working paper series

ARE INTERNATIONAL FOOD PRICE SPIKES THE SOURCE OF EGYPT'S HIGH INFLATION?

Sherine Al-Shawarby and Hoda Selim

Working Paper 714

October 2012

Send correspondence to:
Sherine Al-Shawarby
Associate Professor, Cairo University and Senior Economist
selshawarby@worldbank.org

Abstract

This paper examines whether domestic inflation spikes in Egypt during 2001-2011 were primarily the result of external food price shocks. To estimate the pass-through of international food price inflation to domestic price inflation, two different methodologies are used: a 2-step regression model estimates the pass-through in the long run, and a VAR model provides the short-run estimates. The empirical evidence confirms that pass-through is high in the short term, but not in the long run. More precisely, our results show that (i) Long-run pass-through to domestic food inflation is relatively low, lying between 13% and 16%, while the long-term spill-over from domestic food inflation to core inflation is moderate, lying around 60%; (ii) In the short-term, pass-through is relatively high, estimated around 29% after 6 months and around two-thirds after a year, but the spill-over effect to core inflation is limited; (iii) international food price shocks explain only a small portion of domestic inflation shocks in both the short and long terms; and (iv) international price inflation has asymmetric effects on domestic prices.

ملخص

تبحث هذه الورقة ما إذا كان ارتفاع التضخم المحلي في مصر خلال 2001-2011 كان في المقام الأول نتيجة لصدمات أسعار المواد الغذائية الخارجية. ولتقدير تضخم أسعار المواد الغذائية الدولية التمريرية لتضخم أسعار المحلية، نستخدم منهجين مختلفين: نموذج الانحدار الثنائي لتقدير التمرير على المدى البعيد، ونموذج VAR الذى يوفر التقديرات على المدى القصير. الأدلة التجريبية تؤكد أن تمرير التضخم مرتفع على المدى القصير، ولكن ليس على المدى الطويل. على نحو أدق، نتائجنا تظهر أن (أولا) التمريرات في ارتفاع اسعار الغذاء المحلية الطويلة المدى منخفضة نسبيا، بنسبة بين 13٪ و 16٪، في حين أن امتداد تأثير ارتفاع اسعار الغذاء المحلية على معدل التضخم الأساسي يكون معتدلا، حوالى 60٪، (ثانيا) في المدى القصير، يكون التمرير مرتفع نسبيا، ويقدر حوالي 29٪ بعد 6 أشهر، ونحو ثلثي بعد العام، ولكن امتداد تأثيره على التضخم الأساسي يكون محدود، (ثالثا) صدمات أسعار الغذاء العالمية لا توضح سوى جزء صغير من صدمات التضخم المحلي في الأجلين القصير والطويل، و (رابعا) تضخم الأسعار العالمية له آثار غير متماثلة على الأسعار المحلية.

1. Introduction

High inflation has been one of the key macroeconomic challenges facing Egypt over the past few years. Indeed, following a decade of low one-digit level, CPI inflation gathered momentum in the end of 2003 and once again in 2007 before accelerating in 2008 to peak close to 24% in August. Headline inflation is driven by inflation in food prices which have the largest weight (around 40%) in the average household's consumption basket. In fact, food price inflation has been much higher than CPI inflation, remaining in the double-digit level since January 2008.

As these domestic increases have been often accompanied by spikes in international food prices, it has been claimed that the latter has been their main driving factor, especially that the food consumption basket has a large imported component (e.g. Egypt is the largest importer of wheat in the world (FAO 2011). Naturally, more frequent rounds of international food price increases could increase Egypt's vulnerability to high domestic inflation.

The objective of this paper is to examine whether domestic inflation spikes in Egypt during the period 2001-2011 were primarily the result of external food price shocks. In addition, other fundamental questions addressed here are: (i) have surging domestic food prices spilled over into core inflation or are there other factors at play? (ii) is the response of Egypt's domestic inflation symmetric for positive and negative international price shocks?

While a vast literature has examined the determinants of inflation in Egypt (Kheir-El-Din 2009 and Kiguel and Okseniuk 2009), only a few studies had focused on the role of international prices, mostly in panel and multi-country studies (World Bank 2011; Albers and Peeters 2011; and Crowley 2010). Other work focused on estimating the long-run relationship (El-Sakka and Ghali 2005). Only one study provided evidence on the spill-over effect of domestic food shocks to other prices in Egypt (FAO 2009).

This paper contributes to the literature on international food price pass-through effects using two complementary methodologies. The first is a 2-step regression (IMF 2008a /2011) that produces long-run estimates of pass-through effects of international price inflation to domestic price inflation and was never applied to the Egyptian case; and the second is a traditional VAR approach that allows estimating the short-run effects and examining the relative importance of different sources of inflation.

Our empirical evidence confirms the widely held view that inflation is due in the short-term to external shocks whereas the effect of the shock seems to dissipate in the long-run. The empirical results can be summarized as follows: (i) in the long-run, pass-through to domestic food inflation is low and lies between 13% and 16% and the spill-over from domestic food inflation to core inflation is moderate, (ii) in the short-term, pass-through is high and is estimated around 29% after 6 months and around two-thirds after a year, but the spill-over effect to core inflation is feeble, (iii) international food shocks explain only a small portion of domestic inflation shocks, and finally (iv) international price inflation has asymmetric effects on domestic prices.

Apart from the introduction, the paper is structured as follows. Section 2 provides a brief descriptive analysis of both domestic and international inflation measures during the last decade. Section 3 presents a literature brief. Section 4 lays out the empirical methodologies and presents the data. Section 5 reports and discusses the key empirical findings. The final section concludes and discusses policy implications.

2. Inflation and Monetary Policy in Egypt

2.1 Inflation measures: A first look

Egypt's CPI inflation averaged around 9.4% between 2001 and 2011 spiking to double-digit figures three times: in 2004, 2008 and 2010. Without these spikes, this figure falls to 5%.

Inflation first accelerated in June 2003 from the low digit level (close to 3%) to 11% afterwards, reaching a peak of 24% in August 2008 following the global commodity price crisis (Figure 1). This was more than double the inflation rate in the MENA region in 2008 (11%) and significantly higher than many other peer countries with more-than-30% weight of food in the CPI (Figure 1). Inflation has been subdued since then, but it remains in the low-double-digit levels (between 11 and 12%).

Meanwhile, food price inflation—around 40% of consumption expenditure and the largest component in the CPI basket—has been the main driver of headline inflation. It has accelerated from low single digit levels of around 4% in the early 2000s to around 14% on average between FY04 and FY11. In particular, it rose from 6.9% in December 2007 to a 31% peak in August 2008 (Figure 2). Between January 2008 and July 2011, the accumulated inflation of food prices (84%) was significantly higher than that of the overall CPI (51%). It is also worth mentioning that administered prices represent around 19.4% of the CPI basket, and subsidized food prices represent around 6% of food consumption.

Moreover, in all recent spikes of CPI inflation since 2004, price increases in agicultural commodities seem to have played a role in feeding these spikes (Kiguel and Okseniuk 2009). Also, hikes in domestic food price inflation have been generally preceded by increases in international food inflation (Figure 3). However, two aspects are worth noting: inflation of domestic food prices has been higher but less volatile than that of international food prices (Table 1), and domestic food prices decouple from international food prices when the latter decrease (Figure 3). Domestic food prices did not see any deflation since January 2008 and July 2011 cumulatively increased by around 84%, as mentioned earlier, whereas international food price inflation grew by only 18%.

