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SECOND ROUND EFFECTS AND PASS-THROUGH OF FOOD PRICES TO INFLATION IN KENYA

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Abstract

In the recent past, the Kenyan economy experienced persistent inflationary pressures, partly attributed to food price spikes. However, the quantitative role of food prices in inflation is not well understood or formally empirically analyzed in Kenya yet food occupies a weight of 36 percent in the consumer price index and contributes a monthly average of over 40 percent to overall inflation. Based on monthly data covering the period 1997-2012, this paper attempts to fill this gap by examining the relationship between food prices and inflation. The study used gap models and Phillips curve approaches to estimate the pass-through effects of food prices to both overall inflation and non-food non-fuel inflation. Based on gap models, the results confirm presence of second round effects from food prices to inflation while estimations of the Phillips curve suggest a domestic food price pass-through of 0.49 to overall inflation and 0.38 to non-food non-fuel inflation. The world food prices pass-through to overall inflation and non-food non-fuel inflation are estimated at 0.09 and 0.08, respectively. Thus this paper recommends usage of headline inflation to estimate trend inflation, enhanced communication to mitigate second round effects and that while monetary policy is very critical in anchoring inflationary expectations, there is mutual gain from a supportive fiscal policy in addressing supply side shocks.
Key Words: *Food prices, pass-through, overall inflation, core inflation*

1. Introduction

The literature on food prices-inflation relationship is largely dominated by theories grounded in the belief that volatile elements of inflation such as food prices do not reflect underlying inflationary pressures. The main argument is that such commodity price spikes are transitory and the upward spikes are quickly reversed leaving the medium-term aggregate price path unchanged (Jim, 2009; Cecchetti & Moessner, 2008). However, in the recent past, following persistent episodes of commodity price shocks, the research agenda shifted towards a re-examination of the role of commodity prices not only in headline inflation but also in core inflation

The Kenyan economy experienced persistent inflation over the recent past that is partly attributed to persitent commodity price shocks in both the domestic and international market. The prices of sugar, maize and wheat experienced the highest surges in the international market in the last five years and especially in the periods of 2008 and 2011. In the domestic market, the prices of maize, sugar and beef were most affected. As noted by Lora et al.,

(2011), globally, the price surges are explained by medium-term demand increases from emerging markets, slower agricultural productivity and short-term supply disruptions. In Kenya however, experience and previous studies show that food inflation is explained by dependence on erratic weather patterns that are often characterized by large dry spells and destructive floods during favorable periods; inadequate deliberate efforts to mitigate shocks; lack of farming incentives, low strategic reserves; insufficient government investment in food production and poor policy focus (Bryan et al., 2011; Irungu et al., 2009; Odhiambo et al., 2004).

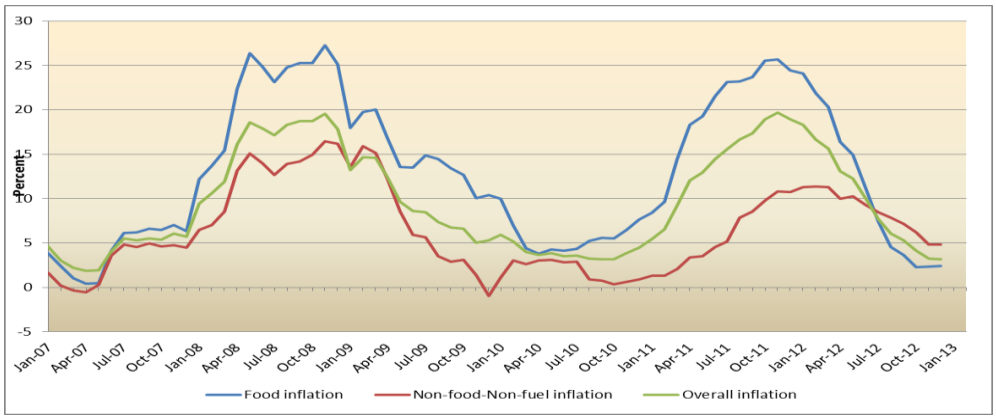
Food occupies a weight of 36 percent in the consumer price index and contributes a monthly average of over 40 percent to overall inflation in Kenya. However, the quantitative role of food prices in inflation is not well understood or formally empirically analyzed in Kenya. Moreover, although Kenya is largely self sufficient in most food products, due to its over dependence on the weather and inadequate deliberate efforts to enhance agricultural productivity, some food items such as sugar, wheat and maize are imported. Thus both international and domestic food shocks affect inflation in Kenya. Understanding the linkages between food prices and inflation is critical for analyzing and forecasting inflation. In addition, quantifying and analysing pass-through effects of food prices to both overall and core inflation will provide important policy insights critical for maintaining macroeconomic stability. The objective of this paper therefore is to examine the food prices-inflation nexus and pass through estimates of both international food prices and domestic food prices to both overall and non-food non-fuel inflation.

