low and very variable levels of trade. For both Malawi and Tanzania there have been major imports from outside the region (Figures 19 and 20). In Malawi the imports in 2017 were from outside the region (from the USA). While there have been some imports by Tanzania from Malawi and Zambia these have been small.

Figure 19: Malawi Soya Imports, by source



Source: Trade Map calculations based on National Statistical Office of Malawi statistics

Figure 20: Tanzania Soya Imports, by source

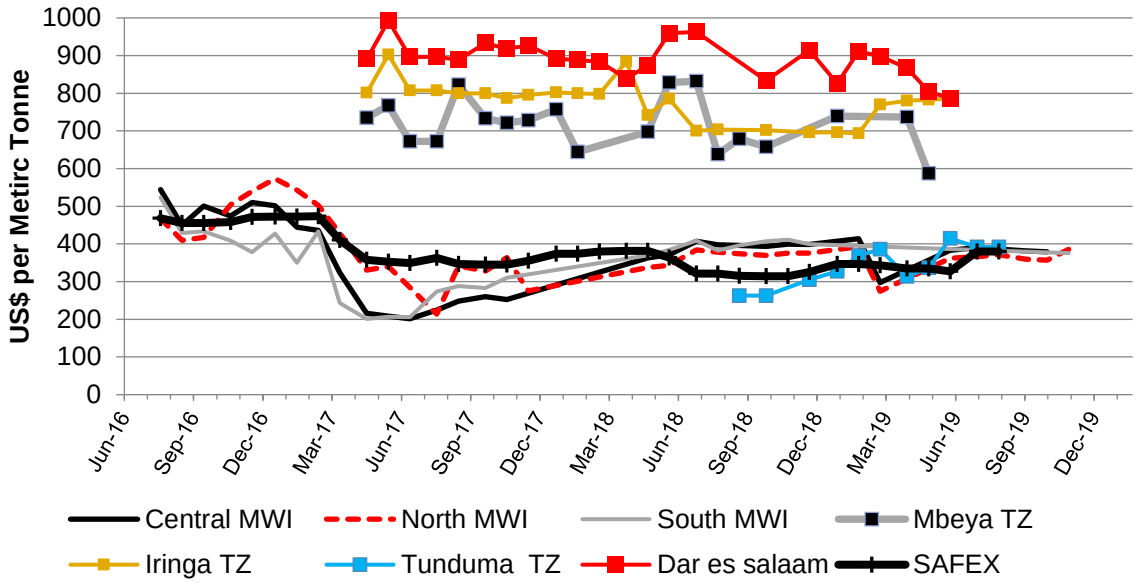


Source: Trade Map calculations based on National Bureau of Statistics data

Pricing within countries

The price data for soya is much poorer than for maize and we are only able to compare prices in Malawi and Tanzania, along with South Africa prices on SAFEX, which are quoted for Randfontein (close to Johannesburg). This data, which differs from above, indicates that prices in the different regions of Malawi (North, Central and South) have been below SAFEX prices for some periods (in 2017) and then slightly above in 2018 (Figures 21 and 22). By comparison, prices in Tanzania are much higher (approximately double) and cannot be justified by transport costs. There are also very large regional differences in Tanzania. Only a short data series is available for Tunduma, but prices there are in line with SAFEX and Malawi prices, and substantially lower than the other regions of Tanzania.

