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Evaluating Policy Options for Strengthening the Resilience of the Zimbabwean Economy to Higher Food and Fuel Prices

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Abstract

After experiencing a decade-long recession, the Zimbabwean economy is now on a recovery path. However, economic recovery efforts in the country may be hampered by international market shocks particularly increases in global food and fuel prices. Since Zimbabwe is a net importer, higher food and fuel prices are likely to have a negative impact on the economy. This paper aims to identify potential policy responses to help mitigate the negative impacts of higher food and fuel prices in Zimbabwe. Understanding the impact of economic policies in the presence of external market shocks is critical for the design of policies aimed at strengthening the economy's resilience to these kinds of international commodity price rises. We analyse the impact of higher international prices on the Zimbabwean economy using a multi-region, multi-sector computable general equilibrium model, known as the Global Trade Analysis Project (GTAP) model. We enhance the standard GTAP model using MyGTAP to incorporate household survey data for Zimbabwe into the model, facilitating richer and more comprehensive analysis on different households within the economy. Our preliminary model results suggest that some macroeconomic variables such as real GDP are likely to decline as a result of the food and fuel price shocks, with urban households tending to suffer more from such shocks. To the extent that there is unemployment of unskilled labour, sensitivity analysis of our results suggests that the overall adverse impacts of the international price increases may be even more severe. Policies that remove tariffs, improve agricultural productivity, or reduce trade transaction costs appear potentially important for cushioning the Zimbabwean economy from higher world prices.

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[1] The findings, interpretations and conclusions expressed herein are those of the authors and do not necessarily reflect the view of the World Bank Group, its Board of Directors or the governments they represent. Contact author is Godfrey Mahofa Godfrey.Mahofa@uct.ac.za.

1. INTRODUCTION

The Zimbabwean economy has experienced an economic crisis and a decade-long recession. During this period the country experienced hyper-inflation, reaching an estimated monthly rate of 79.6 billion percent in mid-November 2008 – the second highest inflation in world history (Hanke and Kwok, 2009). Zimbabwe suffered continued periods of negative real Gross Domestic Product (GDP) growth, massive devaluation of the currency, low productive capacity utilization (below 10 percent for the manufacturing sector), high levels of unemployment, food shortages and massive de-industrialization (Ministry of Economic Planning, 2009). Although now on a recovery path, GDP per capita in 2010 remained lower than that which prevailed during the 1980s and the country is still one of the poorest in Southern Africa (World Development Indicators, 2012). Most of the important sectors, including agriculture and mining, experienced sharp declines in growth rates and the fiscal situation also deteriorated. Even prior to the recent economic crisis, there were worrying increases in poverty in Zimbabwe, with the national headcount poverty ratio more than doubling from 35% in 1993 to 72% in 2003 (World Development Indicators, 2012). Although the proportion of households below the poverty line in urban areas remains lower than in rural areas, even urban poverty increased strikingly from 8% in 1993 to 42% in 2001 (World Bank Development Indicators, 2012).

These general trends in development indicators can be viewed against a background of political instability and adoption of poor economic and agricultural policies by the Zimbabwean government. Since the end of 1997, the economy of Zimbabwe started to deteriorate sharply, following the Government's involvement in the Democratic Republic of Congo conflict and payments of packages to liberation war veterans. This unbudgeted expenditure resulted in the crash of the Zimbabwe dollar in mid-November 1997 and prices of commodities started to increase. Also during this period the government embarked on the controversial Fast Track Land Reform Programme, which destroyed the agricultural sector, resulting in increased food insecurity and poverty. The

problems were increased by the withdrawal of multilateral and bilateral donor support to the country in early 2000.[2]

In 2008, the signing of a Global Political Agreement between the two main political parties and adoption of a multicurrency system brought a new era in the economy of the country (Ministry of Economic Planning, 2009). The parties agreed to restore economic stability and growth through implementing an economic recovery strategy and plan. However, despite significant improvements in economic policies, important policy challenges and vulnerabilities remain in trying to address economic problems (IMF, 2010). Since 2006 the prices of food and fuels in international markets have been on the increase and the prices have remained highly volatile (FAO, 2012). These price rises and volatility pose a significant threat to the economic recovery process in Zimbabwe.

High food and fuel prices in international commodity markets will impact on the functioning of the economy, since Zimbabwe is dependent on revenue from exports of agricultural products and also on imported commodities for intermediate and final use. Fuels, food, machinery, chemicals, manufactured goods, transport equipment and passenger cars accounted for a large share of imports in 2011 (Ministry of Finance, 2011). Rising world prices in key commodities may cause a negative terms of trade effect for an import dependent country like Zimbabwe, with consequences for the balance of payments and the rest of the economy.

The World Bank (2008) noted that there are various factors which determine whether high food prices would improve or worsen the situation of particular households. First, the impacts of high prices will differ across households in a country, depending on whether they are net producers or consumers of the commodity concerned. Net producers of food are expected to gain from high prices whereas net consumers will tend to suffer. High prices therefore affect urban and rural households differently, with the overall impact depending on whether the gains to net producers outweigh the adverse impacts on consumers (Ivanic and Martin, 2008). Second, the impact also

[2] See Coomer and Gstraunthaler (2011), Chitiga and Mabugu (2008) for discussion of these and associated issues impacting the Zimbabwean economy.

depends on the products involved. If products consumed by poor households have increased in price, we expect greater damage to poor households. Third, the patterns of household incomes and expenditure will determine the poverty impacts of higher prices. Low income households spending most of their income on food will be hurt more by increased food prices than high income households which spend a lower proportion of their budget on food items.

Finally, the policy responses of government have an important bearing on how different households will be affected by higher prices. Recent historical experience does not seem to indicate that useful policies were put in place to protect Zimbabwe households from commodity price increases. For example, following the increase in world prices of commodities in 2007, the Government of Zimbabwe imposed price controls on basic food items. However, during this period up to the end of 2008, the country was experiencing hyperinflation caused by quasi-fiscal operations undertaken by the Central Bank and these policy responses were probably an attempt to curb domestic inflation. In the fuel market, the government officially controlled the distribution of fuel at controlled prices to government institutions and selected individuals. This resulted in the creation of a black market, where fuel was available at high prices reflecting world prices.[3]

After the formation of the Government of National Unity and adoption of a multi-currency regime in 2009 (Mutengezanwa et al. 2012), the government liberalized grain markets, but policy inconsistencies still prevail. For example, in 2012 the government imposed tariffs on selected foodstuffs such as vegetables, maize-meal, cooking oil, flour and rice. Regional import tariffs on agricultural products such as potatoes, tomatoes, onions and other related products were increased from 10% to 25% (Ministry of Finance, 2011). These tariffs are mainly directed at imports coming from South Africa. The government also continues to intervene in the fuel market and recently there was an increase in excise duty on diesel and petrol. The excise duty on diesel and petrol was increased from 16 and 20 cents per litre to 20 and 25 cents per litre respectively, with effect from 1 August 2012 (Ministry of Finance, 2012). This increase in excise duty on the back of volatile international oil markets may have a negative impact on the economy. Higher

[3] See Jones (2010) and IMF (2008) for further discussion of these issues.

fuel prices will result in market wide price adjustments, including due to the increase in transport cost, which in turn will jeopardize the recovery of an already fragile economy. The impacts are likely to be exacerbated by power shortages, since most companies will have to resort to generators. This is because the capacity of the country to generate electricity for use in industry was destroyed because of the economic recession which damaged infrastructure.

To improve policy in Zimbabwe, there is need for a clearer understanding of the effect of various policies on the economy in the presence of external market shocks. Research examining the impact of world market shocks on the Zimbabwean economy and possible policy responses is scant. This has exacerbated the inability of policymakers in government to come up with clear economic policies.

The current study examines the impact of higher food and fuel prices on the Zimbabwean economy and evaluates policy options that may be used to mitigate the impact of such shocks. We also consider the distributional impacts of policy responses by examining impacts on different types of households.

