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Transmission of International Prices to Domestic Markets in Kenya: The Case of Food and Crude-oil Markets During the 2007-8 Global Crisis

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Abstract
This study looks at the transmission of international prices to the Kenyan economy in 2007-2008 with a focus on food and oil prices. The degree of price transmission between spatial markets signifies the level of integration of such markets. The information on magnitudes of the price elasticities of demand for imports, and the extent of price transmissions is very important in the design of policies to deal with external price shocks. The paper uses the imperfect substitute demand model and the Kenya CGE model to estimate the import elasticities that are then employed to simulate domestic price effects of external shocks. The findings show that aggregate import demand elasticities for food and crude oil in Kenya are fairly elastic, with coefficients being slightly greater than unity. This implies that when international prices fall, the demand for imported products rises by more than a proportionate quantity. Thus changes in international prices for oil and food are likely to have substantial effects on the country's trade balance. In addition, the results indicate that in the year 2007-2008, there was less than full transmission of external crude oil price shocks to domestic market prices, and the crisis had low or negligible effects on domestic prices for other goods and services. Similarly, transmissions of world market food prices to the domestic market were negligible. The results suggest very low integration between domestic and world markets, especially for agricultural products. The study recommends re-alignment of Kenya's food production and supply strategies with international initiatives in order to meet food security requirements and stabilize domestic prices.
Keywords: Price shocks, import elasticities, price transmission, market integration.

1. Introduction

The global economic crisis which erupted during the period 2007 - 2008 presented unprecedented episodes of international commodity price shocks. International food and crude oil prices dramatically increased by 118 per cent and 347.6 per cent, respectively during 2008 then subsequently fell sharply in 2009 and again picked up in 2011 reaching higher levels than 2008 in 2012 (World Bank, 2013). Changes in international prices are transmitted to domestic markets through international economic integration[4] (Bhattacharyya and Williamson, 2011). However, countries bore the brunt of the crisis differently leading to a rethinking about the economic frameworks upon which countries formulate their development policies.

The existing literature on price transmission from international to domestic markets is broadly looked at from the pass-through elasticity and the import demands. The former explores how upstream prices or those quoted in higher markets affect those in lower markets with special focus on price transmission and the law of one price (LOP)[5]. The indicators for price transmission are measured in terms of transmission elasticities. The latter is defined as the percentage change in the price in one market given a one per cent change in price in another market. The price transmission elasticity is important in denoting the extent of market integration (Minot, 2011). The import demand approach considers the degree to which imported and domestically produced versions of a good substitute for one another in demand (Warr, 2005). In this case, it is assumed that imported and domestically produced goods are perfect or imperfect substitutes of each other. The perfect substitute model ignores such factors as lags in buyers' responses and differentiation of products. On the other hand, the imperfect substitutes model argues that products are distinguished not only by their kind but also their place of production. This assumption is also referred to as the "Armington assumption" following Armington (1969).

The degree of price transmission between spatial markets signifies the level of integration of given markets. The integration of markets is an indicator of the extent to which given products are tradable in separate markets (Taylor and Taylor, 2004). Hence, the analysis of price transmission is necessary to inform trade policy

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[4] Commodity price shocks are times when prices suddenly increase or decrease thereby affecting supply and demand in local markets.
[5] LOP says that foreign and domestic prices of a commodity are equal when both are expressed in the same currency and adjusted for transaction costs.

and provide insights on how to respond to volatility of domestic prices (Minot, 2012).

High, volatile and rising global food and oil prices determine the decisions of economic agents and policy makers of a domestic economy (World Bank, 2008; Minot, 2012). Specifically, commodity price shock episodes influence distribution of incomes across various economic agents depending on their roles and position in markets (Ivanic and Martin, 2008). At the same time, the use of domestic protectionist policies lead to failure of international markets to guarantee supplies when and where needed. In turn, the transmission of the combined effects into domestic markets is aggravated by the interdependence and interconnectedness of economies, thereby increasing vulnerability and exposure to the vagaries of unforeseen economic shocks.