A couple of attempts have been made in Kenya. One such recent attempt used Forecasting and Policy Analysis Systems (FPAS) to analyze food and non food inflation in Kenya (Andre et al., 2013). The study concluded that both imported and domestic food shocks are important in inflation dynamics in Kenya. Although they introduced food inflation into the Phillips curve wich is partly similar to our study, the main emphasis of their study centered on the importance of using FPAS framework to analyze monetary policy besides isolating the role of external factors and monetary policy decisions in the recent inflationary episodes. Misati et al (2013) examined linkages between commodity price shocks and inflation based on granger causality and SVAR methods. The study found a role for food prices in explaining inflation. However, the study focused only on international food prices. While acknowledging that domestic prices are correlated to international prices, for an agricultural based economy like Kenya domestic food price pass-through to inflation is very important in monetary policy decision making. Moreover, this study didnot examine the extent of second round effects of food prices to overall and core inflation. Our study is distinct from previous attempts in atleast three respects. First, our study uses two different methods which facilitate assessment of the size of food prices pass through to overall and core inflation; Second, our study provides estimates of pass-through from both domestic and international food price shocks to overall and core inflation and third, our study examines in detail the relationship between core and overall inflation by examining the presence of second round effects (See also Durevall & Ndung'u, 1999).

2. Food prices and inflation trends in Kenya

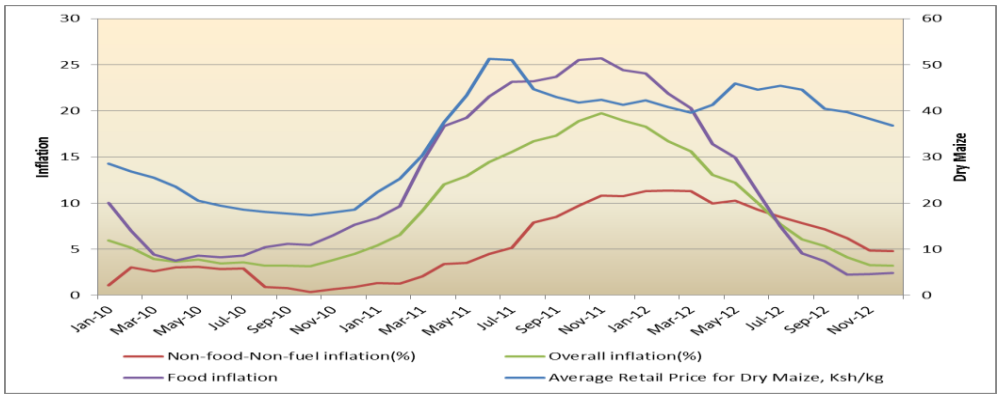
In this section, we analyse the trends of food inflation, including specific food components and core and overall inflation. Figure 1 shows historical movements of food inflation, non-food non-fuel inflation and overall inflation. From the figure, it can be observed that overall inflation started increasing beyond 7 percent in January 2008 and remained high until August 2009 and again from March 2011 to July 2012, with food

inflation being much higher than overall inflation.[1] It is clearly visible from the figure that during this period overall inflation and food inflation tracked one another confirming that food inflation is a major contributor to overall inflation. Figure 1 also shows that between January 2007 and December 2012, overall inflation was within the inflation target of 5 percent provided by the Treasury for only 10 months in 2007 and the year 2010. The prolonged peak periods concide with the global financial crisis and the associated commodity price spikes experienced in 2008-2009 and 2011 periods.