Moreover, core inflation has been lower than both headline and food inflation. Core inflation—as measured by the Central Bank of Egypt (CBE) and that excludes fruits and vegetables and regulated prices— was high, averaging close to 9% between 2005 and 2011.[1] It closely followed headline inflation during the period January 2005 and August 2009 but they decoupled since then (Figure 4). However, the more traditional measure of core inflation, which excludes all food and energy prices, has been significantly lower, averaging only around 5% during the overall period. Moreover, it has been in the low single digits since July 2009, and has posted negative growth rates in most of FY11. Thus, this core measure of inflation seems to be more disconnected from headline inflation movements, suggesting that shocks transmission from the food sector to other sector was minimal, except for the period January 2005 to April 2009 (where it averaged 7.5%). This confirms the analysis by Kiguel and Okseniuk (2009) who argued that not all inflation spikes have spill-over effects. The 2004 inflation surge was not accompanied by inflation in other sectors, but in 2008 domestic food price increases spilled over to other non-food components; such as tourism, education, recreation, transport and clothing and footwear. This is particularly worrying, because it means that food price shocks influence headline inflation indirectly through agents' inflation expectations, feeding thus into the actual price of other non-food products.

It is very possible that high inflation in recent years is the consequence of many other factors. In fact, demand pressures may have resulted from strong domestic demand (economic growth was between 6 and 7% over FY06-FY08), stimulated by large cuts in income tax rates (in July 2005) and other reforms. Large capital inflows (around 8.5 % of GDP in FY07) — stimulated by ample regional liquidity and negative real interest rates—have further resulted in a significant rise in M2 growth, which has fuelled high inflation (Figure 5).

---

[1] Data available only since January 2005.

Moreover, Noureldin (2008) presents empirical evidence that relative price adjustments (driven by the 2003 devaluation of the pound, the increases in the prices of energy-related products and the outbreak of the avian flu virus) were important factors in the dynamics of inflation. In particular, the role of the exchange rate in producing lagged inflationary pressures has been examined in some work (Rabanal 2005). Also, Kraay (2007) found that the exchange rate pass-through to food items between 2000 and 2005 was higher than that to other items. Finally, other structural factors like the persistent budget deficit (Helmy 2008) and downward price rigidity (Hassan 2008) have also contributed to sustaining the pressures.

2.2 Monetary policy in Egypt

After the official abandon of the exchange rate anchor in early 2003, recent reforms were introduced to enhance the monetary policy framework in Egypt. In particular, price stability was formally declared (through the 2003 Banking Law and other CBE statements) to be the overriding medium-term objective of monetary policy (CBE 2005). The CBE also announced in 2005 its intention to move to inflation targeting. Yet, these improvements did not allow monetary policy to achieve price stability, especially that the framework still lacks an official nominal anchor since the abandonment of the exchange rate peg (Selim 2011).[2] Like many other central banks, the CBE relies on short-term interest rates as an instrument to influence liquidity and inflation. However, monetary policy remained initially inactive in the face of inflation shocks and policy tightening often occurred too late in the aftermath of shocks and was not sufficient in the face of mounting inflation (Figure 6). In many cases, the stance of monetary policy was accommodating as real interest rates remained negative and were declining. More generally, Al-Mashat and Billmeier (2008) find that the interest rate transmission channel is weak.

3. Literature Review

Theory states that commodity prices are able to forecast changes in prices and may thus be expected to correlate positively with intermediate and consumption prices. This is because commodity prices are set in competitive flexible markets and thus respond immediately to actual or expected changes in supply or demand, but because consumer prices are set contractually by producers and retailers, they respond with a lag to these pressures. Empirical work was carried out to verify this relationship in the context of the 1970s' oil price shocks (Blomberg and Harris 1995 and Furlong and Ingenito 1996). Moreover, imperfect competition and/or price stickiness (Rotemberg and Woodford 1999) lead firms to only partially pass-on commodity price increases (originating from supply shocks) to consumer prices, thus making pass-through incomplete (Kalecki 1971).

The empirical work aiming to quantify the response of domestic prices to global price shocks is voluminous and received renewed attention in the aftermath of the 2007-2008 commodity price shock (IMF 2011; Ferrucci et al. 2010, Zoli 2009, IMF 2008a, b and c, Jongwanich and Park 2008, and Liu and Tsang 2008). More generally, the literature review shows four main findings:

First, international to domestic food pass-through is incomplete and has changed over time. Incomplete pass-through is most likely due to the presence of significant local production components (including retail and distribution components), subsidies and domestic consumption patterns that are different from the composition of world commodity price indices (IMF 2011). Moreover, Blomberg and Harris (1995) and Furlong and Ingenito (1996) show that a declining food commodity pass-through in the United States since the mid-1980s was due to a weakened demand for commodities, as the latter gradually shifted toward sectors with low commodity content (such as IT and services). Evidence of a declining pass-

---

[2] For more information on the monetary policy framework in Egypt, please see Selim (2011).

through in advanced economies was also provided by IMF (2008a) between the period 1975-1995 and 1995-2008. Hahn (2003) had shown that pass-through remained stable over time in the euro area. No study has investigated this for emerging markets economies (EMEs).

Second, pass-through in EMEs is higher than in advanced economies (IMF 2011/ 2008a and b and Ferrucci et al. 2010, Galesi and Lombardi 2009). IMF (2011) estimates a pass-through of a 1 percent international food price shock to domestic food prices at around 0.18 for advanced economies and 0.34 for EMEs. Estimates of the size and speed of pass-through reveal a wide variation across EMEs and depended on the sample, period of analysis and the international price measure used in the analysis. On the one hand, Zoli (2009) finds that a 1 percentage point (ppt) shock in international commodity prices leads to an average 0.2 ppt increase in domestic inflation in 18 European emerging economies and IMF (2008c) finds that a 30% increase in world food prices raised annual headline inflation by an average of 1 ppt in 10 Latin American economies. Liu and Tsang (2008) provides evidence of a weak pass-through in China and Jongwanich and Park (2008) shows that pass-through did not have a significant role in developing Asia. On MENA, World Bank (2011) provides pass-through estimates, ranging between 20 and 40% (except for Tunisia and Algeria where they are very low). The report also finds that the pass-through is relatively fast, taking about one year to reach full impact, and in some cases much less (3-6 months). Albers and Peeters (2011) find similar evidence for a number of Southern Mediterranean economies. On the other, Loungani and Swagel (2001) showed that both fuel and nonfuel commodity prices to have a significant but modest impact on inflation in developing countries.

Third, there is evidence of a moderate spill-over effect from domestic food prices to core prices, suggesting weak second-round effects of higher commodity prices (IMF 2011; Galesi and Lombardi 2009; Cecchetti and Moessner 2008; IMF 2008a and b). Moreover, such pass-through is also higher for EMEs than for advanced economies (IMF 2008a / 2011). IMF (2008a) shows that one-half of the shock to domestic food prices eventually makes its way through to core inflation in EMEs, whereas in advanced economies, less than one-quarter passes through. This is due to several factors specific to EMEs, including a higher share of food consumption, and a poor track record in controlling inflation which means that international price shocks contribute to raising inflation expectations, which are in turn reflected into domestic prices.