2. IMPACT OF HIGHER FOOD AND FUEL PRICES

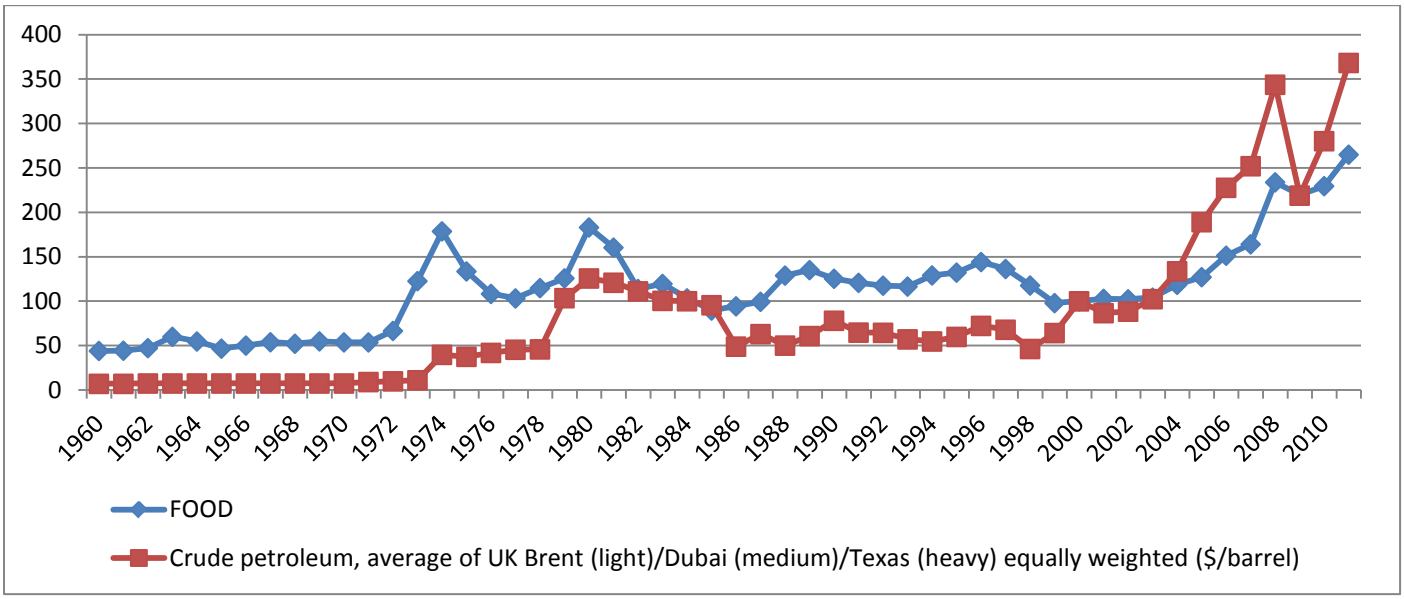
2.1 Trends in Commodity Prices

Since 2006 the prices of main staple food crops such as maize, wheat, and rice have increased in world markets. According to the FAO, food prices rose by 7% in 2006 and 27% in 2007, and the increase continued until the first half of 2008. Figure 1 below shows the trends in prices of fuel and food in international markets. Generally world prices of fuels and food have been on the increase since the 1960s, and in 2008 commodity prices reached the highest level. In 2010, the FAO food price index was above the 2008 peak suggesting that the trend is still there. The prices of commodities such as cereals, oils and sugar contributed much to the increase in the food price index (FAO, 2010). Some projections also show that real commodity prices are likely to remain high for the next decade. Also prices of crude oil have been on the increase

recently, reaching an all-time high of above $144 per barrel in July 2008 from a low of $20 per barrel in December 2001. Anderson and Strutt (2012) discuss a range of alternative views on long-term international agricultural prices. Their own core projection to 2030 allows the price of farm products to be only slightly higher than their 2004 baseline prices, however they also model the potential for significant increases in primary product prices under alternative scenarios over the next few decades.

There are a number of developments in international commodity markets which help to explain significant fluctuations in prices; chief among them is the positive relationship between food and oil prices. This is related to policies recently set by some countries which encouraged the use of maize and other oil crops for the production of biofuels (Ogg, 2010). Biofuels production could raise future prices of maize and other crops by 72% (Rosengrant et al., 2008) as encouraging the use of these crops to produce fuel will raise prices of food since the supply of food in the market will decline. Ogg (2010) noted that if oil prices move upwards towards $160 per barrel, subsidized production of biofuels will increase and the amount of crops produced for food would decline, resulting in increase in the price of food. On the other hand if oil prices fall below a certain threshold of say $40 per barrel, maize prices will also fall because oil is now affordable and there is no need to encourage biofuels production to substitute for the expensive oil. Other factors contributing to the increased volatility in commodity prices are; (1) strong demand in emerging economies such as China, India, South Africa and Russia, although softening recently, (2) a decline in oil production, and (3) rising production costs and unfavourable weather conditions due to climate change (Ogg, 2010). Productivity declines in the agricultural sector are also considered one of the factors contributing to the rise in prices (Headey and Fan, 2008).

Figure 1: Trends in World Food and Fuel Prices (Commodity Price indices, 2000=100)



Source: UNCTADSTAT (2013)

These high prices have caused havoc in net food and oil importing countries such as Zimbabwe. Because of the decade long economic recession, many people have been made particularly vulnerable to such international shocks. Domestic price increases induced by world price shocks are likely to drive more people into poverty since most people spend a large portion of their income on basic food items. The future outlook is that world market prices are likely to remain significantly higher than 2004 levels and there are calls for policy responses to manage such high prices which may have a negative impact on economic recovery prospects of Zimbabwe.

2.2 Impacts of higher commodity prices

A number of researchers have studied the impact of higher international prices of commodities on economies of different countries. One would expect that since most developing countries like Zimbabwe are agricultural production focused, increases in prices of these commodities in international markets would benefit the country and also rural farmers. Agriculture in Zimbabwe is the main economy activity and will continue to be so in the foreseeable future. Agriculture contributed only around 16 percent of GDP

in 2011. However, the most recently available data for 2005 indicated that the sector provided employment for almost 65 percent of the population at a time when agriculture was still contributing less than 20 percent to GDP (World Bank, 2012), and about 60 percent of all raw materials for the industry. If a country is a net exporter of these commodities the country can reap the benefits of high prices, but despite being an agricultural based economy it turns out that, like many developing countries, Zimbabwe is a net importer of food.

The likely impact of price increases on vulnerable developing countries is not yet clear, but in the short run these countries are likely to lose out. The IMF (2008) examines the balance of payments and fiscal balance effects of higher food and fuel prices on low-income African countries and also explores possible policy responses to protect such economies. Using a descriptive approach where they characterised countries according to the extent of the shock, policy responses and the success of such policy adjustment, the IMF study found that the impact of higher prices on the balance of payments is large on average but the incidence is country-specific, depending on initial conditions and trade patterns. Their results indicate that Zimbabwe was one of the countries hardest hit by the price increases.

The Ministry of Finance (2011), documents the impact of international commodity prices on the Zimbabwean economy. They show that there are some positive benefits to be obtained from higher prices of tobacco, cotton and other mineral commodities, which has seen the agricultural and mining sectors growing faster than other sectors in recent years. However, higher prices of food and fuel have resulted in unsustainable trade and current account deficits (Ministry of Finance, 2011). The Ministry of Finance also documents some of the policy responses to cope with such shocks. The policies recommended include; (1) value addition - since the prices of valued added products are assumed to be more stable, (2) product and market diversification to avoid reliance on a few commodity exports and markets, (3) building reserves and macroeconomic stability. However, the problem with this descriptive analysis is that there is no quantitative examination of the impact of price shocks on the economy in the presence

of such policies. There is need for a quantitative analysis which assesses alternative policy responses and presents clear policy recommendations.

Diao et al. (2002) conducted a quantitative analysis of the impact of declines in world prices of tobacco on the Zimbabwean economy using a computable general equilibrium model. They found that declines in prices of tobacco will have a negative effect on the economy through depreciation of the exchange rate, decline in tobacco exports and also increase in the consumer price index. Other studies elsewhere in the developing world have shown that higher world prices of commodities have a negative impact on economic performance. Ivanic and Martin (2008), using cross-country data from several low income countries, showed that high food prices had a negative effect on developing countries. Arndt et al (2008) analyse the impact of higher food and fuel prices on the Mozambican economy using a computable general equilibrium model, finding that the impact of fuel price shocks dominates from both the macroeconomic and poverty perspective. This finding suggests that fuel price changes are important and policies should be adopted to deal with such shocks. They consider possible trade policies, subsidies, and improved agricultural technology policy responses to help insulate the country from international price shocks. Conclusions from their study highlight the importance of the agricultural production response in general and export response in particular. This emphasises the importance of considering policy options that improve productivity and the competitiveness of the economy.

Fofana et al. (2008) examine the impact of policy responses on the South African economy to a US$10 exogenous increase in oil prices. Using a computable general equilibrium model linked to a micro-simulation household model they find that GDP would decline by 2%, while the budget deficit and unemployment increases. They also find that poverty increases, but the effect differs across different households. The poorest are severely affected and rural households who depend on income transfers are less affected. Their study documents the impact of various policy responses to oil price shocks on the South African economy and different household groupings in the country, noting there are differential impacts across different households. The implication of these findings is that for other countries in Africa, policy responses to

prices shocks might have a different impact on different types of households. Thus it is important for Zimbabwe to try to assess the differential impacts of policy responses to shocks on households.

The above studies provide useful insights on the impact of higher commodity prices on Zimbabwe and other developing countries. However, studies in Zimbabwe have concentrated on the macroeconomic impacts and have not analysed alternative policy responses to such price shocks. Also, most of the studies have been descriptive rather than quantitative analysis of impacts and possible policy responses. Given the persistence of food and fuel price shocks there is need to come up with clear policies to protect the economy and people of Zimbabwe. Therefore the current study simulates domestic policy response packages to higher food and fuel prices, including assessing distributional impacts of such policies on different households.

3. EMPIRICAL FRAMEWORK

3.1 GTAP Model and Projections to 2015

To capture the effects of price shocks and potential policy changes on the economy and households, it is necessary to use an economy-wide framework which takes into account complex interactions between factor incomes and prices in determining outcomes at the household level. Increases in the price of food and fuel will also change the country's terms of trade and this will affect the whole economy and fuel, in particular, will tend to increase production costs throughout the economy. Since food and fuel price changes will have complex effects on economic performance, we adopt a general equilibrium approach to undertake this analysis.

We use the Global Trade Analysis Project (GTAP) model, a multi-region, multi-sector computable general equilibrium model (Hertel, 1997), along with MyGTAP to facilitate modelling of multiple household types (Walmsely and Minor, 2012). This model is used with the GTAP version 8 data base, which has a base year of 2007 for 129 countries or regions and 57 sectors (Narayanan et al. 2012). We aggregate the database into 18

sectors and 13 regions, representing regions and sectors of particular importance to the Zimbabwean economy and poor households (see Appendix Tables A1 and A2 for details of the database aggregation we use). Use of this global general equilibrium model enables examination of the general equilibrium and open economy impacts of higher food and fuel prices on the Zimbabwean economy. Our analysis will trace the impacts on output of different sectors of the economy, prices of commodities, terms of trade, balance of payments position and implication for factor returns.