For Kenya, the inter-connectedness of the economy to other economies in the rest of the world can be traced back to economic and political reforms undertaken from the 1980s and the subsequent heightened quest for economic integration into regional and global economies. However, little is known about how the foreign goods compete with domestic goods in the markets, given the seemingly numerous supplying areas of the imported products. This is important as it reflects on the extent of integration between the domestic and other foreign markets and subsequently the transmission of external prices to domestic markets. Secondly, Kenya has been undertaking fundamental structural reforms, under the framework of the Vision 2030 programme, to ensure food and energy security among other goals.

Thus, a number of questions need to be addressed for economic analysis and policy recommendations to be relevant in the wake of increased episodes of price shocks, Specifically, what are the magnitudes of the price elasticities of demand for imported crude oil and food products in Kenyaand to what extent are international food and crude oil price shocks transmitted into domestic markets? This study seeks to estimate the price elasticities of demand for imported food and oil products in Kenya and also evaluate the degree to which international food and oil price shocks affect domestic market prices.

2. Literature Review

2.1 Approaches to Price Transmission

The linkage between prices of imports and domestic products, and by extension the factor prices and incomes, can broadly be looked into from two approaches: the pass-through elasticity and the import demand approaches. The first approach explores how upstream prices or those quoted in higher markets affect those in lower markets with special focus on price transmission and the law of one price (LOP). The analyses of price relationships began with Cassel (1918) who introduced the concept of purchasing power parity (PPP), implying that national prices are equal at aggregate levels when expressed in the units of one common currency. An integral part of the PPP is the law of one price (LOP) in which individual commodity prices, in spatially separated markets, are equal when adjusted for foreign currency exchange rates and transportation costs (Baffes, 1991; Mohanty, et al., 1998). Furthermore, Ardeni (1989) noted that when there is disparity between the prices, an opportunity for arbitrage arises, and arbitrageurs will actively seek profit by transferring goods from lower to high priced markets, until prices are equalized in the respective markets[1].

The Enke-Samuelson-Takayama-Judge (ESTJ) equilibrium model postulates that when a commodity is sold in competitive foreign and domestic markets, full price transmission of prices takes place and the prices only deviate from each other by the amount of transfer costs when converted to a common currency (Amikuzuno and Ogundari, 2013)[2]. The ESTJ model predicts market integration through changes in supply and demand conditions in one market, which affect trade and therefore prices in other markets. Consequently, equilibria are restored through spatial arbitrage. Thus, by causing prices in different markets to converge, arbitrage ensures that commodities trade in the same price in all markets.

Fossati, *et al.* (2007) note that trade between two regions takes place under the assumption of perfect competition, if the import price plus transport cost equals the export price. Such markets are said to be fully integrated into one, if a price change in the export market induces an equal change in the import market[3]. Baffes and Ajwad (2001) argued that incomplete price transmission also occurs due to high transaction costs as a result of poor transport and communication infrastructure, policy distortions introduced by government interventions in the forms of domestic price controls, import tariffs, quotas and subsidies.

Furthermore the study by Sexton, *et al.* (1991) indicates poor state of physical infrastructure, transport and communication services also gives rise to large marketing margins. This is because they raise the costs of delivering imported commodities to the domestic market for consumption, and insulate domestic markets from increases in international prices. Under these circumstances, changes in world market prices are not fully

[1] The 9th edition of the Concise Oxford Dictionary (1995) defines arbitrage as buying and selling of stocks or bills of exchange to take advantage of varying prices in different markets.

[2] The ESTJ model was developed by Enke (1951); Samuelson (1952); and Takayama and Judge (1971).

[3] A market is an area within which the price of a commodity tends to be uniform. Where allowance is made for transportation costs, market integration refers to adherence to the law of one price (Stigler, 1969).

transmitted to domestic prices and economic agents partially adjust to shifts in world supply and demand (Taylor, *et al.*, 2001; Taylor, 2003). On the other hand, Badiane and Shively (1998) argue that non-competitive trade practices, such as oligopolistic behaviour and collusion among domestic traders, have the tendency to maintain higher price differences between international and domestic prices than those determined by transfer costs.