Fourth, the price pass-through of external shocks is asymmetric. In an extensive study of 282 products and product categories, including 120 agricultural and food items, Peltzman (2000) shows that asymmetric price transmission is the rule rather than the exception and is prevalent in the majority of producer and consumer markets. Zoli (2009) finds that increases in food price inflation generates increases in headline inflation in emerging Europe, while falls in food price inflation do not lead necessarily to falls in headline inflation. Similar evidence for a number of MENA countries can be found in Albers and Peeters (2011) and World Bank (2011).

Results of empirical work on Egypt provide mixed results. Older studies, find no evidence that import prices affect inflation in the long-run (Bahmani-Oskooee and Malixi 1992; and Deme and Fayissa 1995). More recent work provides evidence of a long-run pass-through effect, regardless of the adopted methodology. Using cointegration techniques, El-Sakka and Ghali (2005) find that a 10% increase in international prices push-up domestic inflation by 1.9%, though changes in domestic consumer prices do not seem to be highly sensitive to changes in import prices. They attribute this to the heavy subsidy scheme. Using panel data for a sample of MENA and Central Asian counties including Egypt, Crowley (2010) finds that doubling prices of nonfuel commodities would induce increases of 4-6 points in inflation. Investigating short-run dynamics using VAR analysis, multi-country studies like those of

Albers and Peeters (2011) and World Bank (2011) find that Egypt is among the high pass-through countries. In particular, World Bank (2011) estimates pass-through to domestic food prices by more than 44%. Moreover, the shock reaches its full strength after a year. Finally, FAO (2009) provides evidence of a spill-over from domestic food prices to both CPI and core prices, estimated respectively at 59 and 16%.

4. The Models' Set-up and Data Properties

Pass-through empirical work is mainly carried out using two different methodologies: bivariate models and VAR models. This section presents these two models then addresses data issues.

4.1 Empirical Models

4.1.1 The 2-step OLS regression Model

According to this methodology adopted by IMF (2008a and 2011), the pass through from international to domestic food price inflation is first estimated using a bivariate regression of the following form:

$$\pi_{t\,domestic} = \alpha + \sum_{i=1}^{12} \beta_i\, \pi_{t-i\,domestic} + \sum_{i=0}^{12} \delta\, \pi_{t-i\,world} + \varepsilon_t$$

Where π stands for the annualized month-over-month log difference in food prices. The long-term pass-through effect from international to domestic price inflation is then calculated as follows:

$$price\ pass-through = \frac{\sum_{i=0}^{12} \delta_i}{1 - \sum_{t=1}^{12} \beta_i}$$

Secondly, the pass-through from domestic food price inflation to core inflation (and non-food price inflation) is estimated using the following generalized Phillips curve equation:

$$\pi_{t\,core} = \alpha + \sum_{i=1}^{12} \theta_i\, \pi_{t-i\,core} + \sum_{i=0}^{12} \gamma_i\, (y_{t-i} - y_{t-i}^*) + \sum_{i=0}^{12} \varphi_i\, \pi hat_{t-i}^{domestic} + \epsilon_t$$

Where π stands for the annualized month-over-month log difference in core prices, *y* and *y** denote the annualized month-over-month log difference in real and potential GDP (growth gap), respectively, while πhat denotes the predicted values of domestic food inflation obtained from the first-step bivariate regression.

The predicted values are used to ensure that domestic food prices in step 2 reflect only the variation that is due to changes in international prices and lagged effects of domestic food price changes, rather than movements in other factors (like labor, transportation, retailing cost, etc...) that may have common origins with overall inflation (IMF 2008a). Coefficients obtained in this step allow the calculation of the food price pass through as follows:

$$domestic\ food\ price\ pass-through = \frac{\sum_{i=0}^{12} \varphi_i}{1 - \sum_{t=1}^{12} \theta_i}$$

Finally, one can examine the presence of asymmetric effects by including a dummy variable for periods when international food price changes are decreasing. The dummy variables equal to 1 when there is a decrease in international food prices and zero otherwise. The dummy is then entered in a multiplicative form with the variable representing international price inflation. If the summation of the coefficient of international food price inflation and the differential slope coefficient is positive, one can conclude that asymmetric effects of world food prices on CPI are likely to be present.

4.1.2 The VAR Baseline Model

Most papers use VAR models (World Bank 2011; Galesi and Lombardi 2009; Zoli 2009; IMF 2008b and c; Jongwanich and Park 2008; and Hahn 2003). VAR models are able to capture the interaction of domestic prices with different domestic factors and external shocks (commodity prices, exchange rate, etc...). In particular, they can capture both the direct effects of higher costs of commodity prices and the indirect effects coming from the fact that these commodities are inputs in the production of other goods. Moreover, VAR models have three main advantages over bivariate models. First, they solve the endogeneity problem inherent in the single-equation based methods. Second, they take into account the influence of other macroeconomic variables (supply and demand shocks). Third, in addition to estimating pass-through effect, they assess its dynamics over time.

Two different VAR models are estimated at monthly frequency for Egypt.[3] The first includes the following variables: world food price inflation, output gap, as a measure of economic activity, headline inflation, the change in M2d, and changes in the real exchange rate. This model will estimate the pass-through from world food price inflation to headline inflation. In the second model, headline inflation is replaced by domestic food inflation, and core inflation, providing thus further insights on the transmission of international commodity price shocks to domestic food inflation, as well as the spill-over of the latter to core inflation.

The shocks are identified using the Cholesky decomposition of the variance-covariance matrix of the reduced form residuals. The use of a recursive identification scheme implies that the identified shocks contemporaneously affect their corresponding variables and those variables that are ordered at a later stage, but have no impact on those that are ordered before. Hence, the most exogenous variable, international food prices, comes first. Food price shocks may thus affect all other variables in the system contemporaneously but they are not themselves affected contemporaneously by any of the other shocks. Estimates of the pass-through coefficients are derived from cumulative impulse response function to assess the impact over time of temporary external and domestic shocks on relevant price measures. Variance decomposition analysis is used to determine the relative importance of these shocks for fluctuations in the different price measures.

4.2 Data

The models are estimated for the period 2000M7 and 2011M7. All variables are included as the annualized log differences, except for the output gap in the VAR and the growth gap in the 2-step regression. While all variables, except for the exchange rate, were seasonally adjusted before getting their log differences in the VAR, dummy variables are used in the 2-step regression to find out the seasonal effects of various months. Annex 1 provides details on data description and sources.

In order to assess the stationarity of the variables, unit root tests were performed using the Augmented Dicky-Fuller (ADF). The tests, summarized in Annex 2, show that all the variables are stationary (i.e. I(0)).

5. Results

In this section, the empirical results are presented and discussed. The long-term pass-through coefficients are estimated from the 2-step regression model, and the short-run dynamics are obtained from the VAR models. *In general, the results show that pass-through is incomplete both in the long and short runs, which is in line with theory. However, the results on the size of the pass-through diverge between the long and short term. In fact, the short-term impact of external food shocks is higher than in the long run, suggesting that the effect of the shock tends to dissipate over time.*

---

[3] Energy prices in Egypt are fixed and therefore are left out of the empirical analysis.

5.1 Long-term pass-through coefficients

The 2-step regression model shows that pass-through to domestic food inflation is low and lies between 13% and 16% (depending on the international price measure used) and the spill-over from domestic food inflation to core inflation is moderate, estimated at around 0.6%.