Our analysis is forward looking, thus we first project the world economy to 2015, following a similar approach to that employed in Anderson and Strutt (2012) and other studies. Over the period from our baseline of 2007 to 2015, we assume that national real GDP, population, unskilled and skilled labor, capital, agricultural land, and extractable mineral resources (oil, gas, coal and other minerals) grow at exogenously set rates, following assumptions detailed in Anderson and Strutt (2013). We pay particular attention to ensure that the pattern of trade and production appropriately reflects the Zimbabwean economy, including adjusting the key export sector of minerals and metals.[4]

From this projected 2015 database, world price increase scenarios are modelled, then combined with a range of policy scenarios to evaluate impacts for the overall economy as well as particular household-types. Trade liberalization is a potential policy response to international price volatility that, while likely to lead to overall benefits to the economy, may impact household types in different ways and we explore these impacts. Reducing a range of barriers to regional trade of basic staples is likely to be of particular importance within Africa (World Bank 2012a). Policy measures to improve trade facilitation as well as agricultural productivity in Zimbabwe will also be explored. There is significant potential to improve agricultural performance in Zimbabwe, which may help to cushion the economy from adverse impacts of international commodity prices.

[4] Where exports in the 2007 database are about 54% of total Zimbabwe exports, which is in marked contrast to the average level of about 30% over the 8 years from 2002, which seems a more credible share of Zimbabwe exports for 2015.

3.2 Splitting Zimbabwe Households using MyGTAP

Since this study aims to evaluate potential policy responses to higher world prices of food and fuel, including assessing the distributional impacts of such polices, we supplement the GTAP database with national household survey data for Zimbabwe to split households.[5] This facilitates a richer and comprehensive analysis of increased commodity prices on different households within the economy, providing a platform to evaluate various policy options that may be used to cushion the overall economy and particular household types from global market shocks.

We split households and factors using the 2001 household income and consumption survey data from Zimstat (Central Statistics Office, 2005). For consumption splits we use information on average annual household consumption by sector and commodity groups, with consumption shares calculated from this information. We map these as closely as possible to the GTAP sectors we model, however, it should be noted that commodity groupings provided by the survey do not exactly match those in the GTAP aggregations.[6] We also use data from the 1991 Zimbabwe Social Accounting Matrix (SAM) for splitting factors. The 1991 SAM has 27 sectors, 9 factors (4 labor categories, 3 capital and 2 land) and 5 household groupings. In terms of the factors, the 4 labour categories in the SAM are: 1) large scale unskilled workers, 2) unskilled formal labour, 3) unskilled informal labour and smallholder, and 4) skilled labour. Capital is divided into: 1) capital large scale, 2) capital smallholder, and 3) other capital. In the current study, given consumption data limitations, we are only able to split households into two categories: rural and urban. In terms of factors of production, we split labor into 4 categories of unskilled rural, unskilled urban, skilled rural and skilled urban. We split capital into two categories of agricultural capital which comprises capital large scale and smallholder, and other capital. Land and natural resources are not split in the current study.

[5] Initially using a historical social accounting matrix combined with available published data. However, if the 2009 household survey data become available for Zimbabwe, we will update to incorporate this.

[6] With a particular limitation being that food is aggregated into one sector in the report, while our GTAP aggregation, there are various categories of food including wheat, grains and livestock products

The split data is used in conjunction with a recently developed extension tool for the GTAP model, which facilitates the incorporation of multiple household types for a particular country (Walmsely and Minor, 2012). Under this approach, we replace the standard GTAP regional household for Zimbabwe with multiple private households and a separate government, with private household expenditure modeled using a Linear Expenditure System (LES) specification.[7] Data from Mabugu and Chitiga (2008) are also used to define factor ownership shares of the two households, with these factor ownership shares useful for determining disposable incomes.

4. Empirical results and discussion

The purpose of this section is to discuss the experiments conducted and the results from the simulations. We begin by characterizing the two price and five policy shocks. We then present and discuss the results from these simulations. Results are discussed in terms of overall impacts in the economy and the differential impacts on different household types. Analysing results according to the type of households has important implications for policies aimed at improving inclusive growth.

4.1 Commodity price shocks

The shocks are conducted in such a way that we simulate what would happen in 2015 if commodity prices where to increase in magnitudes similar to 2007-2008 world price increase. Various studies have documented the magnitude of price changes during the 2007-2008 period, with many studies reporting a world price increase of more than 70 percent (Arndt et al., 2008; World Bank, 2008; Headey and Fan, 2008; Ivanic and Martin,2008). However, there is high degree of uncertainty on where prices will be in the next ten years. We adopted lower magnitudes of price changes, as shown in Table 1, since most of those reported in the literature are in nominal terms but real prices may also remain high over the next decade. According to OECD-FAO (2011) projections, there are several factors that will put pressure on prices of commodities. Projections of

[7] Contrasting with the approach, for example, of Ahmed et al. (2011), which considers the impact of climate volatility on poverty in Tanzania by following earlier work by Hertel et al. (2004) to estimate changes in income and consumption of households in the neighborhood of the poverty line

input costs suggest that they are likely to increase, because energy and feed related costs have been on the increase. Also productivity growth is slowing in comparison to the previous decade. The slower growth in productivity, coupled with increased demand in food, will put an upward pressure on prices.

We consider two commodity price increase scenarios: 1) agriculture and food price shocks, and 2) a shock to petroleum products to proxy a fuel price increase. Table 1 shows the magnitude of the shocks to be implemented for various commodities. We model these price increases as exogenous changes in world prices, resulting from global productivity reductions in these sectors.[8]

Table 1: International Price Shocks

Commodity	World price increases (%)
Rice	70
Wheat	70
Other Cereal Grains	60
Sugar	40
Veg & fruit, oilseeds, plant fibre	25
Other crops	25
Dairy prods and raw milk	40
Meats and other livestock	25
Processed Food	40
Petroleum and coal products	70

Source: Authors' assumptions, as explained in the text.

4.2 Policy responses

To analyse the impact of policy responses on the economy and households, we combine the price shocks described above with a range of policy scenarios. For policy scenarios we simulate the removal of all import tariffs on agricultural products in Zimbabwe from all regions and also a movement towards improved market access by lowering trade transaction costs. To analyse improved market access through reductions in transaction costs we lower the effective price associated with delivery of

[8] Appropriate closure rules are implemented in order for us to shock world prices. Since prices are endogenous in the GTAP model, we swap the appropriate world prices with world sectoral productivity to exogenize the world price of the relevant tradable commodities in Zimbabwe.

products from different regions in Sub-Saharan Africa, since greater economic integration implies prices of commodities between countries will converge. Reducing transaction costs has been found to be important in facilitating participation in markets, hence encouraging agroprocessing and value addition (Diao et al., 2008). We also model public investments in agricultural sector which will result in productivity growth. We assume that public sector investments in research and extension, institutions and infrastructure reform will increase sector productivity and improve resilience to market shocks. These public sector investments would lead to a change in productivity that will make Zimbabwe reach the average productivity in other developing and developed regions. Because of differences in productivity between sectors, we use different shocks for each sector, as shown in Table 2 below.[9] We apply these productivity increases to all production inputs in the respective sectors.

Table 2: Potential agricultural productivity increases modelled

Commodity	Productivity shock (%)
Rice	15
Wheat	15
Other Cereal Grains	15
Sugar	5
Veg & Fruit, oilseeds, plant fibre	10
Other crops	10
Dairy products and raw milk	10
Meats and other livestock	10
Processed Food	10

Source: Authors' assumptions, as explained in the text.

We consider five policy scenarios: four of which combine the world food price shock with policy responses and the fifth of which combines the world fuel price shock with a potential policy response:

[9] We calculated the change in productivity that might be required to reach regional and international productivity levels based on FAOSTAT data on yields. However, since the change in productivity required for most commodities was above 200 percent, we assume a gradual movement towards the best productivity level.

- The first policy scenario models the removal of all tariffs on agricultural and food products in Zimbabwe, combined with the world food price shocks. We assume a full removal of import duties on all agricultural food products coming into Zimbabwe. While this may currently be viewed as unrealistically ambitious, we explore it in an effort to better understand the potential for farm trade reform to cushion the Zimbabwe economy from the food price shocks.
- The second policy scenario considers the impact of a reduction in trade transaction costs within the Sub-Saharan Africa region, combined with a world food price shock. To model the effects of an improvement in trade facilitation measures, we implement an approach introduced in Hertel et al. (2001) which allows for a region-specific shift in the Armington import demand function, effectively lowering the foreign market price. This approach was used by Stone et al. (2012) to assess the impact of improved regional trade facilitation among Greater Mekong Sub-region countries, which we follow with a more conservative assumption that improved trade facilitation leads to an effective intra-regional import price reduction of 15%. Arguably this may still be much too optimistic an aim for a region such as Sub-Saharan Africa at present.
- The third policy scenario explores the impact of an increase in agricultural productivity, combined with the world food price shock. If policy measures are undertaken that improve the productivity of all inputs in the agricultural sector, these could alleviate some of the adverse consequences of the international food price rise. The specific total sectoral output productivity assumption improvements made are detailed in Table 2.
- The fourth policy scenario combines the first and third policy simulations to consider the combined impact agricultural trade liberalization and improved agricultural productivity improvement as a potential cushion against sharp rises in international food prices.
- The final policy scenario explores a trade liberalization response to the world price increase for petroleum products. In particular, we consider a 50 percent reduction in import duties on these products by Zimbabwe.

4.3 Overall impacts and assessment

Since Zimbabwe has a negative trade balance for some food commodities and also for petroleum products (Figure 2), higher world prices may be expected to result in negative terms of trade, with implications for balance of payments and the rest of the economy. Results of the price and policy experiments are shown in Tables 3-10.

The impacts of price shocks on macroeconomic variables are shown in Table 3 and 4. The increases in the world price of food commodities and fuel that we model result in the increase in the costs of imported food and fuel in the country. Increases in price of food only lead to real GDP falling by 4.2% in our results. This is largely driven by a drop in exports. Exports from the country fall by a large magnitude (-7.9%) and real imports increased by 4%. The increase in world fuel prices had a much larger impact on the demand for exports from Zimbabwe than for any other countries, implying substitution of demand to other export countries, since the price of exports from Zimbabwe increased by a large magnitude relative to average price of exports. The net fall in trade flows outweighs the increase in other components of GDP, hence GDP declines. Other rows of table 3 show the different impact of various commodity shocks on GDP and terms of trade. Results show that other crops, processed food and sugar had a relatively large negative impact on GDP compared to other commodities. Increases in prices of wheat and rice had a positive impact on GDP. The impact of increase in the price of fuel on GDP is less than the impact of the food price increase in our current simulations.

