# Inflation responses to commodity price shocks – how and why do countries differ?

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## I. INTRODUCTION

Recent swings in commodity prices have brought the implications of their impact on domestic prices and the appropriate policy response to the forefront. Moreover, these large shocks can potentially serve as event studies to assess the empirical performance of different types of monetary and exchange rate regimes, such as inflation targeting. Is there a relation between differences in policy frameworks and the transmission of international price shocks to domestic headline and core inflation? To date, surprisingly little systematic research has been conducted on this issue. One attempt can be found in the IMF's World Economic Outlook (IMF, 2011) which examines the impact of commodities prices on inflation in a broad set of countries.[2] However, the analysis stops at assessing that "commodity prices tend to have stronger and longer-lasting effects on inflation in economies with high food shares in the consumption basket and in economies with less firmly anchored expectations."

Here, we go further in various dimensions. We explre questions such as: Did countries with more independent central banks or inflation-targeting regimes experience lower pass-throughs and spillovers to core inflation? What is the role of the openness of the economy and the development of its financial sector in the transmission of international price shocks? How important is the pre-existing level of inflation in determining the pass-through? Are weaker fiscal positions associated with less anchored inflation expectations? To which extent does a country's governance framework – beyond the institutional features of the monetary regime - matter in containing the impact on inflation? What role does exchange-rate flexibility play? We examine these questions in a comprehensive way using data from both developing and advance economies over the period 1990-2010.

First we assess the speeds at which headline inflation revert to core inflation in advanced and developing economies, and relate these adjustment speeds to country characteristics and policy frameworks. Next, we estimate pass-throughs of international food and fuel prices to domestic inflation using both country-by-country estimations and panel estimations of augmented Phillips curves, relating the size of the pass-throughs to country variables.

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[2] See also IMF (2008) and Habermeier et al (2009).

Finally, we study the cross-country performance of headline and core inflation around the large 2008 food price shock. One methodological innovation is that we explicitly examine the role of the dispersion of survey forecasts of inflation (as a measure of uncertainty about monetary policy.)

To some extent, the results are surprising. In line with conventional wisdom, we find that commodity price shocks have stronger and longer-lasting effects on domestic inflation in developing countries than in advanced economies. Moreover, there is evidence that more fuel-intensive economies and those with higher food shares in CPI experienced a stronger inflation impact. However, while we find some indication that inflation targeting countries fared better in their inflation response to shocks, the effect is very modest and not evident around the large 2008 food price shock.[3]

In particular, the data suggest that around that episode, inflation targeters were not more able than other countries to prevent a pass-through of commodity price shocks to core inflation, even when controlling for other factors. However, this does not mean that monetary policy credibility does not matter: to some extent, countries with more independent central banks appear to have been able to anchor inflation expectations, and countries with higher governance and regulatory framework scores – proxies for policy credibility – also seem to have managed to contain the impact of these shocks better. We also find evidence that countries with tighter monetary policies managed to contain the inflationary impact.

Neither financial development nor labor market flexibility appear to significantly influence the way to which domestic inflation responds to international price shocks. There is some indication that higher dispersion of inflation expectations is associated with higher pass-throughs, but the evidence is mixed and deserves to be examined further.

## II. LITERATURE REVIEW

The IMF's World Economic Outlook (IMF, 2011) discusses the adequate monetary policy response to commodity price shocks and examines the impact of these shocks on inflation in a broad set of countries. It reports that food price shocks tend to have larger effects on headline inflation in emerging and developing economies than in advanced economies.[4] The impact is larger and longer lasting in economies with high food shares in consumption. Moreover, because medium-term inflation expectations are weakly anchored in many

[3] This is in contrast to preliminary findings by Habermeier et al (2008). See Brito and Bystedt (2010) for a recent study finding only weak effects of inflation targeting on inflation performance.