The first-step equation was estimated following the methodology shown in the previous section. Three measures of international food prices were used (IMF food index, FAO food index and FAO cereals sub-index). Only statistically significant coefficients of the different lags, regardless of their signs, were used to compute the full long-term pass-through from international price inflation to domestic food inflation[4]. The results using the IMF food price index are not reported because it yielded negative pass-through estimates. In general, the results from this step, reported in Table 2, show that the pass-through to domestic food inflation is low. A 1% increase in the international price inflation leads to a 0.16% increase in the domestic food price inflation when the FAO food index is used as a measure of international food prices, and to a 0.13% when the FAO cereals sub-index is instead used. Also, the first-step equation shows that international food price inflation explains around one quarter of the changes in domestic food price inflation, meaning that changes of domestic food prices are attributed to factors other than the international food price inflation.

These results are in line with the 0.16 weighted average pass-through of the IMF (2008a) country-by-country estimate, and the 0.19% estimate of El-Sakka and Ghali (2005). Yet, these results may seem much lower than the 0.34 median long-term pass-through of international food price shock in EMEs, (IMF 2011). This may be due to expressing international prices in local currency in IMF (2011), blending thus together changes in the exchange rate and changes in international food prices. Yet, our results remain unexpected given the large size of the food basket in Egypt's CPI.

The estimation of the second-step equation showed that the long-term the spill-over from domestic food prices to other domestic prices is sensitive to the variables used both in step 1, the international price index being (either the FAO food index or the FAO cereals sub-index), and step 2, the domestic price index (core versus non-food inflation) and the economic activity proxy variable (output gap versus output growth gap). In fact, the eight equations that were estimated showed that the long-term spill-over effects ranged between 0.15 (from domestic food prices impacted by FAO cereals price changes to core inflation) and 1 (complete spill-over of the shock to domestic food price inflation to non-food price inflation when the FAO food index is used) (Table 3).

To solve the inconclusiveness of the results of the spill-over estimates, the authors resorted to an out-of-sample forecasting method to compare the forecasting power of various models. As shown in table 3, ceteris paribus, having a lower Root Mean Square Error (RMSE), the growth gap variable produces more accurate forecasts than the output gap; and the FAO cereals sub-index produces more accurate forecasts than the FAO food index. Consequently, based on the RMSE criterion, the most accurate relation would be that of the non-food price inflation regressed, among other things, on the predicted values of domestic food prices estimated from the bivariate regression of domestic food and FAO cereals sub index, and the growth gap variable. This relation indicates that a 1% increase in the domestic food price inflation is estimated to increase non-food inflation by almost 0.6%, and that changes in domestic food price inflation explain almost 75% of changes in non-food inflation. Moreover, for the same specification, the spill-over to core inflation is also close to 0.6%.

Finally, there is evidence that international prices have an asymmetric effect on domestic prices (Table 4). Following the approach described in section 4, domestic food price inflation

---

[4] All selected coefficients are significant at least at the 95% confidence level.

is found to increase by only 5.4% when inflation of FAO food index increases by 10% and by 1.8% when inflation of FAO food index decreases by the same magnitude. Using the FAO cereals sub index inflation, the asymmetric effect is less pronounced: an increase of 10% in international food prices would cause a 2.3% increase of domestic food prices, while a decrease of the same magnitude would cause a decline of 1.8%.

5.2 Short-run dynamics

In this section, results of the VAR analysis are reported. The number of lags in the VAR is determined through the standard information criteria (see Appendix 3). The results were not sensitive to the ordering of the variables. In general, the results show that pass-through to headline inflation is feeble but it is high to food price inflation (estimated around 29% after 6 months and around two-thirds after a year). The spill-over effect to core inflation is almost negligible.

5.2.1 Impulse response functions

Table 4 report the pass-through coefficients for horizons j = 1, 3, 6, 12, 18 and 24 months. Impulse responses suggest that movements in world food prices have a feeble impact on domestic CPI inflation. A 1-standard deviation initial shock (estimated at around 31.15 percentage points (ppts)) in world food prices leads to an estimated cumulative increase in CPI by 4.5 ppts after 6 months. Another measure of the size of the pass-through in month *j* is to look at the ratio of accumulated responses of domestic inflation to one standard deviation shock to the international food price inflation *j* horizons after the shock. This way of measurement, usually used in the exchange rate pass-through literature, would suggest that the pass-through to CPI is weak, with only around 9% of the external shock passing through to CPI inflation after 6 months and around 10% after 8 months.

Shocks from international food price inflation to domestic food inflation have a stronger effect. A hike in world food inflation by 27.5 ppts is estimated to raise domestic food inflation by 10.7 percentage points after 6 months (Table 5). In the same way of measurement as above, pass-through to food prices is high: more than a quarter of the external shock (29%) passes through to food inflation after 6 months and around two-thirds after a year. This is in line with Kraay (2007) who found that pass-through to food items is higher than other items. While our results are not strictly comparable with others (World Bank 2011), they confirm that pass-through to domestic food prices is high in Egypt.

It is also useful to examine the impact of domestic food inflation on core inflation, to assess whether there are second round effects of initial shocks, which could be long lasting. Indeed, the analysis of the VAR impulse response suggests that core inflation does not respond significantly to shocks to domestic food inflation (Table 6). Impulse responses of core prices indicate that the initial impact of a 1-standard deviation (initial) shock (estimated at 14.8 ppts) in domestic food prices is mostly negative, suggesting the absence of a significant spill-over effect.

5.2.2 Robustness Checks

The basic results were slightly altered when the estimations were conducted using alternative measures of international supply shocks (The FAO food index). Table 7 reports these results and confirms that pass-through to CPI is low, estimated at 8% after 6 months. However, shocks from international food price inflation still have a stronger effect on domestic food inflation than on CPI inflation. However, this effect is slightly weaker than when the IMF food index is used. In fact, pass-through to food prices is estimated at 22% after 6 months. More importantly, it subsides over time. Also, the spill-over to core inflation from domestic food price inflation is still weak but stronger than when the IMF food index is used.

5.2.3 Sources of inflation: variance decomposition analysis

Although impulse response functions (IRFs) provide information on the impact of the fluctuations of world food prices on the CPI, they do not indicate the importance of these shocks in CPI fluctuations. By contrast, variance decomposition indicates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

Figures 7a and 7b summarize the results on the variance decomposition of both domestic food inflation and core inflation respectively. Variance decomposition of domestic food price inflation indicates that it is explained by inertia or its own innovation (65%). International food price inflation accounts for 10% of the variance of domestic food inflation. As for core inflation, again innovations in the variable explain a bit more than half of its variance, but together domestic and international food inflation account for 25% of its variability.

To sum up, the results of the two methods diverge but they are not strictly comparable. They both show that pass-through of external shocks to headline inflation is low. However, the VAR shows the short-term impact of such shocks to food price inflation, confirming that Egypt is among the high pass-through economies. The 2-step model provides a lower pass-through estimate in the long run, which could be interpreted as a dissipation of the effect of the shock over time. Finally, the VAR model shows that the spill-over from domestic food inflation to core is feeble, which is in line with the descriptive analysis above and also close to the results of FAO (2009).

6. Conclusion and Policy Inferences

This paper estimates pass-through coefficients of external food shocks to domestic price inflation in Egypt using monthly data from 2000 to 2011. The paper relies on two alternative methodologies to do so. The first is a two-step model that provides the long-run pass-through effects and is able to identify the change in domestic inflation that is due only to changes in international prices rather than movements in other factors. The second is a traditional VAR model that assesses the short-run dynamics of external food shocks to domestic food prices and those of the latter to other domestic prices. Our results can be summarized as follows:

First, the long-term pass-through to domestic food price inflation is low and is estimated between 13% and 16%, while the long-run spill-over effect of domestic price shocks to non-food inflation is more significant- estimated at 60%. Also, while changes in international food prices explain only one quarter of the variations in domestic food prices, changes in the latter explain almost three quarters of the variations in domestic non-food prices.