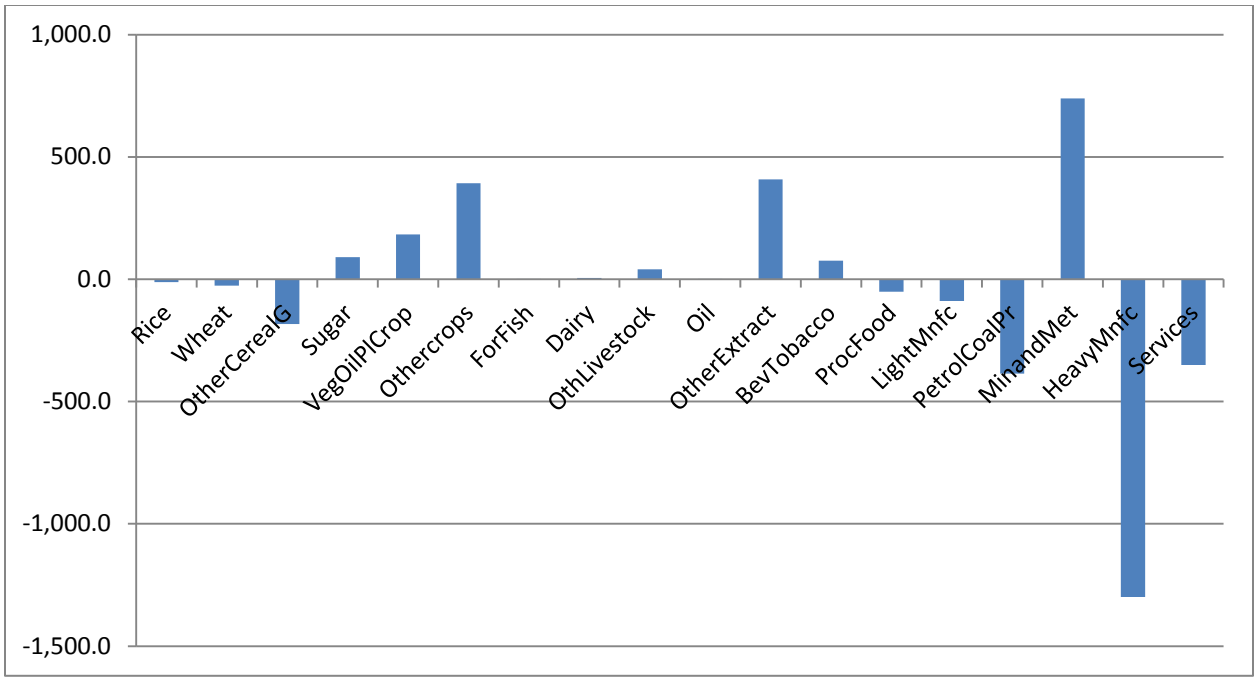


Figure 2: Trade balance by commodity in the initial database (million US dollars)

Source: Authors' 2015 projections from GTAP Version 8 database

Table 3: Impact of world price increase on the Zimbabwean Economy (percentage changes)

	GDP	Terms of Trade
Increase in world food prices	**-4.21**	**3.49**
Contribution of each food commodity price shock		
Other cereals	-0.34	-2.59
Rice	0.37	-0.27
Wheat	0.24	-0.33
Sugar	-0.98	0.99
Veg & fruit and oilseeds	-0.04	1.51
Other crops	-1.71	3.71
Dairy	-0.59	0.16
Other livestock	-0.25	0.44
Processed food	-0.91	-0.13
Increase in world fuel prices	**-2.35**	**-6.47**

Source: Authors' model results

The fuel price increase we model results in a 2.4% decline in GDP for Zimbabwe. Increases in the world price of fuel lead to a decline in domestic consumption and investment in Zimbabwe, resulting in a decline in GDP.

The food price shock improves Zimbabwe's terms of trade by 3.5%, whilst a fuel shock results in a 6.47% decline in terms of trade. An increase in world food prices pushes up the aggregate price received of goods exported from Zimbabwe by 7.3%, while the price paid for tradables imported by Zimbabwe increases by 3.6%. On the other hand the increase in world fuel prices increases the price received for exports from Zimbabwe by 2.7% but the price of imports increases by 9.8%, leading to the significant terms of trade decline in this scenario.

Table 4 shows the effect of commodity price changes on trade balances in Zimbabwe. The last row of column one shows the overall change in the trade balance as a result of increases in food prices. Overall, an increase in the world price of food increases net imports in Zimbabwe, leading to a reduction in the trade balance of US$359 million. Results indicate that the country will increase net imports of cereals, sugar and livestock products, while increasing net exports of oilseeds and other crops. Zimbabwe will also increase net imports of commodities from extraction, manufacturing and service sectors.

Further decomposition of results indicates that an increase in the world price of non food crops contributes most to the negative balance of trade (-US$159 million), whereas increases in world price of other cereal crops such as maize will increase net exports by US$11 million. Increases in the world price of dairy and livestock products will result in a US$80.6 million (32.7 + 47.9) increase in net imports.

In contrast, an increase in the world price of fuel leads to an overall increase in net exports in Zimbabwe (US$185 million). While petroleum and coal products contribute a $183m reduction to Zimbabwe's trade balance, this is more than offset by increases in other sectors, particularly minerals and metals, heavy manufactures and services. Since sectors such as other crops, wheat, and fruit and vegetables uses more of fuel relative to other sectors, increases in fuel prices led to a deterioration of trade balances of these sectors.

Table 4: Change in trade balance by commodity in Zimbabwe, US$ million

	Initial Trade Balance	Change in Trade Balance	
		Total Food effect	Fuel Shock
Rice	-12.1	-7.3	0.6
Wheat	-25.6	-20.3	-2.1
OtherCerealG	-183.6	-97.2	4.9
Sugar	89.8	-12.1	14.6
VegOilPlCrop	182.7	50.6	-4.7
Othercrops	392.9	101.8	-26.1
ForFish	0.7	-0.4	0.8
Dairy	5.5	-10.2	1.6
OthLivestock	41.0	-4.4	13.8
Oil	0.2	0.0	0.1
OtherExtract	407.7	-68.5	-1.5
BevTobacco	75.6	-12.5	13.0
ProcFood	-50.5	-18.0	25.9
LightMnfc	-88.6	-130.0	92.1
PetrolCoalPr	-385.6	-0.1	-182.8
MinandMet	738.9	-50.0	85.7
HeavyMnfc	-1,299.0	-64.6	86.1
Services	-350.4	-16.1	63.3
Total (X-M)	-460.2	-359.3	185.3

Source: Authors' model results

Higher food and fuel prices will have an effect on the pricing structure of different commodities and also on resource allocation, which in turn will have an effect on the output of different sectors of the Zimbabwean economy. The differential impacts on real sectoral production depend on whether the commodities are substitutes or complements with the sector experiencing a shock. If goods are substitutes and compete for resources, then an increase in the price of the other good will shift resources away from the other commodity towards the commodity experiencing a price increases. This is because an increase in the price of the other commodity will make it profitable to increase production of that good. Impacts on real output also depend on whether the product experiencing a shock is an important input in the production of commodities for that sector. If the sector uses more of the commodity experiencing a price increase, we would expect a decline in output of that sector since increases in prices will also increase production costs and hence reduce production. In addition, the

demand structure also contributes to the distributional structure of price shocks among sectors of the economy.

Table 5: Impact on Real Sectoral Output in Zimbabwe (percentage changes)

	Total Food effect	Effect of different commodity price shocks									Fuel Shock
		Other Cereals	Rice	Wheat	Sugar	Veg & Fruit, oilseeds	Other crops	Dairy	Other livestock	Proc. Food	
Rice	**4.3**	-0.6	26.9	2.2	-2.9	-4.8	-10.2	-3.9	-4.6	2.0	**-7.3**
Wheat	**-0.3**	-0.1	-0.6	-7.3	-0.7	-1.7	-4.6	-0.0	-0.5	15.3	**5.7**
Other Cereals	**0.8**	-3.6	0.2	-0.6	-0.2	1.5	1.8	0.0	0.4	1.4	**-4.0**
Sugar	**-17.9**	-0.4	0.2	0.5	-8.1	-2.0	-5.3	-1.7	-2.3	1.2	**7.2**
Veg & Fruit Oilseeds	**2.2**	-0.3	1.6	0.4	-0.4	4.4	-8.1	0.2	0.8	3.5	**-3.6**
Other crops	**-1.9**	0	1.9	1.3	-0.6	-1.5	-5.4	-0.1	0.1	2.5	**-5.1**
Forestry & Fish	**-5.5**	-2.7	0.0	-0.2	-0.7	0.1	-0.5	-0.6	-0.1	-0.8	**-5.3**
Dairy	**5.8**	-1.4	0.2	0.5	-0.6	2.4	4.1	2.5	0.3	-2.2	**-6.3**
Other Livestock	**1.0**	0.7	0.2	0.3	-0.7	0.4	-1.3	-0.1	3.8	-2.4	**1.7**
Oil	**-1.0**	0.2	-0.1	0.1	-0.0	-0.3	-0.1	-0.1	-0.3	-0.3	**9.1**
Other Extraction	**-6.1**	-0.2	-0.3	-0.1	-0.4	-1.4	-1.8	-0.6	-0.9	-0.5	**2.2**
Beverage & Tobacco	**-9.6**	-1.3	0.1	-0.8	-1.2	-0.8	-3	-1.5	-1.1	-0.1	**1.3**
Processed Food	**4.4**	1.4	0.4	-6.2	0.1	3.4	3.6	1.0	1.0	-0.1	**4.9**
Light Mnfc	**-7.4**	0.7	0.3	0.9	-0.0	-0.8	-7.1	-0.0	0.1	-1.5	**5.6**
Petroleum and Coal	**-1.0**	-0.8	0.0	0.2	-0.3	0.0	1.3	-0.3	-0.4	-0.89	**30.0**
Min and Met	**-3.7**	1.9	-0.5	0.3	0.0	-2.2	-0.6	-0.4	-1.3	-1.0	**5.3**
Heavy Mnfc	**-0.1**	3.3	-0.6	0.8	0.6	-1.8	1.3	-0.4	-1.6	-1.7	**10.6**
Services	**1.6**	-0.7	0.1	0.2	-0.0	0.7	1.5	0.1	0.4	-0.7	**-4.**