The second approach involves estimation of import demand elasticities or the degree to which imported and domestically produced goods substitute one another in demand. The choice of the import demand approach is motivated by the reasoning that international trade may reinforce or offset demand shocks including preference shocks, tastes and government expenses depending on the nature of trade between countries. The traditional formulation of import demand model suggests an analysis of import demand relations based on the consumer theory of demand. In this model a household chooses the bundle of consumption goods that maximizes his/her utility, and then allocates the chosen bundle between domestically produced and imported goods.

According to Bobić (2010), the theory suggests two basic trade models: the perfect substitute model and the imperfect substitute model. The perfect substitute model assumes that there is perfect substitution between domestically produced and foreign goods. This assumption implies that at any given time period, each country can only be either an exporter or an importer of a traded good. The perfect substitute model is suitably analyzed using partial equilibrium tools, where the empirical relationships between international and domestic prices are examined, while assuming goods in question are homogeneous and trade in a particular good is assumed to take place in one direction.

The imperfect substitute model on the other hand, assumes that imported goods are not perfect substitutes for domestically produced goods. This condition reflects the fact that the goods market comprises a mix of domestic and foreign goods such that it is neither filled completely with domestic nor with foreign goods. Thus, the imperfect substitute model gives provision for cross-hauling of products where similar commodities are simultaneously exported and imported by the country due to the existence of product differentiation and aggregations. Algieri (2004) empirically confirmed that the imperfect substitute assumption holds for such products in the short and long run.

2.2: Other Empirical Studies

According to Abbott and Battisti (2011), there are variations in price transmission pattern elasticities among developing and less developed countries. For instance, the elasticities range from almost zero in China to virtually full transmission in Brazil. In the African continent, domestic market prices in countries like Nigeria and Ethiopia appear to be closely linked to those of world markets. But other countries and especially those within the Eastern African region, show limited and/or lagged responses to changes in world prices, suggesting that world market pressures get resistance from domestic market institutions. The study also identified certain patterns such as much greater price transmission for highly traded commodities like rice, compared to non-tradable ones like millet and sorghum, and higher price transmission rates for import dependent countries including rice in Burkina Faso, Niger, Malawi, Senegal, Mali and Uganda; maize in Uganda and Malawi; and, wheat in Ethiopia.

Baltzer (2013) studied price transmission from international to domestic markets in 14 developing countries for maize, rice and wheat during the global food crisis in 2007/08. The results were grouped into four broad categories: (a) free market economies or well-integrated and open agricultural economies such as Brazil and South Africa exhibited relatively large degrees of price transmission; (b) exporting stabilizers, namely India and China showed reductions in price transmissions, while Vietnam exhibited strong pass-through of international prices despite export restrictions; (c) net importers, namely Bangladesh, Egypt, Kenya, Mozambique and Senegal showed mixed results. Bangladesh exhibited low domestic rice prices, while domestic prices in the rest of the countries rose rapidly and stayed high even after the crisis and (d) isolated countries or those poorly integrated in cereals markets (Ethiopia, Nigeria, Malawi and Zambia) also experienced rapid increases in domestic prices during the crisis contrary to expectations. The study attributed the variations in the price transmission patterns across countries to divergences in application of price stabilization policies, public policy failures, incomplete market integration and coinciding domestic shocks. Most countries in Africa experienced commodity price increases that were relatively lower than the world market prices, except Ethiopia and Malawi (Minot, 2012; Baltzer, 2013). This suggests that other factors besides world market prices affected domestic prices. Similarly, Benson, *et al*. (2008) argued that domestic or regional factors were responsible for the rising food prices. For instance, rising food prices in Uganda can be attributed to spill-over effects from harvest shortfalls or higher prices in neighbouring Kenya, rather than by the global food crisis.

Minot (2012) examined the patterns and trends in food price volatility for 15 African countries, including Kenya during the crisis period 2007 - 2010. The study failed to find evidence of increased volatility contrary to views that food price volatilities increased during the crisis period. The results of the study further indicated that price volatility was lower for processed and tradable foods than for non-tradable foods; the volatility was lower in the bigger than in smaller towns. Finally; maize price volatility was actually higher in

countries with the most active interventions to stabilize maize prices. The study recommended that greater attention should be given to lowering the high level of food prices in the region, rather than lowering price volatilities. In addition, regional trade in food items can play an important role in reducing food price volatility; thus, price stabilization efforts on traditional foods may be counterproductive. The author, however, only looked at food items while this study also considers non-food items like fuel in the analysis.