Second, the short-term pass-through to CPI is weak, with only around 9% of the external shock passing through to CPI inflation after 6 months, while the short-term pass-through to food prices is higher with more than a quarter of the external shock (29%) passing through to food inflation after 6 months and around two-thirds after a year. Also, the spill-over from domestic food price inflation to core inflation, is limited. Moreover, international food shocks explain only a small portion of domestic inflation shocks,

Finally, there is evidence of an asymmetric effect suggesting that domestic prices are vulnerable to increases in international food prices but seem to be somewhat insulated from their decreases (downward rigid).

This paper has shown that external food shocks affect domestic food price inflation in the short term. Yet, domestic increases, especially since 2008 had taken place when other traditional and structural sources of inflation were already at play, as concluded by Kiguel and Okseniuk (2009). In other words, such increases decisively and pre-emptively defused the risk of deeply entrenched long-term inflation. Meanwhile, market rigidities, weak market

institutions and lack of competition and ineffective consumer protection maybe responsible for downward price rigidity and/or amplifying the imported inflation increases as producers are able to drive their mark-ups and adopt ad hoc pricing strategies. These areas are left for future research.

To conclude, global food shocks are exogenous and therefore are largely beyond policymakers' control. Yet, this does not mean that the monetary authorities do not have a role in reducing pass-through. In fact, appropriately tight and forward-looking monetary policy could pre-emptively act to curb such pressures. This would surely require that the CBE possess the inflation forecasting and modelling capabilities and the data needed in order to assess inflation prospects. According to Al-Mashat (2008), the CBE has already developed models to forecast inflation and carried out both 'near-term' (a quarter ahead) and longer-term forecasts but these forecasts have not yet been published. However, as inflation is also the result of long-term factors, a more prudent fiscal policy together with agriculture and food security policies that ensure increased food supply and improved productive and allocative efficiency in Egypt's markets would significantly reduce inflationary pressures.

References

Albers, R., and M. Peeters. 2011. Food and energy prices, government subsidies and fiscal balances in South Mediterranean countries. European Commission Economic Papers 437. Brussels: European Union.

Al-Mashat, R. 2008. Monetary policy in Egypt: A retrospective and preparedness for inflation targeting. ECES Working Paper Series 134. Cairo: The Egyptian Center for Economic Studies.

Al-Mashat, R., and Billmeier, A. (2008), 'The Monetary Transmission Mechanism in

Egypt.' *Review of Middle East Economics and Finance* 4(3):1-51.

Bahmani-Oskooee, M., and M. Malixi. 1992. Inflationary effects of changes in effective exchange rates: LDCs' experience. *Applied Economics* 24(4): 465–71.

Blomberg, S. B., and E. Harris. 1995. The commodity-consumer price connection: Fact or fable? *Federal Reserve Bank of New York Economic Policy Review* (October): 21–38.

Cecchetti, S. G., and R. Moessner. 2008. Commodity prices and inflation dynamics. *BIS Quarterly Review* (December):55-68.

Central Bank of Egypt (2005), Monetary Policy Statement. Cairo: Central Bank of Egypt.

Crowley, j. 2010. commodity prices and Inflation in the Middle East, North Africa, and Central Asia. IMF Working Paper 10/135. Washington D.C.

Deme, M., and B. Fayissa. 1995. Inflation, money, interest rate, exchange rate and causality: The case of Egypt, Morocco and Tunisia. *Applied Economics* 274(12):1219–24.

El-Sakka, M., and K. Ghali. 2005. The sources of inflation in Egypt: A multivariate co-integration analysis. *Review of Middle East Economics and Finance* 3(3): 257–69.

FAO. 2009. Macro-economic and poverty situation. Working Paper 1, Initiative on Soaring Food Prices, Inter-Agency Assessment Mission (17 November – 4 December 2008), Government of Egypt, FAO, WFP, World Bank and IFAD.

FAO. 2011. North Africa Brief. FAO/GIEWS Global Watch. March 2011. Available on: http://www.fao.org/giews/english/shortnews/nafria110311.pdf Accessed on 28 July 2012.

Ferrucci, G., R. Jiménez-Rodríguez, and L. Onorante. 2010. Food price pass-through in the Euro area: The role of asymmetries and non-linearities. European Central Bank Working Paper Series 1168. Frankfurt.

Furlong, F., and R. Ingenito. 1996. Commodity prices and inflation. *Federal Reserve Bank of San Francisco Economic Review* 2: 27–47.

Galesi, A., and M. J. Lombardi. 2009. External shocks and international inflation linkages - a global VAR analysis. European Central Bank Working Paper Series 1062. Frankfurt.

Hahn, E. 2003. Pass-through of external shocks to Euro area inflation. European Central Bank Working Paper 243. Frankfurt.

Hassan, M. 2008. Inflation dynamics in Egypt: Consumer price data at elementary product level. Paper presented at the Egyptian Banking Institute Second Annual Conference, Cairo, June 2008.

Helmy, O. 2008. The impact of budget deficit on inflation in Egypt. ECES Working Paper Series 141. Cairo: The Egyptian Centre for Economic Studies.

International Monetary Fund (IMF). 2011. Target what you can hit: Commodity price swings and monetary policy. In *World economic outlook September 2011: Slowing growth, rising risks.* Washington, D.C.: The International Monetary Fund.

_____. 2008a. Is inflation back? Commodity prices and inflation. In *World economic outlook October 2008: Financial stress, downturns, and recoveries.* Washington, D.C.: The International Monetary Fund.

_____. 2008b. Europe: Coping with high commodity prices. In *Regional economic outlook Europe October 2008: Dealing with shocks.* Washington, D.C.: The International Monetary Fund.

_____. 2008c. World commodity prices and LAC inflation. In *Regional economic outlook Western Hemisphere April 2008.* Washington, D.C.: The International Monetary Fund.

Jongwanich, J., and D. Park.2008. Inflation in developing Asia: Demand-pull or cost-push? ERD Working Paper 121. Manila: Asian Development Bank.

Kalecki, M. 1971. *Selected essays in the dynamics of capitalist economies.* Cambridge: Cambridge University Press.

Kheir-El-Din, H. (ed.). 2009. *What drives prices in Egypt: An analysis in light of international experience.* Cairo: American University in Cairo Press.

Kiguel, M. A., and J. Okseniuk. 2009. Egypt: A long-term view of the inflation process. Mimeo

Kraay, A. 2007. The welfare effects of a large depreciation: The case of Egypt 2000-2005. ECES Working Paper Series 120. Cairo: The Egyptian Centre for Economic Studies.

Liu, L., and A. Tsang. 2008. Pass-through effects of global commodity prices on China's inflation: An empirical investigation. *China and the World Economy* 16(6): 22–34.

Loungani, P., and P. Swagel. 2001. Sources of inflation in developing countries. IMF Working Paper 01/198. Washington D.C.

Noureldin, D. 2008. Relative price adjustment and inflation dynamics: The case of Egypt. ECES Working Paper Series 133. Cairo: The Egyptian Centre for Economic Studies.

Peltzman, S. 2000. Prices rise faster than they fall. *Journal of Political Economy* 108(3):477–502.