Source: Kenya National Bureau of Statistics

Figure 1. Food Inflation and Overall and Non-Food Non-Fuel Inflation Trends in Kenya

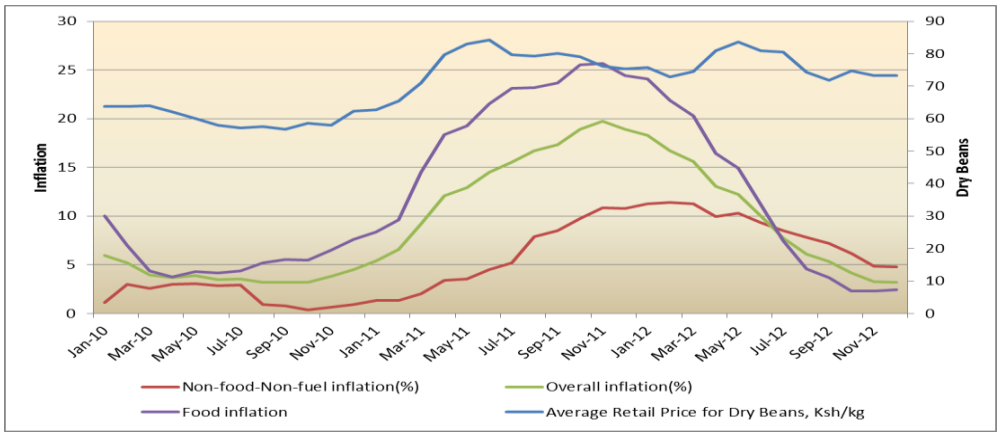


Source: Kenya National Bureau of Statistic

Figure 2. Trends of Maize Prices and Inflation

[1] The annual inflation objective set by the Ministry of Finance is 5 percent but it could flunctuate 2 percentage points above or below the set value before November 2011. However, reflective of the persistent supply side shocks experienced in 2011, the inflation objective was revized from 5 percent to 9 percent between November 2011 to June 2012. Subsequently, the band was expanded by 0.5 percentage points.

The trends of non-food non-fuel inflation follow overall inflation with a lag of between 2-4 months during the prolonged peak periods. Non-food non-fuel inflation started increasing above 7 percent in March 2008 and remained high until May 2009 and again from August 2011 to August 2012. Although the trends in figure 1 suggest some spill over effects from food inflation to non-food non-fuel inflation in general, it should be noted that after July 2012, food inflation was below both overall and non-food non-fuel inflation, implying that different factors other than food contributed to inflation during this period.



Source: Kenya National Bureau of Statistics

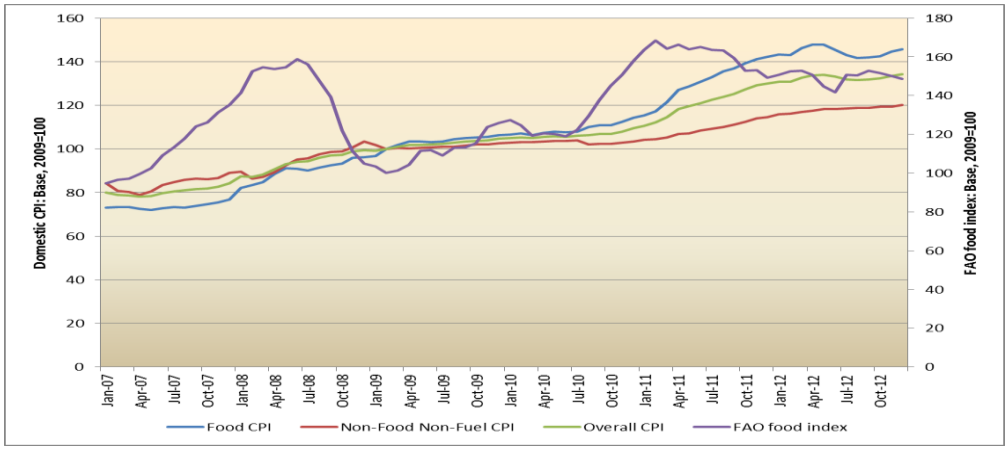
Figure 3. Trends of Bean Prices and Inflation