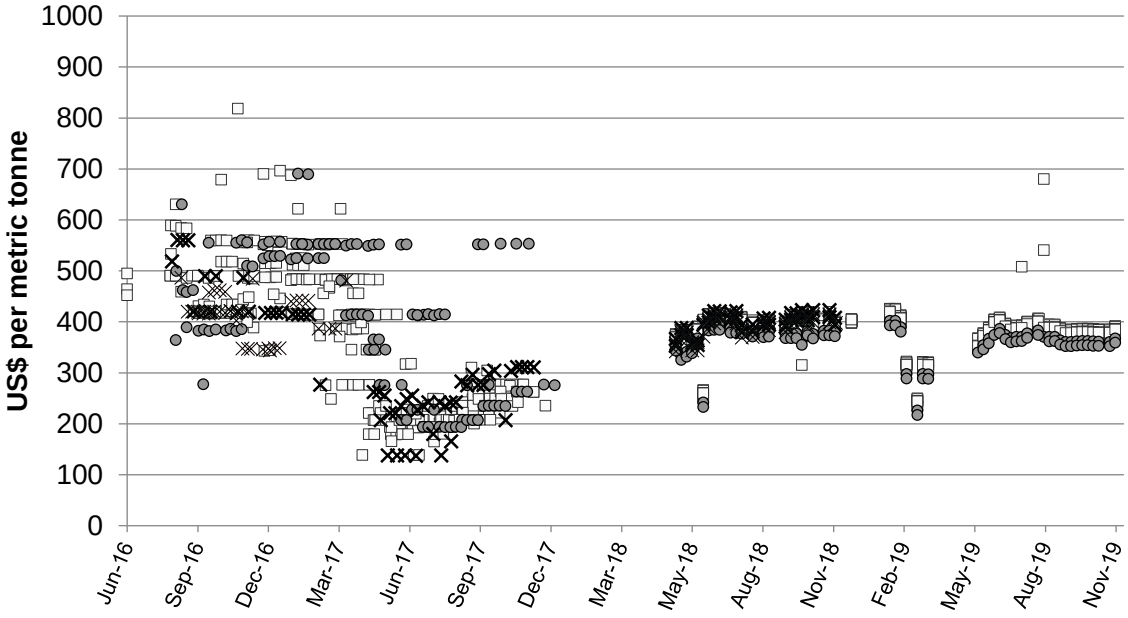
Figure 21: Wholesale Soya Prices



Source: Malawi – ACE regional averages. RSA – SAFEX. Tanzania – RATIN weekly median of daily prices for location, averaged by month

Looking at local prices at a more granular level in Malawi reveals that there was a much greater geographic dispersion in 2016 and 2017 (Figure 22). Prices also dropped sharply in early 2017 followed by a convergence around US$400/MT which indicates more integrated markets within Malawi.

Figure 22: Regional Wholesale Prices in Malawi



Source: Malawi – ACE. Average prices from 23 locations in Central (icon: square), North (filled circle) and South (cross) regions. Data gaps in original data source

In Tanzania, informal information suggests that soya production has been intermittent because farmers are reluctant to grow the crop due to lack of seed, weak market linkages and market power of traders meaning that farmers receive low prices even while market prices are much higher.[22] This is evident also in very large spreads between wholesale and retail prices, with margins in Dar es Salaam, Iringa and, for much of the time, Tunduma, being around US$100/MT or more.

7. Conclusions – the need for a market observatory

The threat of climate change makes it even more imperative that concerted actions are taken to improve the workings of agricultural markets at a regional level across Southern and East Africa. There is great potential for much higher levels of production in large parts of the region, while in other areas increasing water scarcity will lower output. Realising the potential for higher levels of production is important not just for exports to the region but also as a contribution to sustainable world food supply, as the region can be a substantial net exporter to international markets given the abundant water in countries such as Zambia, DRC and Tanzania. This can sustain agricultural production without deforestation if properly managed. Production can be relatively inclusive if it involves supporting small and medium scale farmers and be linked to industrial development and employment creation through agro-processing.

The increased volatility in rainfall, alongside the projected long-term developments from climate change, imply integrated regional markets are very important to dampen the effects of supply shocks on food prices. Market integration requires investment in logistics and storage facilities, alongside support for farmers to better manage water through increased use of irrigation, coupled with insurance to ride-out disasters. Making the case for these investments means communicating the practical implications of non-action. While these implications in terms of food insecurity are understood by those on the ground, it is striking just how poor the data are on wholesale prices by location. A Market Observatory is thus a key part of the picture to monitor the impacts on prices and to design systems to better support the integration of regional markets.

Notwithstanding the data challenges, our assessment of maize, the staple across the region, demonstrates very large price differences within and between countries which are far in excess of transport and related costs. This is the case even while the great majority of imports, which many countries require in times of poor harvests, are from within the region. This points to some intermediaries being able to make large sums of money from speculating and possibly manipulating markets. Greater price transparency has the potential to reduce these margins, as we observed between locations within Malawi in 2018 and 2019 (Figure 10) and this may be due to the market initiatives being undertaken.