Rabanal, P. 2005. Exchange rate pass-through. In *Arab Republic of Egypt Selected Issues.* IMF Country Report 05/179. Washington, D.C.

Rotemberg, J., and M. Woodford. 1999. The cyclical behavior of prices and costs. NBER Working Papers 6909. Cambridge, Massacheusets.

Selim, H. 2011. The evolution of the monetary policy framework in Egypt and the elusive goal of price stability. In *MENA money: Monetary policy frameworks and strategies in the Middle East and North Africa,* ed. David Cobham and Ghassan Dibeh. London: Routledge. Political Economy of the Middle East Series.

World Bank. 2011. *Middle East and North Africa region regional economic update May 2011: MENA facing challenges and opportunities.* Washington, D.C.: The World Bank

Zoli, E. 2009. Commodity price volatility, cyclical fluctuations, and convergence: What is ahead for inflation in emerging Europe? IMF Working Paper 09/41. Washington, D.C.

Figure 1: Domestic Inflation Measures (year-on-year, %)
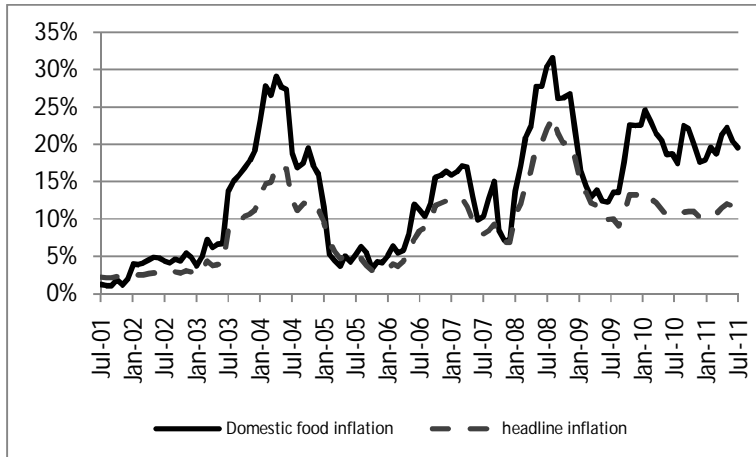
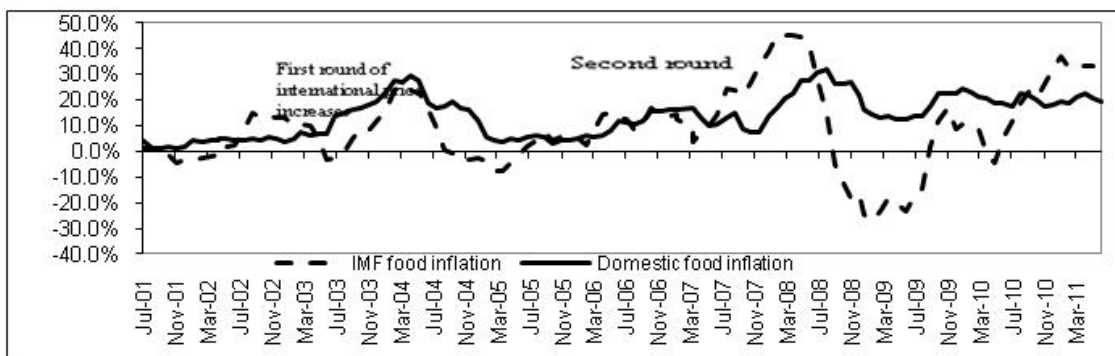Source: Authors calculations based on Central Agency for Public Mobilization and Statistics (CAPMAS) data

Figure 2: CPI Inflation in Selected Countries (year-on-year change %)
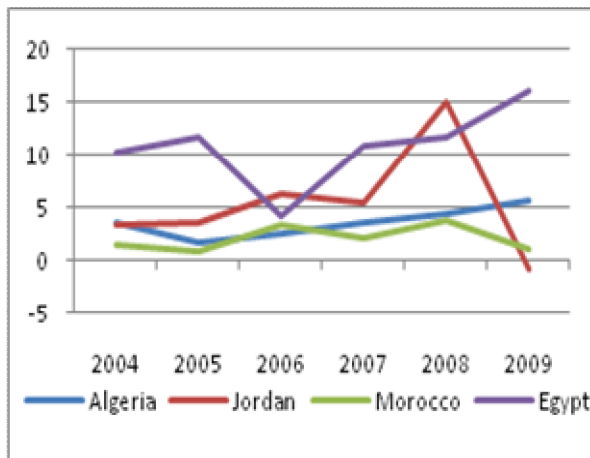
Source: Authors calculations based on World Development Indicators (WDI) data

Figure 3: Domestic and International Food Price Inflation (year-on-year, %)

Source: Authors calculations on Central Bank of Egypt (CBE) and CAPMAS data

14

Figure 4: Headline and Core Inflation Measures (year-on-year, %)
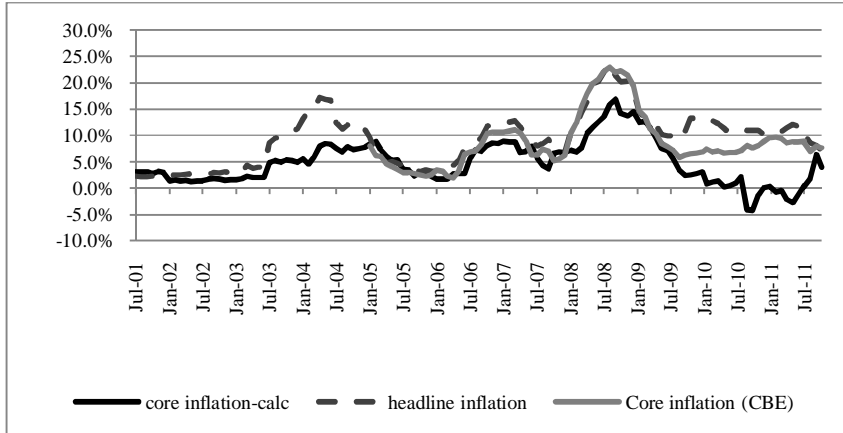
Source: Authors calculations on CBE and CAPMAS data

Figure 5: M2 growth, Net Foreign Assets' Growth and Real Interest Rates
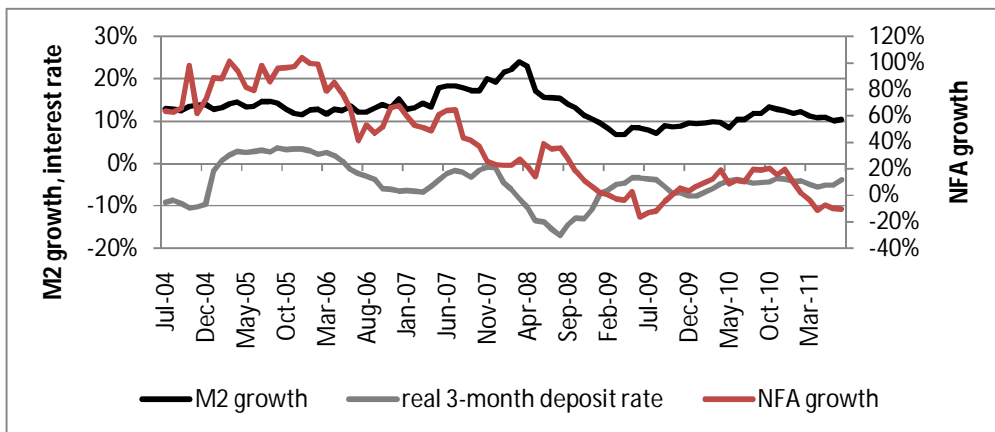
Source: Authors' calculations based on CBE data