Source: Authors' model results

Table 5 above shows the results of the impact of price increases on real sectoral output in Zimbabwe. An increase in the world price of food leads to increased output of sectors such as rice (4.3%), other cereals (0.8%), vegetables & fruit (2.3%), dairy (5.8%) and other livestock (1.0%), processed food (4.4%), and services (1.6%). Much of the increase in output of these sectors is due to the increase in domestic sales. An increase in the price of food and agricultural products generally results in an increase of domestic sales and much of it is coming from the increased demand by firms in

Zimbabwe for intermediate domestic inputs as output expands. However, an increase in the price of food and agricultural products can lead to a decline in output of sectors such as wheat (-0.3%), sugar (-17.9%), other crops (-1.9%), forestry and fisheries (-5.5%), extraction (-6.1%), beverages and tobacco (-9.6%), light manufacturing (-7.4%), petroleum and coal products (-1.0%), minerals and metals (-3.7%), and heavy manufacturing (-0.1%). The decline in the wheat, other crops, and forestry and fish sector is mainly due to a decline in domestic sales. The increase in food prices has resulted in the increase in the domestic price of these commodities relative to their average price. Thus the decline in demand by domestic firms as a result of the substitution effect causes output to shrink in these sectors. For other sectors, the decline in output is mainly attributed to reduced demand for exports from Zimbabwe. This is because increased food prices have increased the prices of exports from Zimbabwe by a higher magnitude relative to the average world price of exports, causing a shift away from Zimbabwe exports to other cheaper sources.

Results in column 2 to 10 of table 5 also show that the effect of different commodity price shocks on sectoral output is varied. For example, much of the increase in rice output is coming from the increase in the world price of rice, which tends to be dampened by the impact of other commodity price increases. In contrast, the increase in the real output of other cereals comes from increases in world prices of other crops; vegetables, fruits and oilseeds; and processed food. Increases in output of the dairy, processed food and services sectors are largely driven by increases in world price of other crops. Declines in output of sectors such as sugar, other crops and wheat are largely driven by increases in world prices of that sector.

The increase in the price of fuel products is expected to have a negative impact on the sectors which use fuel intensively. Increasing the price of fuel will increase operational costs and hence result in a decline in output in some sectors of the economy. Results presented in Table 5 show a reduction in output in sectors such as rice, other cereals, vegetables, fruit and oilseeds, other crops, forestry and fisheries, dairy, and services.

With these changes in output of different sectors, prices of factors of production also change in the economy. Table 6 below shows the effect of world commodity price shocks on returns to factors of production, relative to the price index for private consumption expenditure, in Zimbabwe. An increase in the price of food and agricultural products will, not surprisingly, significantly increase returns to land in the whole economy. The stock of agricultural land is assumed fixed in our simulation, therefore as output expands in the sectors that use land intensively, this raises the price of land. Table 6 shows that the increase in the world price of the other crops sector has a particularly large impact on the return to land, relative to other food commodity price shocks. The other crops sector is a large agricultural sector that uses more than 50 percent of the agricultural land; therefore this sector has a particularly strong impact on the price of land. Increases in the price of sugar result in slight declines in returns to land. Other factors which gain are unskilled rural (21.6%) and agricultural capital (17.5%). Increases in output of agricultural and food sectors increase the demand for these inputs, thereby increasing returns to these factors. The contraction in output in manufacturing sectors leads to a fall in demand for unskilled and skilled urban workers, and also non agricultural capital. This causes the wage rates for unskilled urban and skilled urban to decline by 9.1% and 8.3% respectively.

On the other hand, an increase in the price of fuel will lead to a decline in returns to all factors of production except skilled rural workers. The real wage rate for skilled rural increases by 7.3% as a result of an increase in the price of fuel.

Table 6: Impact of price shocks on factor prices in Zimbabwe

	Total Food Effect	Effect of different commodity price shocks									Fuel Shock
		Other Cereals	Rice	Wheat	Sugar	Veg & Fruit oilseeds	Other crops	Dairy	Other livestock	Proc. Food	
Land	**100.4**	1.0	2.0	1.0	9.8	3.6	5.4	-0.5	23.2	43.3	**-17.4**
Unsk. Rural	**21.6**	1.0	1.2	0.2	1.5	0.5	1.5	0.9	5.2	10.9	**-3.0**
Unsk. Urban	**-9.1**	1.0	0.9	-0.1	-3.8	0.2	-0.2	-0.6	0.2	-2.2	**-12.6**
Skilled Rural	**-9.8**	1.0	0.9	-0.1	-1.8	-0.6	0.1	2.6	-2.2	-1.8	**7.3**
Skilled Urban	**-8.3**	1.0	0.9	-0.1	-4.2	0.2	-0.2	-0.7	0.5	-1.4	**-14.1**
Non Ag. Capital	**-8.8**	1.0	0.9	-0.1	-3.8	0.1	-0.5	-0.7	0.1	-1.9	**-12.0**
Agric. Capital	**17.5**	1.0	1.2	0.2	-1.0	0.8	0.4	2.4	4.8	7.3	**-2.0**
Nat. Resources	**-34.1**	1.0	0.7	-0.3	-2.3	-1.7	-0.2	-1.9	-7.1	-7.7	**14.2**

Source: Authors' model results

Policy Responses

In an attempt to evaluate policy options which might be used to cushion the Zimbabwean economy from higher prices, we consider scenarios combining the world commodity price shocks with various policy interventions, as described above.

The results of these scenarios are reported in Tables 7-10. Table 7 reports results of the impact of various policy options on macroeconomic variables. In the face of food and agricultural price increases, our results suggest that full liberalization of agricultural trade is not sufficient to offset the dampening impact of the world food price on real GDP for Zimbabwe. However, it should be noted that in the presence of this policy the decline in GDP (-3.9%) is lower than that experienced if no trade liberalisation policy is implemented (-4.3%). The country's real GDP increases if it eliminates all tariffs on agricultural products while also putting in place policies that enhance productivity in the agricultural sector. Also, reducing trade transaction costs in SSA will result in a significant increase in GDP and terms of trade will improve. Partial removal of duties on fuel will dampen but not completely offset the decline in real GDP due to a fuel product price shock, suggesting that a removal of duty on fuel will help cushion the overall economy from this external price shock.

Table 7: Impact of policy responses on macroeconomic variables

	GDP	Terms of Trade
Food Price + Agric trade liberalisation in Zimbabwe	-3.9	3.1
Food Price + Reduction of trade transaction costs in SSA	8.6	8.1
Food Price + Productivity Improvement in Zimbabwe	0.3	4.8
Food Price + Agric trade liberalisation and prod. improvement in Zimbabwe	0.6	4.4
Fuel Shock + Partial removal of duties on fuel in Zimbabwe	-2.0	-6.3

Source: Authors' model results

The effect of policy responses on trade balances is shown in Table 8. The decline in net exports is greater in the policy response simulations than it was when the food price shock is considered alone. However, in terms of sectoral trade balances, trade liberalisation and productivity improvement in the agricultural sector in Zimbabwe will lead to an increase in net exports of the other crops, vegetables, fruits and oilseeds, and sugar sectors. Also productivity improvement in the country will result in an increase in net exports in other livestock products, processed food, and sugar. A fuel shock and a partial removal of duties on fuel results in an increase in net exports from Zimbabwe ($81.3m). However, it should be noted that the increase in net exports in the presence of this policy is lower than without the policy ($185m). Therefore it appears that all of these policy responses tend to have a negative impact on the trade balance for Zimbabwe, relative to the price shocks alone.

The impact of policy responses on sectoral output is shown in Table 9. Results show that different policy interventions in Zimbabwe will have differential impacts on sectoral output. Some sectors will be favored by a particular policy while other will lose out. For example agricultural trade liberalisation in the presence of world price increases still results in decreases in output in almost all sectors, except services (1.8%); and vegetables, fruit and oilseeds (2.5%). Reduction in trade transaction costs in Sub-Saharan Africa (SSA) in the presence of higher world food prices particularly increases output of other livestock (18.6%), dairy (15.7%), minerals and metals (13.8%), forestry and fish (10.7%), and services (9.2%). Other sectors expand to a lesser degree, including rice (0.6%), other cereals (1.7%), vegetables, fruit and oilseeds (5.3%). The

increases in output are higher than if world food prices increase without reducing trade costs.

Column three shows that a productivity improvement in the presence of a food price shock in world markets had a larger effect on the output of rice (52.8%); wheat (28.4%); other cereals (15.0%); vegetables, fruit and oilseeds (13.8%); other crops (10.4%); dairy (20.5%); other livestock products (21.9%); processed food (24.9%) and services (4.3%). The increase in output in most of these sectors with the exception of vegetables, fruit and oilseeds and other crops is attributed mainly to increase in domestic sales because firms have increased demand for domestic intermediate inputs. In the case of rice, firms have been able to substitute domestic rice since the price of rice purchased in domestic markets has declined relative to the average price of rice. For other sectors, the increase in demand is due to the expansion of output. Manufacturing, minerals and metals, forestry and fisheries, and sugar sector recorded declines in output. Results also show that all policy interventions lead to a decline in output in sugar. This is due to a decline in export sales since other regions are sourcing imports of sugar from cheaper sources. However, the decline in sugar output in the presence of agricultural trade liberalisation and productivity improvement in Zimbabwe is lower in magnitude, relative to the case where food and agricultural prices only increase.