The data also point to huge price swings for maize in relatively short periods of time, from less than US$100/MT to above US$300/MT (and higher in some countries such as Mozambique and Tanzania). This means it is very difficult for farmers to plan based on any reasonable expectation of the prices they may be paid in future. It means that there have been rewarding opportunities to store maize in good years with very low prices, for sale in poor years when prices spike, which would have dampened price cycles. This depends on the storage

[22] https://africanharvesters.com/2018/05/21/tanzania-call-boost-soya-value-chain/; http://wire.farmradio.fm/en/farmer-stories/2017/04/tanzania-confusion-about-soya-bean-markets-discourages-farmers-16092

infrastructure such as was constructed in South Africa for the agricultural co-operatives, alongside rail transport links.

Soybeans are a quite different commodity in that the demand is predominantly for use in animal feed, which is growing rapidly. While production has increased massively, led by South Africa, other countries have very good conditions for this crop and there remains a very large regional net trade deficit in direct and derived form (imports of oilcake). Soybeans are also an important crop for farmers to be able to diversify from maize and realise better overall returns. In addition, expanding production can improve the competitiveness of downstream industries such as poultry.

The pricing data for soybeans is even poorer than for maize. The data which is available illustrates very large differences across the region by location, which again are far in excess of reasonable transport and related costs. The expanded production in Zambia and Malawi has led to lower and more stable prices, with these countries being net exporters to their neighbours. This points to the potential gains from investment linked to more integrated regional markets.

In both maize and soybeans, South Africa accounts for a substantial proportion of regional production, reflecting the historic investments in large-scale commercial farming with extensive government support under apartheid. However, expected changes in rainfall under climate change means South Africa's food security is intimately linked to growing production to the north of it. While there are positive developments in this regard, they are not nearly at the pace and magnitude required. There is a very strong case for South Africa to support market integration and investment in agriculture in the southern African region.

The case for a Market Observatory is part of the agenda for agriculture and regional integration in the face of climate change. The data collated here indicate the value of systems to collect data at the local level at a weekly frequency to have an accurate picture in close to real time of the market outcomes in each country and across the region.

It is also important to track the demand and supply reporting in each country. An example of this initiative is the South African Supply and Demand Estimates Committee (SASDEC). The SASDEC is an official supply and demand reporting mechanism that enhances the statutory measures by requiring grain and oilseed producers to declare imports and exports. The aim of the SASDEC is to bring about price transparency and stability in the South African market.[23] This type of initiative can contribute to food security in a given country. This type of mechanism can also ensure proper conduct on the part of producers and suppliers as well as leading to a convergence of prices across and within countries.

Regional transport markets are also a key part of the picture as transport costs are a significant percentage of the cost of imported products. Furthermore, reliable and consistent data will aide policymakers in identifying abuses of power, including by transporters and traders. Given the significant levels of food insecurity in the South and East African region, the creation of a market observatory is an important tool towards addressing this and other issues relating to the production of maize and soybeans in the region.