Previous studies for the Eastern African region established that food prices often show a different pattern and fluctuate more than the world prices. For instance, the study by Karugia, *et al.* (2013) evaluated the price trends for staples in Kenya and other Eastern African countries, using a partial equilibrium method. The authors established that domestic regional prices correlate more with each other than with world prices, and the influence of world price developments is relatively small compared to regional developments in maize, wheat and beans.

Mwega (1993) utilized an error correction model to estimate demand elasticities for aggregate imports and its components in Kenya over the period 1964-1991 and found low elasticities for relative price; real income and import demands in the short-run. The author argues that policies that directly increase export earnings and access to external capital inflows bring about larger impacts on import volumes than those that concentrate exclusively on aggregate demand and exchange rate management. However, the study assumes perfect import substitutability and there is a high level of aggregation of import categories in which food, beverages and tobacco are lumped together.

3. Methodology

3.1 The Model

The import demand elasticities in this study are estimated using the imperfect substitute demand framework following Jones (2008). In this framework, the demand function for imports constitutes the level of money income of the domestic economy; the imported goods own price; and the price of domestic substitutes. Hence, the demand for country *i*'s imports from the rest of the world is represented by equation (1).

$$M_i^D = f(Y_i, PM_i, PD_i) \quad \text{.....(1).}$$

where M_i^D denotes the quantity of imports demanded by country *i*; Y_i represents the level of money income in country *i*; PM_i represents the domestic currency price paid by importers in country *i*; and PD_i, denotes the price of all domestically produced goods within country *i*.

Subsequently, the supply of country *i*'s imports from the rest of the world can be represented as equation (2).

$$M_i^s = g(Y, PM_i^*{}_i, PD^*) \quad \text{.....(2).}$$

where M_i^s denotes the supply of imports from the rest of the world to country *i*; PM^* denotes the price of the rest of the world's exports; and $PD^*$the foreign currency price of all domestically produced goods in the rest of the world. Y refers to money income as defined under equation 1. In which case, the specified supply function is a positive function of the own price and a negative function of the price of domestically produced goods in the exporting country. At equilibrium, the demand for imports by country *i* is equal to the supply of exports to country *i* from the rest of the world as shown in equation (3).

$$M_i^D = M_i^s \quad \text{.....(3).}$$

The supply and demand for imports is a simultaneous equation system, and prices move to equate supply and demand in each time period. In trade theory, if PD^* is the border price of imports, then their tariff-inclusive domestic price is stated as (1+ *t)* PD^*. Trade enforces some sort of relationship between the domestic price *PD* of goods that compete with imports (1+ *t*)PD*. Perfect competition means that the relationship would be *PD* = (1+ *t*)PD *. Thus, the empirical estimation is provided as equation (4).

$$lnQ_{it} = \alpha_{it} + \beta ln[\mathrm{PD^*}_{it}(1 + t_{it})] + \varepsilon_{it} \quad \text{.....(4).}$$

where the subscripts *i* and *t* represent product categories and time respectively; *Q* represents the logarithm of imports measured in quantities; $\mathrm{PD^*}_{it}(1 + t_{it})$ represents the logarithm of the tariff-inclusive price; α_{it} is a constant and, ε_{it} the error term. Since the model is estimated in log-linear form, the coefficient β can be interpreted as the import price elasticity of demand. The null hypothesis is that β is negative. This suggests that as the tariff-inclusive prices rise, the demand for imports fall.