In figures 2-3, we present historical trends of maize and bean prices and inflation with the objective of understanding which components of food affect inflation most. We focus on maize which is considered a staple food for most Kenyans and beans which is a relatively cheaper source of protein assumed to be consumed by a large population in Kenya.[2] In figure 2, it can be observed that the prices of maize started rising in November 2010 and remained high until July 2011, when it only dropped slightly, then it settled at a much higher level than where it was previously. The trends of food inflation, overall inflation and non-food non-fuel inflation follow the same pattern as maize prices but with a lag of one month, 5 months and 7 months, respectively. After Januay 2012 when overall inflation, food inflation and non food non fuel inflation droped sharply, maize prices also declined but at a much slower rate implying that other factors, possibly other food components contributed to inflation more than maize prices. In figure 3, we observe similar trends between the price of beans and all indicators of inflation. The price of beans which is relatively less volatile but generally high started increasing in December 2010 and remained high until July 2011 when it slightly declined but settled at a higher level than before.

In figure 4, we report trends of international food price index represented by the FAO food price index and the overall inflation, food inflation and non-food non-fuel price indices. Generally, the FAO food price index, reprensenting international food prices is highly volatile compared to the domestic (overall CPI; non-food non-fuel CPI and food CPI) indices. Whereas the FAO price index increased rapidly after January 2007 and remained

[2] For more details on staple foods in Kenya, see Ariga et al., (2010)

high until July 2008 when it again sharply dropped, the domestic price indices were increasing but only modestly before July 2010.



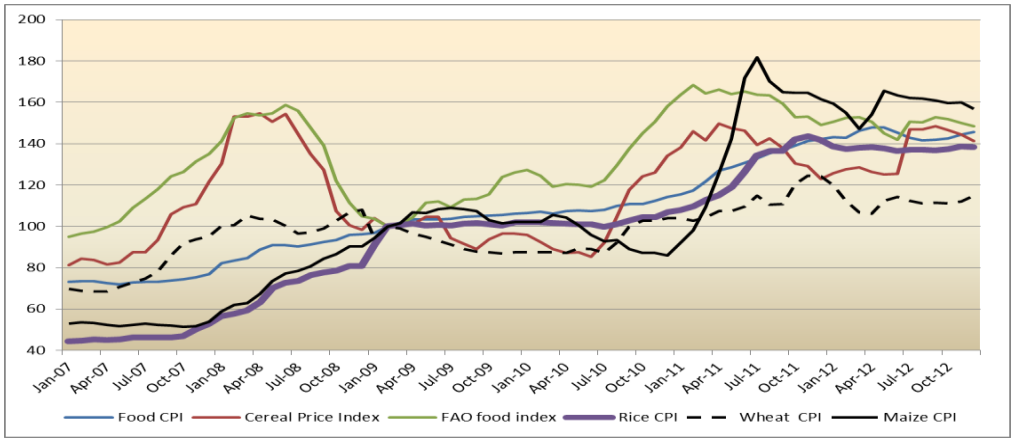
Source: Kenya National Bureau of Statistics and FAO website

Figure 4. Trends of International Food Index and Domestic CPIs

Subsequently, the domestic food price indices started increasing rapidly and have since remained relatively high. Non-food non-fuel CPI was higher with modest increases than overall and food CPI before January 2009 but it started rising after 2010 with the other measures of inflation. However, while the trends, particularly after 2010 show that international food prices is important, its effect on domestic food is minimal and almost absent in the period 2007-2010.

In figures 5-6, we analyse the CPI trends of imported food items (Wheat, Rice, Maize and sugar) and both domestic and international food price indices. This analysis is important since over 80 percent rice consumption is imported in Kenya while 60 percent of the wheat is imported. Although only about 30 percent of sugar is imported, price disturbances in sugar prices affect inflation significantly due to its important role as an input in the production process besides its direct effect on consumer prices. Similarly, although only about 10 percent of maize consumption is imported, changes in its availability affect inflation significantly because it is the main staple food.