Figure 6: Inflation and Real Policy Rates

Source: Authors' calculations based on CBE data

Figure 7: Variance Decomposition of

a. Domestic Food Price Inflation

b. Core Inflation

Table 1: Inflation of Domestic and International Food Prices, July 2001- July 2011 (percent)

| | Egypt | | | International food inflation | |
	Inflation rate %	Food inflation %	IMF food inflation %	FAO food index %	FAO cereals sub-index %
Average	9.4	13.8	9.0	10.5	16.3
Volatility	5.1	8.1	15.4	18.7	33.5
Coefficient of Variation	0.55	0.59	1.72	1.79	2.05

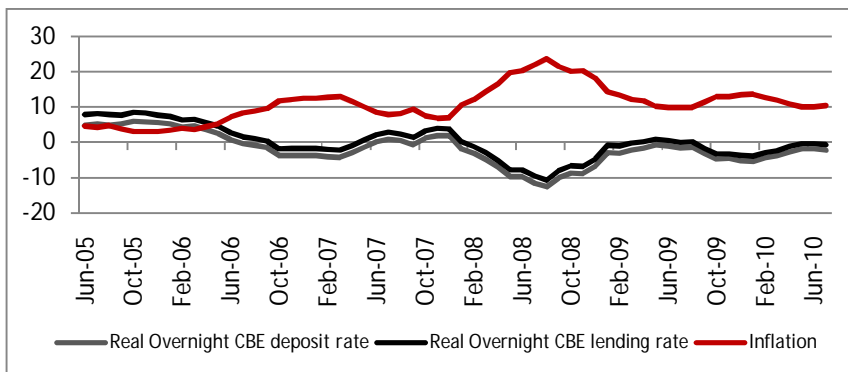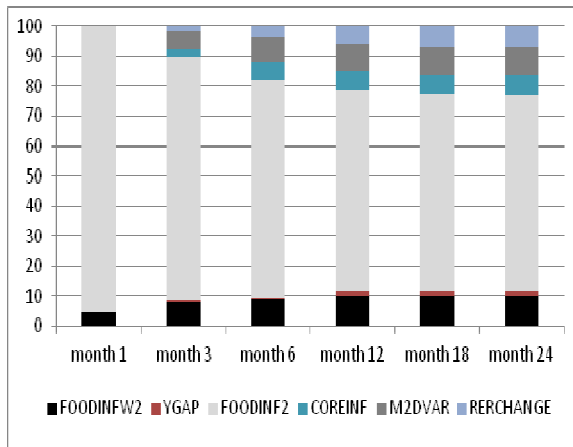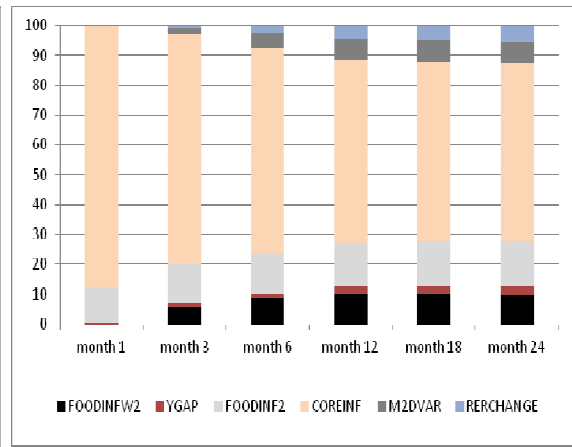Source: Authors' calculations based on data from CAPMAS, International Moneraty Fund (IMF) and Food and Agriculture Organization (FAO)

Table 2: Regression Results for Step 1: Pass-Through from International to Domestic Food Price Inflation

	Full long-term pass-through	R-squared adjusted
Using FAO food index	0.16	0.25
Using FAO cereals sub-index	0.13	0.28

Table 3: Regression Results for Step 2: Spill-over of Domestic Food Price Inflation to other Domestic Prices Inflation and Root Mean Square Error of the Forecasted Domestic Price Inflation*

		Using Output gap	Using Output Growth gap
Core	**Using FAO food index**		
	Coefficient	0.4841	0.5918
	R2 adjusted	0.7210	0.5868
	RMSE	46.4037	31.4460
	Using FAO cereals sub-index		
	Coefficient	0.8782	1.0408
	R2 adjusted	0.6168	0.6617
	RMSE	40.2721	25.7254
Non-Food	**Using FAO food index**		
	Coefficient	0.65497	0.1458
	R2 adjusted	0.7161	0.6968
	RMSE	37.4357	33.6075
	Using FAO cereals sub-index		
	Coefficient	0.8463	0.5883
	R2 adjusted	0.7555	0.7374
	RMSE	32.0512	24.7098

Note: *All figures are calculated from coefficients estimated at 5% significance level at least, and RMSE is calculated for the period 2010M7- 2011M6.

Table 4: Coefficients of International Price Inflation in Step 1 of the 2-step Regression

	FAO food index	FAO cereals sub-index
Slope of inflation increases	0,5366	0,2317
Differential slope	-0,3548	-0,4086
Slope of inflation decreases	0,1817	-0,1769

Note: * All coefficients are significant at the 95% level.

Table 5: Response of Domestic Inflation to International Food Price Inflation Shocks

Horizon	Model 1 (headline inflation)		Model 2 (food inflation)	
	percentage points	alternative measure	percentage points	alternative measure
1	1.3	4.0	3.3	12.0
3	2.7	5.5	7.9	17.9
6	4.1	9.3	10.7	28.6
12	3.4	9.8	10.5	66.4
18	2.8	8.4	10.3	78.7
24	2.9	8.3	10.8	69.2

Source: Author's estimates based on impulse response functions derived from VAR.

Table 6: Response of Core Inflation to Domestic Food Price Inflation Shocks

Horizon	Core inflation	
	percentage points	alternative measure
1	-3.8	-25.3
3	-2.0	-8.9
6	0.7	2.8
12	1.8	7.4
18	-0.5	-2.1
24	-1.6	-6.8

Table 7: Response of Domestic Inflation to International Food Price Inflation Shocks (using the FAO food index)

Horizon	Model 1 (headline inflation)		Model 2 (food inflation)	
	percentage points	alternative measure	percentage points	alternative measure
1	1.3	4.9	0.0	0.0
3	2.8	6.0	9.3	20.6
6	5.0	8.2	12.6	22.0
12	6.3	9.5	9.7	16.1
18	6.4	9.7	8.6	14.5
24	6.3	9.7	8.6	14.5

Table 8: Response of Core inflation to Domestic Food Price Inflation Shocks (using the FAO food index)

Horizon	Core inflation	
	percentage points	alternative measure
1	-2.9	-18.2
3	0.8	3.6
6	2.1	9.0
12	2.5	10.6
18	2.4	10.2
24	2.4	10.2

Annex 1: Data description and sources

International food price indices: three indices are used from the IMF, FAO food, and FAO cereals.