3.2 Simulation of Price Shocks

The transmissions of international price shocks to domestic markets are simulated using the Kenya CGE model

constructed from the Global Trade Analysis Project version 8.1[1]. In the model, imported and domestically produced goods are said to be non-perfect substitutes when consumers consider them as being different from each other, in terms of tastes and or other attributes following Armington (1969).This condition holds regardless of whether the goods are produced by the same industry in different countries or are produced by the same technologies (Zang and Varikios, 2006). In the Kenyan CGE model, the extent of price transmission from international to the domestic markets is determined by the Armington elasticity of substitution and import share parameters. Thus, when there is zero substitution between imports and domestically produced goods and or non importation of goods, then no international price transmission takes place in the domestic markets. Likewise, if there exists high substitution and high levels of importations relative to consumption of domestic produce, then price transmission from international to domestic markets will be high. In the latter case, world price shocks alter relative domestic prices, and affect resource allocations and economy-wide effects in the domestic economy (Petersen, 1996).

3.3 Data Sources

The data for estimating import elasticities for the period 2007 - 2008 was obtained from the World Bank's World Integrated Trade Solution (WITS) database. For each of the products, data on import quantities, average tariffs and unit prices are generated with the latter two used to construct the tariff-inclusive price. The data is interacted to generate elasticities for each of the broader product classifications using equation (4).

The exogenous price shocks are applied to Kenya's major import sources for these commodities based on world price scenarios experienced during the period 2007 – 2008 as shown in Table 1[2].

Table 1: World Price Scenario during 2007 - 2008

Commodity	Percentage price increase	Percentage price decrease
1. Crude Oil	50	50
2. Fruits and vegetables	40	40
3. Grains	50	50
4. Meat	40	40
5. Other agriculture	40	40
6. Dairy	25	25
7. Other foods	40	40
8. Beverages	25	25

Source: FAO, 2008 and World Energy Outlook, 2008

Both positive and negative price shock simulations are carried in the study to ascertain the symmetry of the effects of the price shocks in markets and households.

4 Study Findings

4.1 Import Substitution Elasticities

The elasticity parameters denote the degree to which foreign goods are substituted by domestically produced versions of the goods in domestic markets following international price changes. If the elasticity estimate is between zero and one in absolute value, the demand for imports can be described as inelastic. This implies that the demand for imports is fairly unresponsive to changes in prices. If an elasticity estimate is greater than one, the demand for imports can be described as being elastic or responsive to changes in market prices.

The results for the elasticity estimates for selected products in Kenya are presented in Table 2. Generally, all the import demand elasticity estimates are significant and greater than unity. The elasticity parameters range from -1.19 for textiles and apparels to -2.78 for vegetable oils, with an average of -1.52. This implies that import demand in Kenya is fairly elastic and when international prices fall, import demand rises by a more than proportionate amount[3].

Thus, changes in international prices are likely to have effects on the country's trade balance. However, it should be noted that import surges are likely to occur from price falls depending on whether the own price elasticities for demand for the products in the sector are elastic or not.

[1] The Kenya CGE model is adopted from Onyango C.H. (2015) *Effects of Food and Fuel Price Shocks and Welfare Implications in Kenya: A Computable General Equilibrium Analysis*. Unpublished PhD thesis, University of Nairobi.

[2] The major sources for Kenya's imports are contained in GTAP 8.1 model. The major suppliers to Kenya for agricultural and food products are North America and the Rest of World. Manufactured products are mainly sourced from the EU-25, East Asia and North America, whereas crude oil supplies are from Rest of World and evenly spread in North America, Latin America and Middle East and North Africa.

[3] It is however debatable as to whether the import elasticity estimates are large enough to imply for this possibility.

Table 2: Sectoral Import Demand Elasticity Estimates for Kenya

Sector	Sector Description	Import Demand Elasticity	t-ratios
1	Grains	-1.59	-22.06
2	Fruits and vegetables	-1.30	-4.47
3	Meat and Livestock	-1.20	-9.15
4	Other agriculture	-1.35	-7.86
5	Vegetable oil	-2.78	-4.06
6	Dairy	-1.20	-9.15
7	Other processed food	-1.35	-7.86
8	Beverages and tobacco	-1.41	-16.49
9	Textiles and apparels	-1.19	-14.91
10	Crude oil	-1.90	-7.83
11	Other manufacturing	-1.50	-8.95

Source: Authors' calculations

The import demand elasticity estimates differ marginally across various sectors in accordance with the first hypothesis. Besides, the elasticity estimates are mixed and do not reflect diversity between agricultural and other sectors. The differences in elasticity of import substitution may be due to differences in the level of engagement of multinational presence in the sectors as found by Blonigen and Wesley (1999) and the level of product differentiation according to Feenstra and Hiau (2004).