Table 8: Change in Trade Balance by commodity in Zimbabwe, in US$ million (policy responses)

	Food Price + Agric trade Liberalisation in Zim	Food Price + Reduction of trade transaction costs in SSA	Food Price + Productivity Improvement in Zim	Food Price + (agric trade liberalisation and productivity improvement in Zim	Fuel Shock + Partial removal of duties on fuel in Zim
Rice	-7.7	-8.7	-8.5	-9.0	0.4
Wheat	-15.3	-18.5	-18.5	-14.1	-1.8
Other Cereals	-98.1	-106.4	-109.7	-110.8	3.0
Sugar	-10.2	1.53	0.7	2.3	13.8
Veg & Fruit, Oilseeds	49.0	57.5	75.4	73.0	-4.8
Other crops	104.2	109.1	183.2	185.0	-20.1
Forestry & Fishery	-0.4	-0.9	-0.8	-0.8	0.7
Dairy	-23.2	-16.1	-1.5	-11.8	1.4
Other Livestock	-9.1	1.2	16.8	12.9	12.4
Oil	0.0	-0.0	-0.0	-0.01	0.1
Other Extraction	-65.8	-126.5	-77.4	-75.6	-0.1
Beverage & Tobacco	-11.5	-16.9	-19.7	-19.1	12.3
Processed Food	-60.6	-56.5	5.0	-39.7	21.3
Light Mnfc	-111.6	-285.0	-243.9	-227.3	55.8
Petroleum & Coal	-1.9	-9.8	-13.1	-14.8	-191.3
Min and Met	-48.7	171.0	-172.6	-170.1	72.0
Heavy Mnfc	-65.0	-242.2	-184.9	-184.1	56.5
Services	-19.5	-382.1	-132.9	-134.7	50.0
Total (X-M)	-395.4	-929.4	-702.3	-738.5	81.3

Source: Authors' model results

A combination of productivity improvement and agricultural trade liberalisation increases Zimbabwe's real output of rice (26.4%); wheat (19.3%); other cereals (14.3%); vegetables, fruit and oilseeds (13.9%); other crops (11.0%); dairy (13.3%), other livestock products (21.0%); processed food (12.2%) and services (4.5%).

The last column of table 9 shows the effect of a partial removal of duty on fuel products in the presence of higher world fuel product prices. Sectors such as other cereals; vegetables, fruit and oilseeds; other crops; forestry and fish; dairy and services benefit from the policy. This is because the fall in output is lower in these sectors when duty on fuel is removed than in the case where fuel price increases are only considered.

Table 9: Impact of policy responses on Sectoral Output (percentage changes)

	Food Price + Agric trade Liberalisation in Zim	Food Price + Reduction of trade transaction costs in SSA	Food Price + Productivity Improvement in Zim	Food Price + (agric trade liberalisation and productivity improvement in Zim	Fuel Shock + Partial removal of duties on fuel in Zim
Rice	-14.5	0.4	52.8	26.4	-7.7
Wheat	-8.7	-16.3	28.4	19.3	5.1
Other Cereals	-0.5	0.8	15.6	14.3	-3.2
Sugar	-16.7	-10.2	-9.5	-8.4	6.7
Veg & Fruit, Oilseeds	2.5	4.1	13.8	13.9	-3.6
Other crops	-1.2	-5.2	10.4	11.0	-4.5
Forestry & Fishery	-4.2	5.5	-1.3	-0.4	-4.1
Dairy	-3.7	12.4	20.5	13.3	-5.2
Other Livestock	-0.6	11.6	21.9	21.0	1.8
Oil	-1.0	-5.0	-2.5	-2.5	8.9
Other Extraction	-5.8	-9.2	-10.8	-10.5	1.9
Beverages & Tobacco	-8.4	-7.9	-10.4	-9.5	1.5
Processed Food	-7.7	-0.5	24.9	12.2	3.9
Light Mnfc	-4.8	-17.6	-8.9	-6.6	3.7
Petroleum and Coal	-0.6	-3.2	-0.3	0.1	26.1
Min and Met	-3.6	4.9	-14.5	-14.3	4.3
Heavy Mnfc	-0.1	-29.4	-12.9	-12.6	8.5
Services	1.8	6.5	4.3	4.5	-3.1

Source: Authors' model results

Table 10 shows the impact of policy responses on factor prices. These results are compared with results on impacts of world price increases on factor prices in Zimbabwe (Table 6). In the presence of a food price hike, the return to land increases more significantly in all policy scenarios except agricultural trade liberalisation. The greatest increase in the return to land is obtained when agricultural productivity improves in Zimbabwe. In all policy scenarios real wages paid to unskilled rural workers increase by a higher magnitude than with the world price shock alone, with greatest benefit from a combination of agricultural trade liberalisation and productivity improvement in Zimbabwe. On the other hand real wages paid to unskilled urban, skilled rural and urban workers declines. However, declines in wages paid to skilled urban are lower in scenarios (1), (3) and (4) of table 10 as compared to table 6. Returns to non agricultural

capital declines at a lower rate in scenarios (1), (3) and (4), whereas returns to agricultural capital increases by a higher magnitude in scenarios (3) and (4).

Overall, reduction of import duties on fuel leads to a lower decline in real returns to all factors of production, in comparison to a situation where there is no removal of duties. The exception to this is skilled rural workers, where real wages paid increase at a lower rate. Reduction of trade transaction costs will increase real returns to all factors of production with the exception of skilled rural and natural resources.

Table 10: Impact of policy responses on factor prices

	Food Price + Agric trade Liberalisation in Zim (1)	Food Price + Reduction of trade transaction costs in SSA (2)	Food Price + Productivity Improvement in Zim (3)	Food Price + (agric trade liberalisation and productivity improvement in Zim (4)	Fuel Shock + Partial removal of duties on fuel in Zim (5)
Land	98.2	106.6	158.0	156.3	-15.3
Unsk. Rural	21.9	25.2	31.1	31.8	-2.4
Unsk. Urban	-7.1	10.6	-3.4	-1.6	-10.4
Skilled Rural	-8.5	-7.7	-13.1	-11.8	6.7
Skilled Urban	-6.4	14.0	-1.4	0.3	-11.5
Non Ag. Capital	-7.3	10.8	-3.4	-2.1	-9.9
Agric. Capital	17.5	31.0	32.6	33.1	-0.8
Nat. Resources	-31.8	-41.5	-50.0	-48.3	12.0

Source: Authors' model results

4.4 Household income

The distribution of income among different households depend on how much of the factors different households own and also on changes in factor prices, which are in turn affected by changes in the production structure, along with factor intensities and mobility in different sectors. Since the return to land improves in the whole economy we expect incomes of rural households to increase since they own most of the land. Real wages paid to unskilled rural and returns to agricultural capital also increase, hence we would expect households who own such factors to experience an increase in income. Table 11 below shows that a food price hike will improve income of rural households by more than 70%, whereas income of urban households declines by 1.7%. A fuel shock

increases income of rural households by 1.4% and reduces income of urban households by 9.1%.

Total private consumption for rural households increases, whilst for urban households consumption decreases as a result of increases in world food and agricultural prices. Figures 3 and 4 shows the impact of the world price increases modeled on private consumption by commodity and household type. Results indicate that a food price shock will lead to a decline in consumption of all commodities by urban households, whereas rural households increase consumption of all commodities. In the case of fuel price increases urban households also tend to suffer, since they reduce consumption of all commodities. Rural households increase their consumption of rice, forestry and fish, processed food and light manufacturing and reduce consumption of commodities from other sectors.

In terms of policy responses, agricultural trade liberalisation in Zimbabwe in the presence of food price will increase income of rural households at a lower rate of 67%, while the decline in urban households income is also lower (-1.4%). Reducing trade transaction costs in SSA will increase the income of both rural and urban households by a higher magnitude. Improving agricultural productivity in Zimbabwe will increase rural households income by more than 100% and urban household income will increase by slightly less than 5%. A policy combination of agricultural productivity improvement and reducing import tariffs in the agricultural sector will increase incomes of rural and urban households by 98.1% and 5.0% respectively. Removal of duties on fuel will tend to increase income of rural households by a large magnitude, whilst the damage to income of urban households is low.

The price of commodities purchased by different households will impact the capacity of households to effectively participate in markets. Results indicate that higher world food prices tend to increase consumer prices for rural households by a higher magnitude than is the case for urban households. In the case of a fuel price shock, urban households face higher price increases than rural households. In terms of policy responses, scenarios (1), (3) and (4) will lead to lower increases in consumer prices

faced by rural households, whereas urban households will benefit from policy scenarios (1) and (4).