[4] In an earlier study, the IMF (2008) reported similar findings, with the pass through from international commodity prices to domestic prices higher for emerging economies, and comparable in size to that for advanced economies in the 1970s.

emerging and developing economies, food price shocks have larger effects on inflation expectations in these economies. Overall, however, the size of the pass-through is relatively small, in particular for oil price shocks. The analysis in the World Economic Outlook does not attempt to assess systematically the role of other country characteristics in shaping the response of headline inflation.

Habermeier et al (2009) provide an early assessment of impact of the food and oil prices for developing and emerging countries prior to the global financial crisis. Covering data through June 2008, they explore underlying causes of inflation across countries and analyze the monetary policy response.

Another study that is somewhat related to ours is Neely and Rapach (2011). Using a latent factor model, they examine the role of world, regional, and idiosyncratic components in explaining international comovements in inflation rates. They find that world and regional components account for 35 percent and 16 percent of annual inflation variability, respectively. At the country level, they report that openness, real GDP per capita, and central bank independence are correlated with countries' sensitivity to the world factor.

Zoli (2009) assesses the role of international commodity prices, cyclical fluctuations, and convergence in driving inflation in 18 European emerging economies. Using country-specific VARs and panel estimates, she finds that international commodity price shocks have a significant impact on domestic inflation, but the inflation response is asymmetric for positive and negative shocks.

Examining data for 19 countries, Cecchetti and Moessner (2008) find that in recent years core inflation has not tended to revert to headline, which suggests that higher commodity prices have generally not spawned strong second-round effects on inflation. However, since the examined period covers 1994 through August 2008, it does not fully include the impact of the commodity price shock that peaked in mid-2008.

De Gregorio, Landerretche, and Neilson (2008) present evidence of an important decline during recent decades in the pass-through from the price of oil to the general price level. In a sample of 34 countries, this fall is documented to have been more pronounced in industrial than in emerging economies. They argue that among the factors that might help to explain this decline, the most important are a reduction in the oil intensity of economies around the world, a reduction in the exchange rate pass-through, a more favorable inflation environment, and the fact that the current oil price shock is largely the result of strong world demand.

Focusing on 19 industrialized countries, Chen (2009) investigates the pass-through into inflation across countries and over time. The paper also finds a significant decline in the average pass-through and attributes this to changes in the monetary policy and the behavior of nominal exchange rates.

Rigobón (2010) uses micro price data to examine the passthrough of commodity prices for 50 countries. He finds that countries respond differently to shocks, that sectors respond differently across countries and commodities, and that a third of all the explained variation is driven by sectoral characteristics.

Pedersen (2010) assesses the propagation of food and energy prices shocks in 46 countries for the period 1999-2010. His results indicate that in general, the propagation effect of food price shocks is larger than that of energy price shocks, and that emerging economies are more affected by propagation than advanced ones.

## III. DATA

Our dataset comprises 31 advanced and 48 emerging and developing economies.[5] The country classification follows the IMF's World Economic Outlook. We explore the role of a variety of country factors potentially shaping the response to commodity price shocks. In particular, we assess the role of the following structural characteristics and policy variables:

**Structural characteristics:**

- **Openness.** A higher degree of openness increases a country's exposure to commodity price shocks, may increase the slope of the Phillips curve, and influence the effectiveness of policy responses.[6]
- **Net exporters/importers of commodities.** When the commodity price increases, a next food/oil exporter experiences a positive terms-of-trade shock, prompting an increase in demand and upward pressure on prices and the nominal exchange rate. The opposite is true for a net importer.
- **Food share in CPI/Transport share in CPI.** Higher shares of food and transport in the CPI will not only mechanically be correlated with a higher inflationary impact; if the share of these goods in the consumption basket is higher, second-round effects are likely to be higher.[7]
- **Fuel intensity:** The impact of an increase in oil prices on the general price level can be expected to be related to the fuel intensity of an economy.
- **Degree of financial dollarization.** A high degree of financial dollarization is likely to limit the effectiveness of monetary policy. High financial dollarization is also likely to be associated with a higher degree of indexation in an economy.
- **Financial development.** Higher financial development is generally thought to be associated with a higher effectiveness of monetary policy.[8] With more developed financial markets, it may therefore be easier for monetary policy to dampen the inflationary pressures following a commodity price shock.