The import demand elasticities for agriculture products are not as small as expected. In fact, the sectors that exhibit highest elasticity estimates are vegetable oils, grains, beverages and tobacco. Besides, crude oil whose demand was expected to be inelastic, especially in developed countries, appears fairly elastic at 1.90. Although the latter can be considered to be fairly small, this can be attributed mainly to market distortions arising from government interventions in fuel imports and distribution that make import demand appear more elastic than the market demand.

Furthermore, the elastic nature of the import elasticities can be attributed to homogeneity of the products in question. Generally, homogeneous products tend to have bigger import elasticities compared to heterogeneous products following Kee, *et al*.(2008). In addition, the elastic nature of agricultural products can be attributed to the fact that substantial amounts of agricultural imports are in the form of aid and depend on shortages realized from domestic productions.

The results (Table 3) are well within the range of previous econometric findings for Kenya and other developing countries. For instance, Jones (2008) found the average import demand elasticity for Kenya as 1.148 while the average elasticities for the other Africa countries ranged between 1 and 1.53. In addition, the elasticity estimates in this study seem to be larger than those found by Kee, *et al*.(2008), even though all the three cases demonstrate the elastic nature of import demand in Africa.

Table 3: Import Demand Elasticities from other Studies

Study	Average price elasticity of demand for imports
Jones, 2008	-1.148
Kee, Nicita and Olarrega, 2008	-1.114
Faini, Pritchett Clavijo 1988	-1.48
Tegene, 1989	-2.12

Source: Various studies

According to Zang and Varikios (2006), import demand elasticities in econometric literature tend to take elasticity values in the range of 1 to 3, while pegged at relatively higher values in CGE models. The World Bank (2005) assumes import demand elasticity values of between 3 and 6, whereas the GTAP model assumes the values in the range of 1.9 and 5.2.

4.2 Effects of exogenous shocks on local market prices

4.2.1 Crude oil price shocks

The results showing changes in domestic prices of selected goods and services following crude oil price shocks are presented in Table 4. Being a net importer, the rise of an essential input like oil raises the cost of production of domestic firms and reduces aggregate demand in the domestic economy. The model transmits a 50 per cent increase in crude oil prices to the domestic market prices, showing diversity in magnitudes and directions of the price changes for the various products as evident in Table 4.

A general observation is that the changes in domestic prices for all products are very small in absolute values. However, there are significant changes in the corresponding domestic product, in this case the oil products. The results indicate a 25.5 per cent increase in the domestic market price of oil occurs following a 50 per cent increase in international market price.

Table 4: Changes in Domestic Market Prices due to Shocks

Commodity	Positive price shock (%)	Negative price shock (%)
Grains	-1.46	1.66
Fruits and vegetables	-1.11	1.05
Meat and Livestock	-1.34	1.16
Other Agriculture	-0.70	0.45
Vegetable oil	-1.04	0.48
Dairy	-0.73	-0.03
Other processed foods	-1.44	1.18
Beverages, tobacco	-1.66	1.42
Textiles and apparel	-0.46	-0.54
Crude oil	25.51	-39.23
Other manufacturing	0.23	-1.64
Transport and communication	1.77	-3.86
Business services	-2.02	1.84
Other services	-0.39	-0.01

Source: Authors' simulations.

However, although the domestic prices increase in general, there is a less than full transmission of global price changes to domestic markets. This is mainly due to the relatively low import elasticity of substitution for crude oil in the Kenyan market. The effects of external price shocks on domestic market prices are central to household welfare. Specifically, the increase in international prices leads to a more than proportionate decline in the domestic demand for crude oil products. Hence, although domestic prices increase, they do so at a lower rate relative to the increase in international prices due to depressed domestic demand. In addition, the relatively higher changes in domestic oil prices can be attributed to the higher trade share of the sector in comparison with other sectors. From the baseline data, the import share of household consumption spending of crude oil stood at 57 per cent, whereas the export share of production was 22 per cent.