[23] https://agbizgrain.co.za/en/industry-news/supply-and-demand

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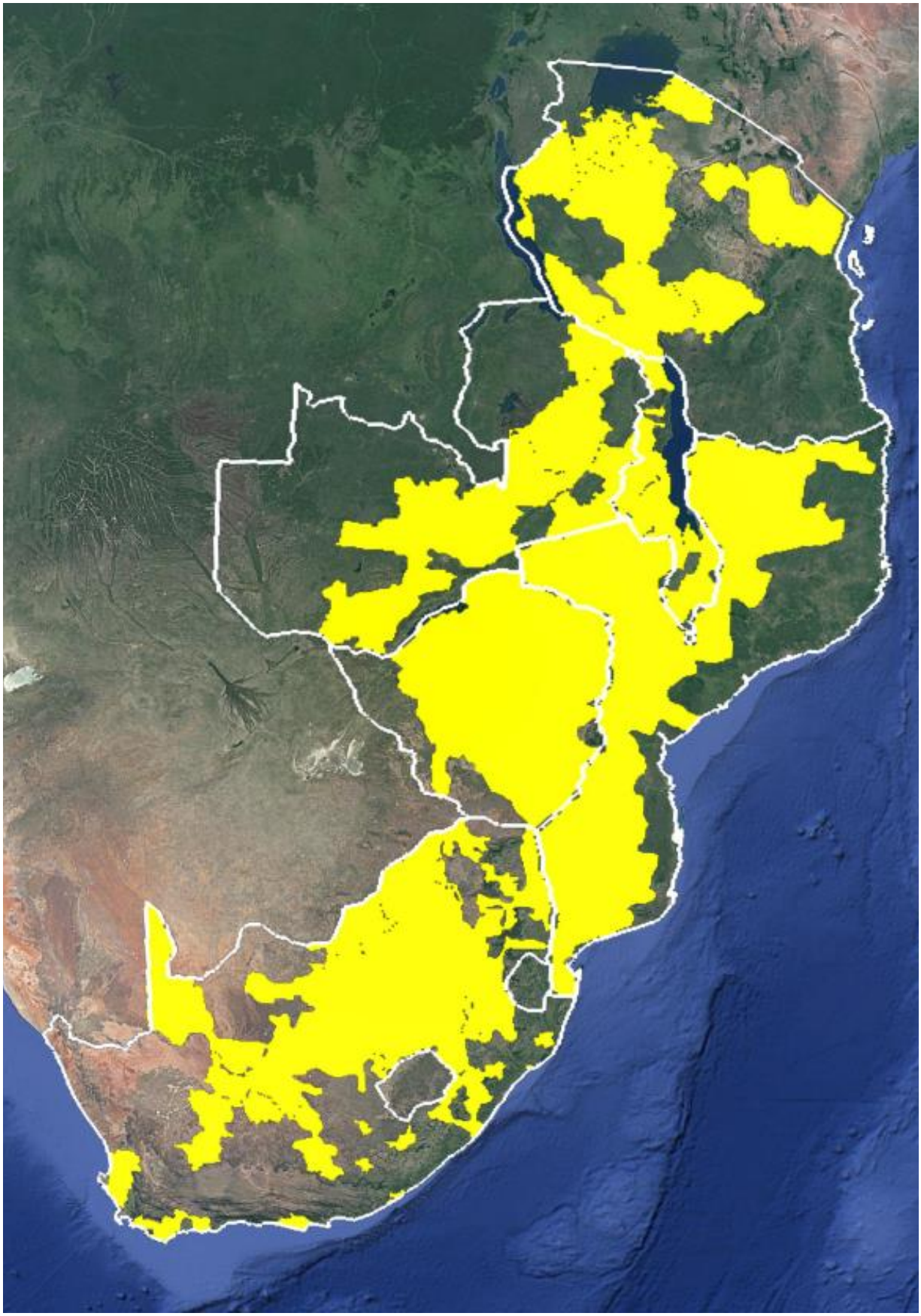
Appendices