Domestic prices: The time series of Egypt's CPI and domestic food prices are constructed by the authors for a unified base year (1999/2000=100) using official data from the Central Agency for Public Mobilization and Statistics (CAPMAS) that is available for different base years.[5] Domestic non-food prices time series are constructed by the authors by excluding the food component (the weight of which is 42.6%) from the CPI. The index of core prices (1999/2000=100) is constructed by the authors from CPI data by excluding food and energy components from the CPI (the weight of which is respectively 42.6 and 3.1%). The Central Bank of Egypt's (CBE) core inflation measure (which excludes only fruits and vegetables and regulated prices) is only available since 2005. Also, the non-availability of this level of disaggregated price data did not allow the authors to extend the CBE core inflation time series. Non-food and core prices were measured using the following formulas:

$$non-food = \frac{\left[CPI - \left(foodCPI * w_f\right)\right]}{\left(1 - w_f\right)}$$, where w_f is the weight of food in the CPI basket.

$$core = \frac{\left[CPI - \left(foodCPI * w_f\right) - \left(energyCPI * w_e\right)\right]}{\left(1 - w_f - w_e\right)}$$, where w_e is the weight of energy in the CPI basket.

Economic activity: In the absence of monthly data on Egypt's GDP the authors proxied the output by an index constructed by the means of principal components analysis using 7 seasonally adjusted real activity variables: real exports of goods, cement production, steel production, oil production, industrial consumption of electricity, Suez Canal tonnage, and the number of tourists. Variables are turned into indices. As the obtained series had in some cases negative values, a positive integer of '5' was added to all the variables' observations. The output gap *(ygap)* is constructed by applying the Hodrick-Prescott (HP) filter under the assumption that output fluctuates around its potential level.[6] The HP filter decomposes output into permanent and transitory components generating a smoothed trend of output. These generated series are the estimated potential output. The *ygap* is calculated as the difference between actual and potential output as a percentage to potential output.

Exchange rate and monetary policy: The nominal exchange rate (LE/US$)—an important cost factor and also affects prices—is obtained from the International Financial Statistics (IFS). To calculate the real exchange rate, the authors used the formula: $q = e * (\frac{ppi_{us}}{cpi_{eg}})$, where *(q)* is the real exchange rate, *(e)* is the nominal exchange rate, (ppi_{us}) is the foreign price level, proxied by the US producer price index for all commodities, and (cpi_{eg}) is the domestic price level, proxied by the CPI in Egypt. Data on the US PPI is from the US Bureau of Labor Statistics.[7]

The M2 in LE millions (excluding foreign currency deposits), a measure of money to allow for the effects of monetary policy and also for the relationship between money and domestic prices, is obtained from the Central Bank of Egypt[8].

---

[5] The weights were fixed to reflect the composition of the basket in 1999/2000.

[6] Other methods, such as Kalman filter and exponential smoothing, which were also attempted, yield almost identical results. Yet, the HP filter proved to perform best in terms of both explanatory power, and diagnostic tests.

[7] http://data.bls.gov/PDQ/servlet/SurveyOutputServlet?data_tool=latest_numbers&series_id=WPSSOP3000&output_view=pct_1mth

[8] Monthly Statistical Bulletin, various issues.

Annex 2: Unit Root tests

Variable	ADF statistic	Order of integration	McKinnon critical values for rejection of hypothesis of a unit root		
			1%	5%	10%
Annualized log differences (except for ygap)					
CPI	-7.641203	I(0)	-3.480818	-2.883579	-2.578601
Food CPI	-8.088061	I(0)	-3.480818	-2.883579	-2.578601
Core	-10.91412	I(0)	-3.480818	-2.883579	-2.578601
IMF	-7.519758	I(0)	-3.480818	-2.883579	-2.578601
FAO	-5.878897	I(0)	-3.481217	-2.883753	-2.578694
FAO cereals	-5.878897	I(0)	-3.481217	-2.883753	-2.578694
M2d	-8.246809	I(0)	-3.480818	-2.883579	-2.578601
Real er	-9.308917	I(0)	-3.480818	-2.883579	-2.578601
ygap	-6.358976	I(0)	-3.480425	-2.883408	-2.578510

The above table reports the ADF unit root test results for a lag of 12 months (based on the Schwartz information criterion (SIC)). The tests included a constant. As shown in the table, all variables in the log-difference form are stationary (i.e. I(0)).

Annex 3: Lag length:

To determine the lag length, a lag order selection test was conducted. The computation of the lag order for a maximum lag of 12 months produced a discrepancy among the different criteria. Based on the likelihood ratio (LR) criterion, the VAR is estimated with 4 lags to allow for enough endogenous transmission of the shocks in the system.

VAR Lag Order Selection Criteria
Endogenous variables: FOODINFW2 YGAP CPIINF2 M2DVAR RERCHANGE
Exogenous variables: C
Date: 11/28/11   Time: 10:46
Sample: 2000M07 2011M07
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	347.8183	NA	2.27e-09	-5.713638	-5.597492	-5.666471
1	412.7338	123.3394	1.17e-09*	-6.378896*	-5.682023*	-6.095893*
2	431.5467	34.17682	1.30e-09	-6.275778	-4.998178	-5.756939
3	449.9909	31.97007	1.46e-09	-6.166516	-4.308188	-5.411840
4	473.0946	38.12100*	1.52e-09	-6.134910	-3.695855	-5.144398
5	492.6005	30.55934	1.69e-09	-6.043342	-3.023560	-4.816995
6	512.9819	30.23235	1.87e-09	-5.966365	-2.365855	-4.504181
7	538.7924	36.13464	1.91e-09	-5.979873	-1.798635	-4.281853
8	554.6831	20.92281	2.34e-09	-5.828052	-1.066087	-3.894196
9	575.3621	25.50406	2.68e-09	-5.756035	-0.413342	-3.586343
10	596.5016	24.31042	3.10e-09	-5.691693	0.231727	-3.286165
11	625.4941	30.92540	3.21e-09	-5.758236	0.745912	-3.116871
12	646.4551	20.61160	3.91e-09	-5.690918	1.393957	-2.813718

Notes: * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

VAR Lag Order Selection Criteria
Endogenous variables: FOODINFW2 YGAP FOODINF2 COREINF M2DVAR RERCHANGE
Exogenous variables: C
Date: 11/28/11   Time: 10:57
Sample: 2000M07 2011M07
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	356.4401	NA	1.17e-10	-5.840668	-5.701293*	-5.784067
1	435.1498	148.2366	5.75e-11*	-6.552496*	-5.576874	-6.156292*
2	468.1538	58.85717	6.07e-11	-6.502563	-4.690694	-5.766755
3	491.0562	38.55234	7.64e-11	-6.284270	-3.636152	-5.208857
4	529.8917	61.48961	7.44e-11	-6.331529	-2.847164	-4.916512
5	554.9483	37.16733	9.24e-11	-6.149139	-1.828527	-4.394519
6	589.7992	48.21032	9.93e-11	-6.129986	-0.973127	-4.035762
7	647.3670	73.87871*	7.47e-11	-6.489450	-0.496343	-4.055622
8	677.5207	35.68192	9.14e-11	-6.392012	0.437342	-3.618580
9	702.4253	26.97998	1.26e-10	-6.207089	1.458513	-3.094053
10	740.2985	37.24198	1.47e-10	-6.238309	2.263541	-2.785669
11	791.0133	44.79800	1.46e-10	-6.483554	2.854543	-2.691310
12	830.8920	31.23830	1.87e-10	-6.548199	3.626146	-2.416351

Notes: * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion ; HQ: Hannan-Quinn information criterion