Moreover, there is less than full transmission of international oil prices to domestic market due to government interventions and existing market distortions within the sector. For instance, Mutua (2013) found that domestic taxes, levies and other charges on petroleum products comprise about 26 per cent of the final domestic market prices in Kenya. Additionally, kerosene is subsidized due to considerations of welfare implications on the rural and urban households. The market distortions are largely attributed to the oligopolistic nature of the market for oil products.

The effects on domestic prices for the other sectors are marginal and negative, except for transport and communications and other manufacturing sectors that experience positive but less than full transmission of international price increases. This is because they are oil intensive sectors and have few domestic substitutes, hence higher domestic prices.

Contrary to expectations, the increase in international crude oil prices negatively affects the domestic prices of agricultural commodities, though the changes are marginal. The likely reason for this is that the rise in international prices strongly reduces aggregate demand in the economy given the elastic nature of the import demand elasticities. Consequently, domestic prices are pulled down as consumers cut down their expenditures. On the other hand, agricultural producers, especially for fruits and vegetables are motivated to produce more following the increase in producer prices which further depress domestic agricultural prices.

With regard to negative price shocks, the effects on domestic prices are in the reverse. In this case, domestic oil prices fall by 39 per cent following a 50 per cent reduction in import prices. It is notable that the effects are asymmetric with the negative oil price shock having bigger effects in absolute terms compared to the positive shock of similar magnitudes. The asymmetry can be attributed to divergent application of policy responses to different shocks by the government. Similarly, domestic prices of textiles and apparels, manufacturing and transport and communications sectors fall marginally and by higher magnitudes compared to positive shocks. On the other hand, the effects on domestic prices for the other remaining sectors are mixed. The domestic prices of agricultural commodities increase marginally due to increased household demand, arising from improved disposable incomes. However, the domestic price changes are generally low, taking into account the relatively low level of correlation observed between international and domestic oil prices. The other possible reason is that there are very few alternatives to imported oil products in the Kenyan economy and therefore consumers have limited options of energy sources to choose from.

4.2.2 Agricultural and Processed Food Price Shocks

The results for the food price shocks are presented in Table 5. The results indicate that positive global food price shocks marginally raise domestic prices for food and processed food commodities, but have minimal effects on non-food products. Similarly, negative price shocks marginally reduce domestic prices. However, the resultant

effects are asymmetric in the sense that global price declines have relatively bigger effects on domestic markets for food items compared to price surges. In addition, the results indicate that there are very limited effects of international price shocks on non-food items.

In general, the results imply that there is low transmission of prices to the domestic market or low integration between domestic and international markets for agricultural-related products. These results are consistent with previous studies, notably Karugia, *et al.*(2013) which found that food prices in the Eastern African region show a different pattern and fluctuate more than the world prices. The cointegration results also suggest that domestic prices correlate more with each other than with world prices and the influence of world price developments is relatively small compared to regional price developments in maize, wheat and beans. Besides, Abbot and Battisti (2011) also established that domestic prices in the East African region show limited responses to global price shocks.

Table 5: Changes in Relative Domestic Market Prices due to Shocks

Commodity	Positive price shock	Negative price shock
Grains	3.98	-5.64
Fruits and vegetables	3.52	-5.05
Meat and Livestock	2.98	-3.82
Other agriculture	2.09	-2.68
Vegetable oil	2.07	-2.21
Dairy	1.77	-1.73
Other proc. foods	2.62	-3.00
Beverages, tobacco	2.28	-2.32
Textiles and apparel	0.20	-0.22
Crude oil	-0.01	0.01
Other manufacturing	0.23	-0.24
Transport and communication	-0.22	0.29
Business services	0.27	-0.26
Other services	0.62	-0.69

Source: Authors' simulations

The weak relationships between international and domestic market prices in Kenya is mainly attributed to direct government interventions via trade policies, including changes in import duties, imposition of export/import bans and domestic policies such as taxes, subsidies and price controls. In addition, the domestic market prices are shielded from external price shock effects by high transaction costs arising from poor transport and communication infrastructure. According to FAO (2009) the National Cereals and Produce Board (NCPB) maintains some influence in the grain sector through involvement in procurement of imported produce and subsequent release of food at predetermined prices.