Appendix 1: Geographical Map of the Road Network in Southern and East Africa

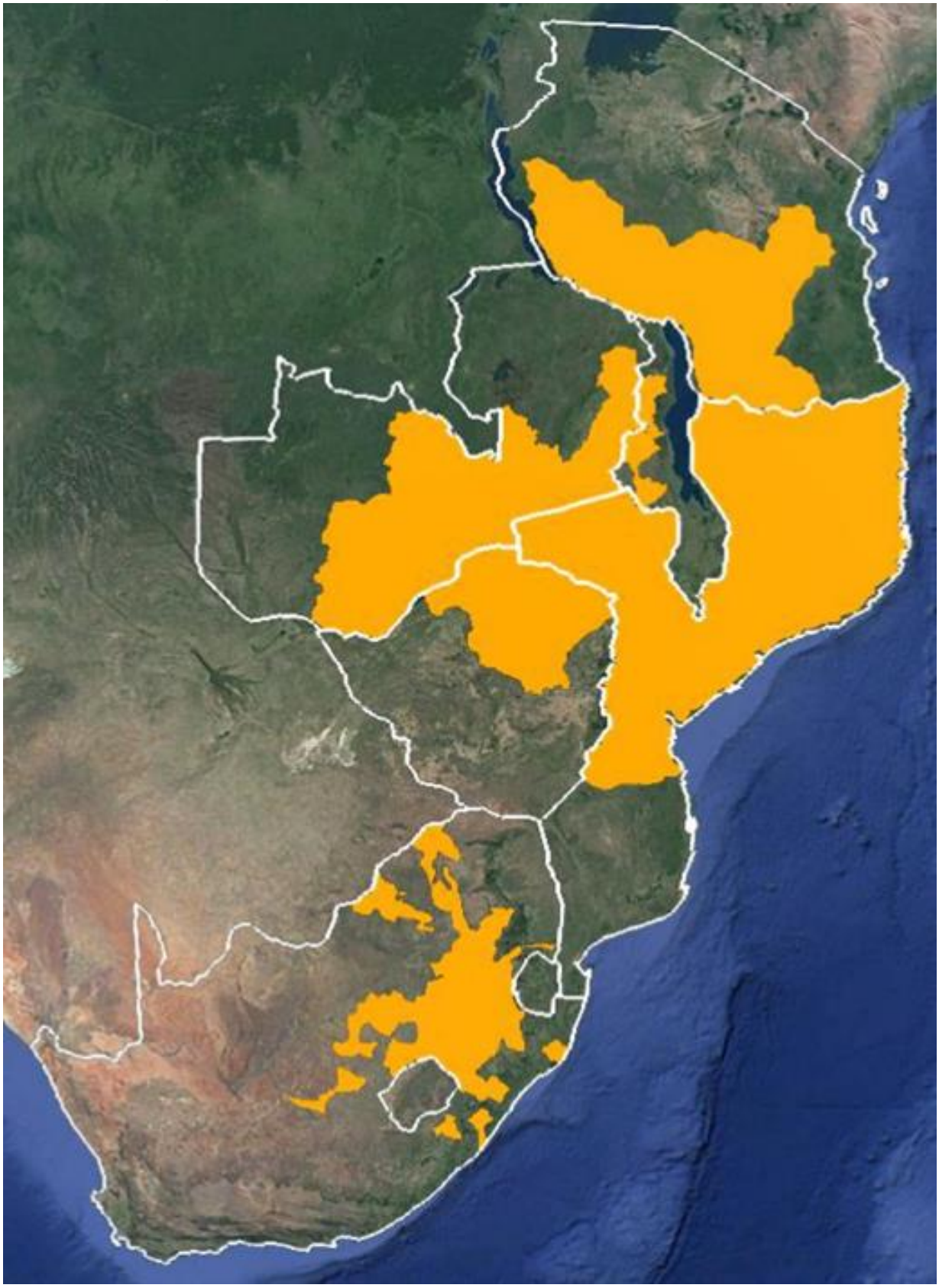
Source: Google Earth

Appendix 2: Maize Production in Selected Southern and East African Regions



Source: Compiled from other sources

Appendix 3: Soybean Production in Selected Southern and East African Regions



Source: Compiled from other sources

Appendix 4: Maize Trade Balance in the Southern and East Africa Region

Malawi					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-9,276**	**-30,482**	**-135,839**	**-11,606**	**6,984**
Mozambique	-1,556	-332	874	2,067	3,818
South Africa	-333	-94	469	-308	925
Tanzania	729	-77	-2,987	527	36
Zambia	-10,102	-31,025	-96,910	-8,989	212
Zimbabwe	1,545	1,046	1,508	1,530	961
SEA	**-9,717**	**-30,482**	**-97,046**	**-5,173**	**5,952**
Mozambique					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-24,157**	**-28,629**	**-53,091**	**-41,769**	**-40,844**
Malawi	-52	-42	-469	-3,029	-3,425
South Africa	-32,557	-26,506	-28,732	-22,164	-33,532
Tanzania	0	0	-640	29	11
Zambia	-3,018	-1,667	-3,519	-1,213	-556
Zimbabwe	10,636	-98	-25	1,507	-135
SEA	**-24,991**	**-28,313**	**-33,385**	**-24,870**	**-37,637**
South Africa					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**565,537**	**57,757**	**-295,808**	**338,650**	**408,765**
Malawi	340	130	399	258	-903
Mozambique	32,654	28,930	25,592	17,691	18,060
Tanzania	363	773	652	4,413	2,484
Zambia	2,617	-3,723	-1,976	5,857	1,157
Zimbabwe	86,292	4,098	106,495	62,773	3,155