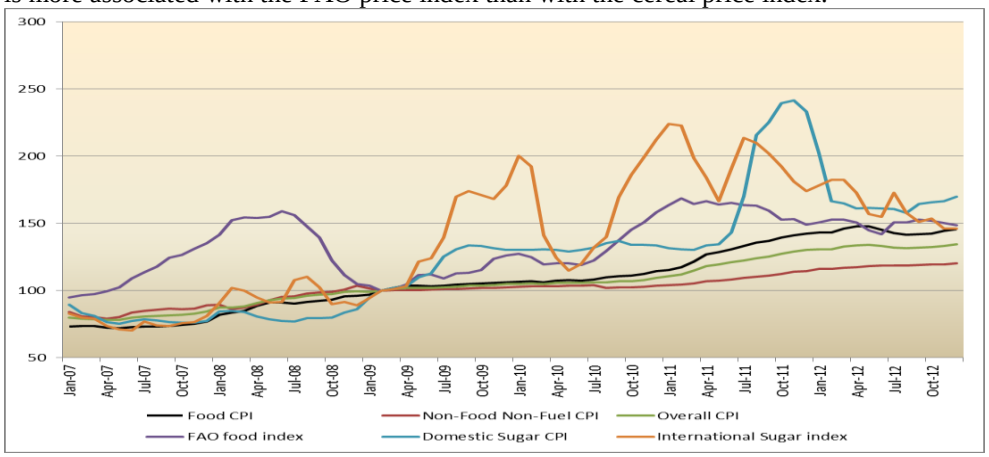
From figure 5, wheat prices marginally increased in the period 2007-2008 compared to the international cereal price index and the FAO price index but it was above the domestic food CPI during this period. This upward trend reversed in 2010 but wheat prices again started increasing in 2011 with similar observations as in 2007-2008 period. The figure also shows that, whereas in the period 2007-2008, domestic wheat CPI increases preceded international cereals price index changes, perhaps based on expectations following the commodity price shocks during this time, in the period 2010-2011, the international cereal price index changes preceded the domestic wheat price index increases, because by this time, the domestic market was not taken by suprise by occurences in the global commodity prices. At the same period of 2007-2008, food CPI started increasing after domestic wheat price changes with a lag of six months. Similar trends are observed in the 2010-2011 period but this time the lag is shorter by three months. Generally however, it is important to note that whereas the international cereals index tracks the FAO food index, they both play a relatively small role in the domestic wheat CPI.



Source: Kenya National Bureau of Statistics and FAO website

Figure 5. Trends of CPI of Domestic Cereals and Food and International CPIs

In the same figure 5, we present the trends of the domestic rice CPI and other domestic CPIs and international CPIs. In this case, the domestic rice price index follows the international cereals index with a lag of three months in both the 2007-2008 and 2010-2011 commodity price shock periods. However, the rice price index tracks the FAO index more closely compared to the wheat index and is above the international cereal price index during some periods, specifically, July 2011-April 2012. It seems therefore that the rice price index is more associated with the FAO price index than with the cereal price index.



Source: Kenya National Bureau of Statistics and FAO website

Figure 6. Trends of CPI of Domestic Sugar and Food and International CPIs

The maize price index follows the international cereal price index with a lag of two months and three months during the 2007-2008 and 2009-2011 periods, respectively. Suprisingsly, it seems that the effect of international food prices is much stronger and higher in terms of magnititude on maize although only 10 percent of maize is imported annually in

Kenya. For example, after October 2010, the maize index jumped sharply and stayed higher than both the FAO and cereals index since July 2011.

In figure 6, we present the trends of the domestic sugar index, international sugar index, the FAO food index and other domestic indices. Whereas the international sugar index is highly volatile, the domestic sugar index is relatively smooth except in the 2011-2012 period when the index was abnormally higher than the international sugar index implying that other factors were more important than the international sugar index in explaining domestic sugar prices during this period.