5. Summary, Conclusion and Recommendations

5.1 Summary and Conclusion

This study examined the transmission of international prices to domestic food and crude oil markets in Kenya. Transmission of prices from one market to another reflects the extent to which the two markets are integrated with each other. It is also an indicator of the extent to which given products are tradable in separate markets within or outside the country. Thus, when markets are not well integrated, changes in prices in one market or country may not affect the prices of similar products in another market. Transmission of prices is influenced by several factors, including the elasticity of demand for imports, physical distance between markets, tariff and nontariff barriers to cross-border trade, domestic trade policies (domestic tax regime, price controls, subsidies etc) and transaction costs.

Understanding the effects of price shocks is critical, especially for Kenya whose economy is increasingly integrating into the global economy, yet it has little or no influence over world food and crude oil market prices. The analysis of the substitutability between domestically produced and imported products has established that the aggregate import demand elasticities for food and crude oil in Kenya are fairly elastic, with coefficients slightly greater than unity. This implies that when international prices fall, the demand for imported products rises by more than a proportionate amount. This means that changes in international prices for oil and food items are likely to have effects on the country's trade balance. In addition, the findings confirm that import elasticities are not uniform across sectors, either due to differences in the levels of product differentiation or involvement of multinationals in a particular sector.

In order to establish the levels of transmission of exogenous food and crude oil price shocks to domestic market prices and effects on household demands and incomes, experiments involving positive and negative price shocks were carried out. The results indicated less than full transmission of external crude oil price shocks to

domestic market prices but very low or negligible effects on domestic prices for other goods and services. Similarly, there are very low transmissions of world market food prices to the domestic market. The results suggest very low integration between domestic and world market prices, especially for agricultural products.

5.2 Policy Implications

5.2.1 The substitutability between domestic and imported food and oil products

Understanding how import flows react to changing economic situations is important in designing appropriate adjustment policies. The results in this study show that import demand elasticities for food and crude oil are fairly elastic. This implies that when world market prices fall, the demand for imports increases by more than proportionate amount. In other words, changes in international prices significantly affect Kenya's trade balance with the rest of the world, all else being equal.

The extent of the demand for imported products however depends on the price and income elasticities of specific products. For a poor country like Kenya, price and income elasticities for food products are fairly elastic. High costs of production make local products expensive relative to cheaper foreign imports. However, as incomes rise, local products become affordable leading to reduction in demand for imported products. Thus, improvements in household welfare are central to prudent management of the trade balance in the wake of adverse effect of trade shocks. Most importantly, increasing food production is equally pertinent since food supply constraints push domestic food prices up. This should be complemented with deliberate efforts to diversify food production and the consumption basket as well as investments in alternative energy sources. The aim should be to minimize domestic price volatilities and widen consumer choices for domestic products.

5.2.2: Market integration and Price Transmission

The results in this study indicate relatively low transmission of world market price shocks for food and oil into Kenya's domestic markets. The results confirm that Kenya's trade on food products in world markets is very small or negligible and in fact much of the food imports into Kenya are in the form of aid. Furthermore, previous studies have shown that food prices in the Eastern African region show a different pattern and fluctuate more than the world prices. They further suggest that domestic prices correlate more with each other within the region than with world prices and the influence of world price developments is relatively small compared to regional price developments particularly for grains. Thus, Kenya should align her food production and supply strategies with the regional initiatives in order to meet her food security requirements and stabilize domestic prices.

With regard to crude oil prices, one would expect full transmission of world market prices into domestic markets given that it is a necessity and it is used in production across many sectors. However, there exists strong government interventions in sector domestic taxations, subsidization of petroleum products and direct control of wholesale and retail prices for fuel products in Kenya. Government interventions cushion consumers from otherwise adverse effects during price escalations in world markets. On the other hand, they prevent consumers from reaping the full benefits of reduced prices when world market prices for crude oil fall. Thus, the government should take cognizance of the fact that taxation regimes and other government interventions in the domestic oil sector influence the extent of such exogenous oil shocks and directly affect domestic prices and household welfare.

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