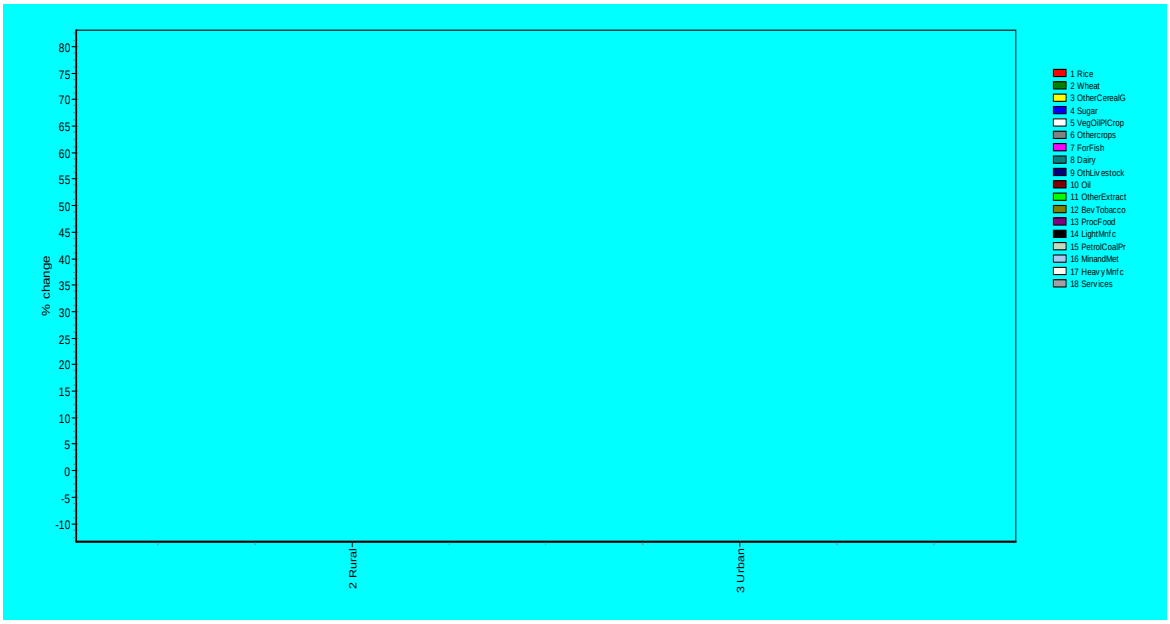


Figure 3: Impact of world food price increases on private household consumption by commodity and household types

Source: Authors' model results

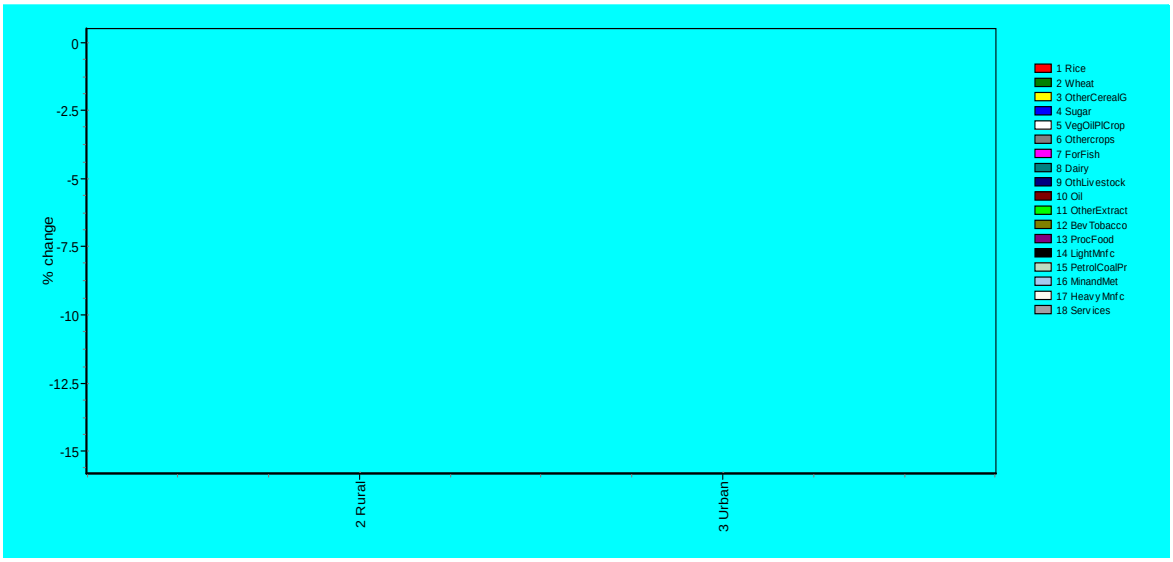


Figure 4: Impact of world fuel price increases on private household consumption by commodity and household types

Source: Authors' model results

Table 11: Impact on household income (percentage changes)

		Price Shocks		Policy Responses				
		Food Price Effect	Fuel Price Effect	Food Price + Agric trade Liberalisation in Zim (1)	Food Price + Reduction of trade transaction costs in SSA (2)	Food Price + Productivity Improvement in Zim (3)	Food Price + (agric trade liberalisation and productivity improvement in Zim (4)	Fuel Shock + Partial removal of duties on fuel in Zim (5)
Change in household income	Rural Households	70.6	1.4	66.6	87.6	101.5	98.1	1.8
	Urban Households	-1.7	-9.1	-1.4	26.4	4.9	5.0	-6.9
Change in total private consumption expenditure	Rural Households	75.4	2.3	72.9	98.9	115.5	113.5	2.6
	Urban Households	-2.7	-9.3	-2.3	26.3	4.1	4.4	-7.0
Change in consumer price	Rural Households	13.0	2.5	10.5	17.0	12.9	10.7	2.7
	Urban Households	8.0	4.3	6.5	12.6	9.2	7.9	4.1

Source: Authors' model results

4.5 Alternative Scenarios

This section discusses the sensitivity of some key results to changes in the macroeconomic closure assumptions used. The above results are based on the assumption of full employment of resources, including labour, in all regions. However, developing regions such as SSA tend to be characterized by unskilled labour unemployment, therefore here we relax the assumption of full employment to explore the impact on results. In particular, we modify the model closure for Zimbabwe and other SSA countries to allow unemployment of unskilled labour.[10] With the assumption of unskilled labour unemployment in the region, increases in world prices of food and fuel of the same magnitude as considered previously appear to have little impact on terms of trade for both the food and fuel shock. However, the impact on real GDP is an even more severe decline than without unemployment in the model, with the decline being 3 percentage points worse in the case of food shock and 5 percent worse in the case of fuel price shocks (see Table 12 and Table 3). As shown in Table 12, unskilled rural employment increases by 6.8 percent when world food prices rise, however, the larger group of unskilled urban workers experiences a reduction in employment of 13.5 percent. In the case of the fuel price shock the impacts on unskilled employment are even more severe with rural unemployment increasing by nearly three percent and urban unemployment increasing by more than 20 percent. These impacts on employment help to explain why the impact on real GDP (and sectoral output) is so much more severe in the case of the fuel price rise.

Increases in world price of food will result in net imports in Zimbabwe declining by US$87 million after allowing for unskilled labour unemployment in SSA countries (Table 13). In terms of sectoral trade balances we notice an increase in net exports in some sectors and a decline in net imports for other sectors of the economy. For example, net exports of other crops increased by US$38.6 million and net imports of light manufacturing increased by US$20 million. Increases in the world price of fuel leads to an increase in net exports by US$153 million when including unskilled labour

[10] We endogenize the supply of unskilled labour and exogenize the real wage rate of unskilled labour in SSA and Zimbabwe.

unemployment impacts. Heavy manufacturing recorded a higher increase in net exports of about US$45.8 million. These results suggest that there are some significant differences on the impact of price shocks on trade balances if we consider unemployment of labour in SSA.

The impact of food price shocks under alternative closure rules on real sectoral output can be seen by comparing results from table 5 and table 14. The increase in rice; wheat; vegetables, fruits and oilseeds; other crops and other livestock output increases by more than 5, 0.4, 2.7, 4, and 0.3 percentage points respectively. On the other hand increases in output of sectors such as cereals, dairy and processed food declined by 0.2 and 2.6 percentage points respectively. Decreases in output of sectors such as sugar, other extraction, and beverages and tobacco declined by 3.3, 1.9, 0.3 percentage points respectively. Decreases in output of sectors such as forestry and fish; light manufacturing; petroleum and coal products; minerals and metals; and heavy manufacturing increased by 1.1, 6.3, 2.4, 2.3 and 8 percentage points respectively.

Similarly the effects of the increase in world fuel price under alternative closure rules on real sectoral output are varied. Increases in output of sectors such as wheat; other extraction; beverages and tobacco; processed food; petroleum and coal products; minerals and metals; and heavy manufacturing declined by 2.6, 0.3, 0.2, 3.4, 5.1, 2.4,and 9.6 percentage points respectively. And declines in output of other sectors such as other cereals; vegetables, fruits and oilseeds; other crops; forestry and fish; dairy; and services has increased by 3, 1.1, 0.9, 4, 6, and 6.6 percentage points respectively.

The impact of food price shocks under alternative closure rules on returns to factors are shown in table 15 and results show that declines in returns to non agricultural capital and skilled urban increased both by just above 1 percentage point. And the increase in the return to agricultural capital declined by just under 4 percentage points. Results also show that the increase in the price of agricultural land increased by about 6 percentage points.