SEA	**122,266**	**30,208**	**131,162**	**90,992**	**23,953**
Tanzania					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**87,518**	**-18,760**	**8,480**	**-39,371**	**22,183**
Malawi	-512	-132	1,361	-486	-73
Mozambique	0	0	1,318	-37	0
South Africa	-1,050	-1,559	-986	-6,229	-2,691
Zambia	-16,168	-11,911	-8,640	-29,297	-16,708
Zimbabwe	0	0	0	-153	-96
SEA	**-17,730**	**-13,602**	**-6,947**	**-36,202**	**-19,568**
Zambia					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**60,697**	**198,126**	**182,197**	**93,886**	**41,905**
Malawi	10,063	25,917	28,635	6,771	-291
Mozambique	1,722	1,998	3,377	602	8
South Africa	-1,240	6,496	2,359	-1,069	-312
Tanzania	10,024	9,354	8,575	30,073	13,964
Zimbabwe	22,947	143,448	128,534	9,015	5,668
SEA	**43,516**	**187,213**	**171,480**	**45,392**	**19,037**

Zimbabwe					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-113,958**	**-173,401**	**-295,700**	**-112,432**	**-44,081**
Malawi	-1,771	-1,253	-1,839	-734	-1,736
Mozambique	-2,703	160	159	-8,464	789
South Africa	-77,120	-4,042	-95,554	-57,700	-19,792
Tanzania	No Data				
Zambia	-19,260	-168,713	-91,670	-8,511	-5,375
SEA	**-100,854**	**-173,848**	**-188,904**	**-75,409**	**-26,114**

Source: National Statistical Office of Malawi, Instituto Nacional de Estatística (Mozambique), South African Revenue Services, National Bureau of Statistics (Tanzania), Central Statistics Office (Tanzania), UN Comtrade (Zimbabwe)

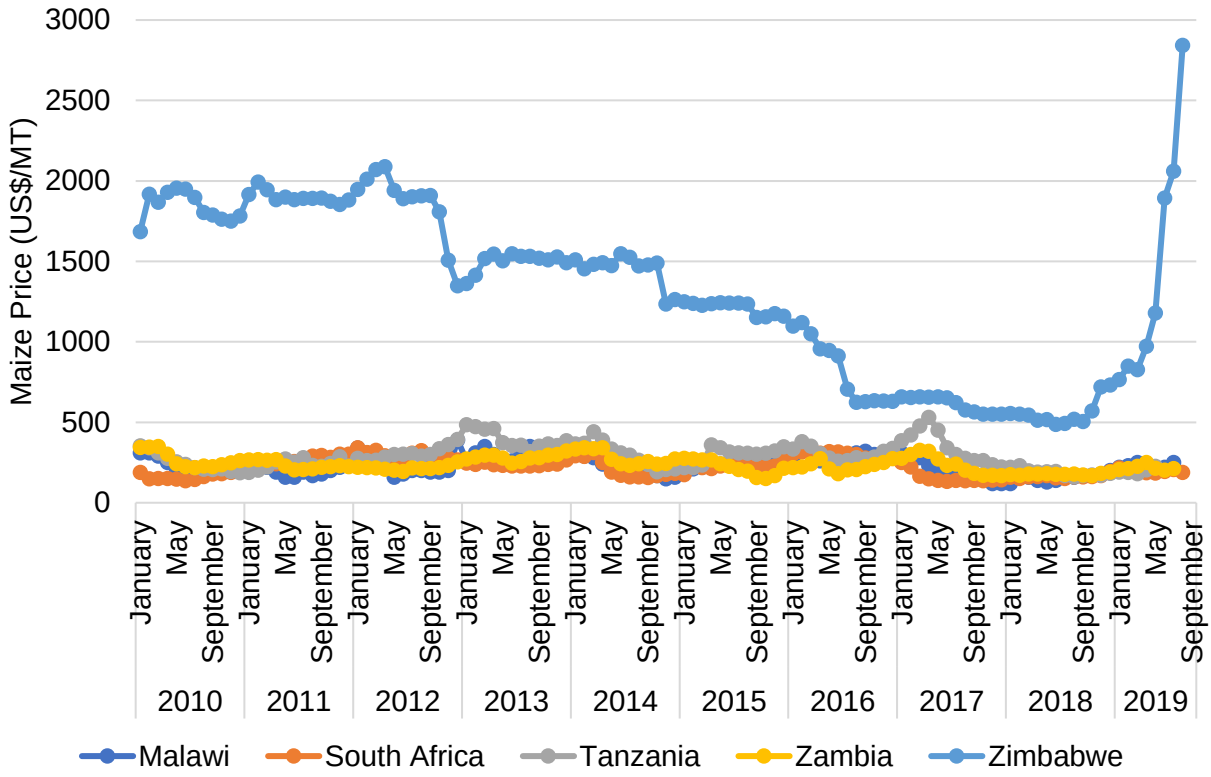
Appendix 5: Soybean Trade Balance in the Southern and East Africa Region