Prior to July 2009, the domestic sugar index and the international sugar index moved together but subsequently, the international sugar index changes preceded the domestic sugar index changes with some inconsistent pattern of lags. It can also be observed from the figure that domestic sugar index is not generally associated with most of the indicators of domestic CPI. Only modest co movement of the domestic sugar price index and indicators of domestic CPI can be observed in 2011. Some pattern can also be observed between the domestic sugar index and FAO food index with the latter preceding the former but with lags that are too long to warrant any constistent and meaningful analysis.

3. Literature Review

Considerable research on commodity price shocks with a bias towards developed countries exists in the literature. Most of the studies have mainly focused on food prices pass-through to inflation; monetary policy response to commodity price shocks and second round effects of commodity price shocks. We briefly review some of the studies below.

The pass-through studies capture the size, speed and assymmetries of international and domestic food prices pass-through to overall inflation and core inflation. In these studies both aggregated and disaggregated data and VAR and single equation methods are used (Atif et al., 2012; Rumler, 2012; Gelos & Ustyugova, 2012; Al-Shawarby & Selim, 2012; Adam et al., 2012; Ali, et al., 2012; Ianchovichina, et al., 2012; Jongwanich & Donghyun, 2011; Jalil & Zea, 2011). In general the results show that (i). International food price pass-through to consumer prices is incomplete due to subsidies and unique domestic consumption patterns and that it has changed over time. The duration and extent of pass-through also varies widely by product and depends on the share of food in CPI basket, central bank's independence, existing inflationary environment, trade openness, financial developemnt, wage flexibility and exchange rate regime (ii) The food price pass-through in emerging market economies is higher than advanced countries (iii). There is evidence of some spill-over effects from domestic food prices to core prices and that it is higher in emerging markets due to poor track record in controlling inflation thus international food price shocks elevate inflation expectations, often reflected in domestic prices and (iv). The price pass-through of food price shocks is asymmetric.

Studies on the transmission of commodity prices to inflation identifies both direct and indirect channels through which food prices affect inflation. The direct impact of an increase in food prices on aggregate inflation is related to the weight of food in the inflation index and the rate of food price inflation compared to the other components in the index. If food price increases exceed those of other goods in the basket, then the contribution of food inflation to headline inflation will be greater than the weight of food in the consumption basket. The indirect effect, also referred to as the second-round effects, on inflation works through its effect on inflation expectations, wages and prices of other components in the consumer price index (Rangasamy, 2011).

A related strand of the literature focuses on relationship of commodity prices and inflation based on the nature or source of the shocks. On the one hand, if the source of price increases is due to increased income and wealth in strongly growing economies such as Asia, it could lead to a one-off change in the level of commodity prices if it happened once. But with economic developments in these regions continuing, each month there would be a group of new consumers demanding more commodity goods so that demand would shift continuously, with more persistent effects on inflation and a smaller degree of reversion of headline inflation to core inflation. On the other hand, if higher commodity prices are mainly due to adverse supply shocks, the impact on inflation may be more transitory unless either the supply shocks are themselves persistent, or they lead to second round effects on inflation (Cecchetti & Moessner, 2008).

The standard view in the literature on appropriate monetary policy response to commodity price shocks is to allow the first round effects of such shocks on headline inflation but not the second-round effects. This line of thinking acknowledges that from a monetary policy perspective, it is impossible to influence international prices of commodities or to mitigate supply shocks stemming from these goods. However, if these price movements affect core and headline inflation and inflation expectations, either directly, or through second round effects, central banks should have a reason to react to international food price changes accordingly (Rhee & Lee, 2012; Jalil & Zea, 2011). Proponents of these arguments attach significant weight on the role of commodity shocks in inflation, particularly in developing countries where food accounts for a large part of the consumption basket and therefore heavily impacts on domestic consumer prices (Durevall et al., 2013; Mija et al., 2013; Jongwanich & Donghyun, 2011). Under this view, discounting food price developments relative to non food developments due to their greater volatility can lead to an underestimation of both overall inflation and core inflation (Pourroy et al., 2011; Walsh, 2011).