Table 12: Impact of world price increase on the Zimbabwean economy on real GDP, terms of trade and unemployment (percentage changes)

	GDP	Terms of Trade	Unskilled rural unemployment	Unskilled urban unemployment
Increase in world food prices	**-6.95**	**3.47**	**6.75**	**-13.52**
Contribution of each food commodity price shock				
Other cereals	-1.81	-2.58	0.06	-6.27
Rice	0.46	-0.28	0.22	0.34
Wheat	0.21	-0.34	0.51	-0.28
Sugar	-1.21	1.02	0.26	-0.99
Veg & fruit and oilseeds	0.24	1.49	1.93	0.68
Other crops	-2.12	3.79	3.61	-2.71
Dairy	-0.9	0.16	0.21	-1.47
Other livestock	-0.23	0.41	0.74	-0.14
Processed food	-1.59	-0.18	-0.78	-2.70
Increase in world fuel prices	**-7.47**	**-6.34**	**-2.84**	**-20.43**

Source: Authors' model results

Table 13: Change in Trade Balance by commodity in Zimbabwe, with unskilled unemployment (US$ million)

	Food price increase	Fuel price increase
Rice	-6.9	1.1
Wheat	-18.7	-1.2
OtherCerealG	-90.3	12.3
Sugar	-6.3	16.3
VegOilPlCrop	62.0	-1.9
Othercrops	140.4	-14.0
ForFish	-0.3	1.1
Dairy	-8.6	2.4
OthLivestock	2.5	15.6
Oil	0.0	0.1
OtherExtract	-20.6	30.1
BevTobacco	-11.0	15.9
ProcFood	-15.6	31.5
LightMnfc	-150.4	76.1
PetrolCoalPr	13.1	-148.7
MinandMet	-60.3	90.2
HeavyMnfc	-78.7	131.5
Services	-22.7	80.9
Total (X-M)	-272.3	339.0

Source: Authors' model results

Table 14: Impact on sectoral output with unskilled labour unemployment (percentage changes)

	Total Food effect	Effect of different commodity price shocks									Fuel Shock
		Other Cereals	Rice	Wheat	Sugar	Veg & Fruit, oilseeds	Other crops	Dairy	Other livestock	Proc. Food	
Rice	**10.0**	0.9	27.6	2.6	-2.6	-4.3	-8.6	-3.5	-4.5	2.4	**-4.8**
Wheat	**0.1**	-0.5	-0.6	-7.3	-0.7	-1.3	-4.1	-0.1	-0.4	15.0	**3.1**
OtherCerealG	**0.6**	-3.8	0.2	-0.5	-0.4	1.7	2.0	-0.2	0.5	1.1	**-7.1**
Sugar	**-14.6**	0.1	0.3	0.8	-8.3	-1.2	-3.7	-1.5	-2.1	1.0	**7.3**
VegOilPlCrop	**4.9**	0.0	1.7	0.6	-0.3	5.1	-6.9	0.4	1.1	3.3	**-4.7**
Othercrops	**2.0**	0.4	2.0	1.6	-0.4	-0.7	-3.9	0.1	0.5	2.4	**-6.0**
ForFish	**-6.5**	-3.9	0.1	-0.2	-0.9	0.6	0.0	-0.8	0.0	-1.6	**-9.3**
Dairy	**3.2**	-3.1	0.3	0.5	-0.8	2.8	3.7	2.6	0.3	-3.0	**-12.4**
OthLivestock	**1.3**	-0.1	0.4	0.4	-0.8	1.1	-0.9	-0.2	4.5	-3.1	**-2.7**
Oil	**-1.0**	0.2	-0.1	0.1	0.0	-0.4	-0.1	-0.1	-0.3	-0.4	**9.1**
OtherExtract	**-4.2**	-0.1	-0.3	0.0	-0.3	-0.9	-0.8	-0.5	-0.7	-0.7	**1.9**
BevTobacco	**-9.9**	-1.5	0.1	-0.8	-1.2	-0.8	-2.9	-1.5	-1.1	-0.2	**1.1**
ProcFood	**1.8**	0.4	0.4	-6.2	-0.1	3.3	2.7	0.8	0.8	-0.3	**1.5**
LightMnfc	**-13.7**	-2.1	0.4	0.7	-0.5	-0.6	-8.4	-0.7	0.0	-2.6	**-4.0**
PetrolCoalPr	**-3.4**	-2.2	0.1	0.2	-0.5	0.4	1.1	-0.6	-0.3	-1.6	**24.9**
MinandMet	**-6.0**	1.1	-0.5	0.3	-0.1	-2.3	-1.3	-0.6	-1.3	-1.3	**2.9**
HeavyMnfc	**-8.1**	0.2	-0.5	0.5	0.0	-1.8	-0.9	-1.1	-1.8	-2.7	**1.0**
Services	**-2.4**	-2.7	0.2	0.1	-0.3	1.0	0.8	-0.4	0.3	-1.5	**-10.6**

Source: Authors' model results

Table 15: Impact of price shocks on factor prices with unskilled labour unemployment

	Total Food Effect	Effect of different commodity price shocks									Fuel Shock
		Other Cereals	Rice	Wheat	Sugar	Veg & Fruit, oilseeds	Other crops	Dairy	Other livestock	Proc. Food	
Land	**107.6**	8.6	4.1	6.1	-0.5	26.2	47.7	2.0	8.9	4.5	**-24.2**
Skilled Rural	**-9.1**	-2.8	-0.5	0.4	2.5	-1.2	-0.4	-0.5	-2.1	-4.5	**2.0**
Skilled Urban	**-9.3**	-5.1	0.3	-0.2	-0.8	0.9	-1.2	-1.1	0.0	-2.1	**-17.3**
Non Ag. Capital	**-10.0**	-4.8	0.2	-0.5	-0.8	0.4	-1.8	-1.2	-0.2	-1.4	**-15.3**
Agric. Capital	**13.9**	-2.9	0.9	0.4	2.1	5.2	6.8	2.7	1.9	-3.1	**-8.1**
Nat. Resources	**-30.2**	-2.8	-1.5	0.2	-1.8	-5.4	-4.8	-3.5	-4.7	-5.9	**9.0**

Source: Authors' model results

5. Conclusions and future directions

Higher world food and fuel prices are a potential threat to the economic recovery process in Zimbabwe and are likely to push people into poverty, particularly since most households have been made more vulnerable to shocks by a decade-long recession. This study examined the impacts of higher international food and fuel prices on the Zimbabwean economy and also on different households. We also evaluated potential policy responses to such shocks. Our preliminary results suggest that in the case of food price hikes, real GDP declines but terms of trade improve, whereas in the case of a fuel shock both GDP and terms of trade deteriorate. Also a food shock will lead Zimbabwe to increasing its net imports, whilst fuel shock will result in the country increasing net exports. This finding may appear rather surprising, since we might expect an increase in world price of fuel to increase the import bill of the country and hence lead to a deterioration of trade balances.

Preliminary modelling results indicate that most of the sectors in this study experience a decline in output as a result of an international food price shock, whereas with the international fuel products price shock, more than half of the sectors experience an increase in output. Results also indicate that returns to land, unskilled rural and agricultural capital will increase when food prices rise, whilst returns to other factors are likely to decrease. Increases in the world price of fuel will decrease returns to all factors, with the exception of skilled rural. Furthermore, our results indicate that a food and fuel price increase will increase income of rural households and decrease income of urban households. This suggests that there are winners and losers in these scenarios, raising the issue of possible need for compensatory mechanisms to be put in place, particularly given the economic vulnerability of many people in Zimbabwe at present. Policy mechanisms need to be put in place that strike a careful balance between the interests of different players. A range of alternative policy scenarios were suggested and evaluated in their effectiveness in cushioning various aspects of the economy from price shocks. The impacts of these policies varied across sectors and agents; however, a combination of improving agricultural productivity and removal of import tariffs seems to be important for the economy. Also improving trade facilitation in SSA appears

potentially important for cushioning the Zimbabwean economy and households from commodity price shocks.

While this study aims to improve understanding of the potential impact of world commodity price rises on Zimbabwe, along with potential policy responses, these preliminary results must of course be considered with caution. While we hope useful insights have been generated, there are always limitations to this type of large-scale modelling effort. For example, taking into account unemployment in Zimbabwe and other SSA countries has the potential to significantly impact results, as shown in the sensitivity analysis. Thus future research could usefully consider the issue of unemployment in SSA in more depth, including under alternative policy responses to the price shocks. We also note that the way we model world price increases is by global sectoral productivity reductions, however, it may be useful to also model other mechanisms that could cause the price increases. Finally, of particular note is the relatively weak quality of the underlying Zimbabwe datasets that are available, therefore appropriate caution interpreting results and conclusions is needed.

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APPENDIX

Table A1: Aggregated Commodities in the GTAP Model

New Sector	Description	Original GTAP Sectors
Rice	Rice - raw and processed	pdr pcr
Wheat	Wheat	wht
Other Cereal Grains	Other cereal grains	gro
Sugar	Sugar - processed and raw	sgr c_b
Vegetables, fruit & Oilseeds	Veg&fruit,oilseeds,plant fibre	v_f osd pfb
Othercrops	Other crops	ocr
ForFish	Forest & fish	frs fsh
Dairy	Dairy prods and raw milk	mil rmk
Other Livestock	Meats and other livestock	ctl oap wol cmt omt
Oil	Oil	oil
Other Extraction	Coal, gas, other minerals	coa gas omn
BevTobacco	Beverages and tobacco	b_t
ProcFood	Processed Food	ofd vol
LightMnfc	Light Manufacturing	tex wap lea lum ppp mvh otn omf
PetrolCoalPr	Petroleum and coal products	p_c
MinandMet	Minerals and metal products	nmm i_s nfm fmp
HeavyMnfc	Heavy Manufacturing	ele ome
Services	Services	ely gdt wtr cns trd otp wtp atp cmn ofi isr obs ros osg dwe

Table A2: Country Aggregation

New Region	Description	Comprising Original GTAP regions
Zimbabwe	Zimbabwe	zwe
SouthAfrica	South Africa	zaf
Malawi	Malawi	mwi
Zambia	Zambia	zmb
RestSSAfrica	Rest of Sub Saharan Africa	cmr civ gha nga sen xwf xcf xac eth ken mdg mus moz tza uga xec bwa nam xsc
MENA	Middle East and North Africa	bhr irn isr kwt omn qat sau tur are xws egy mar tun xnf
EU_27	EU_27	aut bel cyp cze dnk est fra deu grc hun irl ita lva lta lux mlt nld pol prt svk svn esp swe gbr bgr rou
US	United States of America	usa
RestNAmerica	Rest of North America	can mex xna
LatinAmer	Latin America	arg bol bra chl col ecu pry ury ven xsm cri gtm hnd nic pan slv xca xcb
China	China	chn
RAsiaPacific	Rest of Asia Pacific	aus nzl xoc hkg jpn kor mng twn xea khm idn lao mys phl sgp tha vnm xse bgd ind npl pak ika xsa
RestofWorld	Rest of World	che nor xef alb blr hrv rus ukr xee xer kaz kgz xsu arm aze geo