Malawi					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**13,773**	**5,418**	**8,375**	**11,901**	**22,251**
Mozambique	-47	20	-194	-31	88
South Africa	3,083	568	-15	1,891	886
Tanzania	141	58	1	1,062	126
Zambia	837	934	515	0	1,258
Zimbabwe	5,784	3,695	359	6,624	5,099
SEA	**9,798**	**5,275**	**666**	**9,546**	**7,457**
Mozambique					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**17**	**-2,251**	**-2,709**	**-807**	**-63**
Malawi	31	97	148	29	90
South Africa	-353	-2,214	-1,690	-858	161
Tanzania	No Data				
Zambia	No Data				
Zimbabwe	-126	-71	0	0	-176
SEA	**-448**	**-2,188**	**-1,542**	**-829**	**75**
South Africa					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-50,395**	**-48,556**	**-98,563**	**-9,244**	**10,840**
Malawi	-3,626	-551	45	-1,526	-855
Mozambique	186	1,916	1,049	612	-235
Tanzania	0	0	0	2	-90
Zambia	-15,463	-1,752	-959	-8,662	-1,275
Zimbabwe	-16	126	2,380	26	2,532
SEA	**-18,919**	**-261**	**2,515**	**-9,548**	**77**
Tanzania					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-790**	**-529**	**-3,061**	**652**	**1,451**
Malawi	-69	-66	0	-719	-344
Mozambique	No Data				
South Africa	35	0	0	200	411
Zambia	-41	0	-298	-222	-308
Zimbabwe	No Data				
SEA	**-75**	**-66**	**-298**	**-741**	**-241**
Zambia					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**13,310**	**5,493**	**3,223**	**44,590**	**3,884**
Malawi	-560	-966	-353	-2	-7
Mozambique	15	0	0	0	0
South Africa	5,020	1,110	1,060	10,263	1,247
Tanzania	0	0	337	228	209
Zimbabwe	6,844	4,234	706	26,827	1,670
SEA	**11,319**	**4,378**	**1,750**	**37,316**	**3,119**

Zimbabwe					
	2014	**2015**	**2016**	**2017**	**2018**
World ($ '000)	**-7,750**	**-8,494**	**-5,020**	**-29,031**	**-8,533**
Malawi	-4,376	-3,565	-2,266	-5,968	-4,156
Mozambique	410	71	18	15	250
South Africa	0	-60	-2,435	149	-2,740
Tanzania	0	0	0	0	0
Zambia	-3,783	-4,940	-355	-23,256	-1,880
SEA	**-7,749**	**-8,494**	**-5,038**	**-29,060**	**-8,526**

Source: National Statistical Office of Malawi, Instituto Nacional de Estatística (Mozambique), South African Revenue Services, National Bureau of Statistics (Tanzania), Central Statistics Office (Tanzania), UN Comtrade (Zimbabwe)

Appendix 6: Monthly Maize Prices in Southern and East African Economies, 2010-2019 (Including Zimbabwe)



Source: FAOSTAT (Malawi, Tanzania, Zambia, Zimbabwe), SAFEX (South Africa), VAM (Mozambique)