Empirical evidence on food prices- inflation nexus is largely mixed with some studies, particularly, in emerging markets showing considerable and significant effects of food price shocks on both headline and core inflaion while others, mainly advanced economies indicate neglibible effects of commodity shocks on inflation (De Gregorio, ,2012; Ferrucci et al., 2012; Hassan & Salim, 2011; Cecchetti & Moessner, 2008). For example, De Gregorio, (2012) analyzed the impact of food inflation on headline and core infaltion using data from Chile. He found that a 10 percent increase in food prices raises core inflation by about 2 percentage points and that an increase in food prices has both direct and second-round effects. According to De Gregorio, (2012), monetary policy should respond to commodity price shocks, but the response should be calibrated to the structural chracteristics of the economies. This is particularly crucial in emerging economies where commodities such as food represent a significant portion of the consumer basket. However, the author notes that effective commitment to the inflation target enhances credibility and therefore reduces the required response to mantain price stability in the presence of commodity price shocks, and reduces the costs of achieving price stability.

Ferrucci et al., (2012) and Mateja et al., (2012) also analyzed the pass-through of a commodity price shock along the food price chain in the Euro area using various methods and found a significant and long-lasting food price pass-through while emphasizing the role of domestic factors in consumer prices rather than international food prices. Contrastingly, using data for both advanced and emerging economies, Cecchetti and Moessner, (2008) analyzed the potential for second-round effects by analysing whether CPI inflation excluding food and energy reverts to headline inflation and found that it does not implying that there are no strong second-round effects. The study also found that headline inflation converges to

core inflation further confirming the absence of second-round effects for the examined data set.

4. Testing for Second Round Effects

In this study, we use the gap models and phillips curve to establish the second round effects and to quantify the pass-through estimates of domestic and international food prices to overall and core inflation. The analysis of second round effects of food prices is based on the gap method (Gelos a&Ustyugova, 2012; Ruch & Bester, 2012; Rangasamy, 2011; Janak & Sangita, 2011; Ceccetti & Moessner, 2008; Lafleche & Armour, 2006; McCauley, 2006; Rich &Steindel, 2005; Cogley, 2002; Clark, 2001; Macklem, 2001). Under this approach, we analyzed whether headline/ overall inflation reverts back to core inflation or not. If headline inflation reverts to core, it would mean food inflation is temporary and has not lead to persistently rising headline inflation that could arise from persistent upside shocks to food prices or from second round effects due to higher inflation expectations and accelerating wages (Ceccetti & Moessner, 2008).

$$\pi_t^{headline} - \pi_{t-i}^{headline} = \alpha + \beta(\pi_{t-i}^{headline} - \pi_{t-i}^{core}) + \varepsilon_t \quad (1)$$

where π_t^{core} = core inflation in period t. i= lags in months; $\pi_t^{headline}$ = headline inflation in period t.

In this case, equation 1 checks whether headline inflation reverts back to core inflation or not. Reversion implies that β in equation 1 is expected to be negative. A value of β of -1 implies that headline inflation fully reverts back to core inflation within one year if a period of 12 months is considered. We obtain a non negative number of 0.02 for β. This result therefore suggests that headline inflation does not revert back to core inflation and this signals presence of second-round effects. Equation 2 is used to check whether core inflation revert to headline inflation. In this case if δ is equal to 0, core does not revert to headline inflation, whereas a coefficient of -1 implies full reversion.

$$\pi_t^{core} - \pi_{t-i}^{core} = \gamma + \delta(\pi_{t-i}^{core} - \pi_{t-i}^{headline}) + \varepsilon_t \quad (2)$$

Following the methodology in Gelos and Ustyugova (2012) specified in equation 2, the study finds a value of -0.5 for δ which is different from zero implying that core inflation is reverting to headline inflation. This result suggests presence of second round effects. These results are consistent with previous studies for both advanced and emerging economies (Gelos and Ustyugiva, 2012).

$$\pi_t^{Nfood} - \pi_{t-i}^{Nfood} = \alpha + \beta(\pi_{t-i}^{headline} - \pi_{t-i}^{Nfood}) + \varepsilon_t \quad (3)$$

π_t^{Nfood} = Non-food inflation in period t

Equation 3 reflects the impact of food inflation (gap between headline and non-food inflation) in period $(t-i)$ on the increase of non food inflation between period t and (t-i). If

β is positive and significant, then food price changes affect the prices of non-food commodities, confirming the existence of second round effects from food prices. Our result for β is positive and significant at 0.52 for 12 month lag. This implies that for every 1 percent increase in food inflation, (the gap between headline and non food inflation) one year ago, results in non food inflation increasing by 0.52. Food inflation therefore feeds into non food inflation.

4.1. Phillips curve estimation

In order to obtain the full pass-through of food price changes to inflation, we estimate a Phillips curve specified in equation 4 (Gelos and Ustyugova, 2012; Christensson, 2009; De Gregorio et al., 2007). 3

$$\pi t = \alpha + \sum_{i=1}^{n} \delta i \, \pi t-i + \sum_{i=0}^{m} \phi_i \, Outputgap_{t-i} + \sum_{i=0}^{p} \theta i \, Food\, t-i + \varepsilon t \qquad (4)$$

The full pass-through from food price shock to inflation, is obtained by inverting equation 4 as follows:

$$\text{Pass-through} = \frac{\sum_{i=0}^{p} \theta_i}{1 - \sum_{i=1}^{n} \delta i}$$

We obtain pass-through estimates of 0.49 and 0.38 for overall and core inflation respectively when we use domestic food CPI . The results imply that an increase of domestic food prices by 1 percent leads to an increase of overall inflation and core inflation by 0.49 and 0.38, respectively. When we use international food prices, we obtain pass-through estimates of 0.09 and 0.08 for overall and core inflation respectively . The results imply that an increase of international food prices by 1 percent leads to an increase of overall inflation and core inflation by 0.09 and 0.08, respectively.

5. Conclusions

The commodity price shocks and associated long episodes of inflationary pressures experienced in a number of countries in the last five years ignited research debate on the role of food prices in inflation. Most monetary policy makers focus on measures of inflation that exclude food products rather than overall inflation with the belief that food price shocks are transient and therefore not critical in analysing trend inflation. However, a number of studies have shown that food price shocks affect not only overall inflation measures but also the core inflation measures. In order to understand the prolonged inflationary experiences in Kenya in the recent past and the challenges of maintaining price stability amidst prolonged food price spikes , this study attempted to examine the relationship between food price and overall and non- food non-fuel inflation using gap methods and Phillips curve estimations. The study considered both international food prices to capture the fact that Kenya imports some food products and domestic food prices which capture locally produced and consumed foods.

Based on gap models, the results confirm presence of second round effects from food prices to inflation while estimations of the Phillips curve suggest a domestic food price pass-

[3] Argumenting the Phillips curve with the exchange rate did not significantly alter the results and conclusions of the study. The results are therefore not reported here for brevity purposes.

through of 0.49 to overall inflation and 0.38 to non-food non-fuel inflation. The international food prices pass-through to overall inflation and non food non fuel inflation are estimated at 0.09 and 0.08, respectively. The analysis of trends of particular food components reveal that international food prices have only a modest contribution to wheat, rice and sugar consumer price indices but some notable link to the maize price index.

The results of this study suggest that core measures of inflation that exclude food inflation may not be appropriate in estimating underlying inflationary pressures, especially in countries with a large share of food products in the consumptiopn basket. Thus, this paper makes the following recommendations: first, it may be important to review the current core inflation measure with an objective of developing a measure that captures all the persistent products in the consumption basket. This is in view of the fact that overall inflation as currently computed has important persistent components that should be included in the core measure. Second, enhancement of the communication role including effective, credible and consistent communication of the factors driving inflation and monetary policy actions is very critical in mitigating against entrenchment of second round effects. Third and more importantly, this study recommends a re-focusing of national policy towards enhancement of investment in domestic food policies and food production incentives so as to improve food supply. Implicitly therefore, it is important for fiscal policy to support price stability given the challenges persistent supply shocks pose on inflation and in cognisance of the fact that monetary policy tools are limited in addressing supply side shocks.

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