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[5] The availability of the core inflation data restricted the sample.

[6] See Romer (1993).

[7] It is difficult to calculate the share of fuel in CPI, and we therefore restrict our attention to the share of transport.

[8] The evidence on this is, however, ambiguous. See Saizar and Chalk (2009).

- **Labor market flexibility.** Low labor market flexibility is likely to be associated with real wage rigidities. This makes inflation stabilization more costly in terms of output. Therefore, in response to an increase in world commodity prices, prices will tend to rise more with less flexible labor markets (Blanchard and Galí, 2008).

**Monetary and exchange-rate regimes:**

- **Central bank autonomy.** In line with the traditional arguments for higher central bank autonomy, it should be associated with higher credibility and a stronger anchoring of inflation expectations.
- **IT regime.** Similar arguments apply to the role of inflation-targeting regimes.
- **Exchange rate regime.** For net commodity exporters, a rise in commodity prices implies an appreciation of the real exchange rate. If the nominal exchange rate is not allowed to appreciate, pressures on domestic prices will be higher. For net importers, a fixed nominal exchange rate will make the required depreciation more difficult but also dampen the inflationary impact.
- **The level of inflation.** The pass-through is likely to be higher in a high inflation environment. As argued by Taylor (2000), the extent to which firms respond to increases in costs or other prices by raising their own price depends on how persistent the increase is expected to be. Low and more stable inflation should be associated with a less persistent inflationary impact of commodity price shocks.

**Possible presence of fiscal dominance:**

- **Public debt/GDP.** In the presence of fiscal dominance, it will be difficult for monetary policy to achieve its inflation objectives. More generally, there is evidence that fiscal variables tend to influence inflation expectations in emerging market**s.**[9]

**Governance:**

- **Index of monetary policy transparency.** More transparency in monetary policymaking can be expected to help anchor expectations and prevent second-round effects.
- **Index of governance and rule of law.** While not directly measuring the credibility of monetary policy, higher values of this index are associated with a higher confidence by the public in institutions and the conduct of policies.
- **Regulatory quality.** Similar arguments apply to this measure.

**Business cycle factors:**

- **Output gap.** The inflationary impact is likely to be higher the closer the economy is operating to its potential. Measuring the output gap in developing economies is challenging though, partly because of frequent structural breaks.

[9] See Celasun, Gelos, and Prati (2004) and Cerisola and Gelos (2009).

**Policy reactions:**

Clearly, apart from the structural characteristics of the economy, the government's policy track record and the institutional framework, the actual policies pursued in response to commodity price shocks should obviously matter. Here, we examine the roles of:

- De(a)ppreciation of the nominal effective exchange rate.
- Structural fiscal balance and changes therein.
- Short-term interest rates and changes therein.
- Growth of monetary aggregates.

For more details on the variables, see Appendix II.

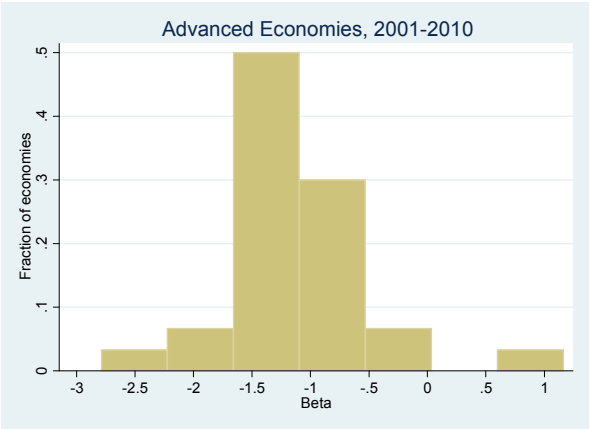
## IV. DOES INFLATION REVERT TO CORE INFLATION OR VICE VERSA?

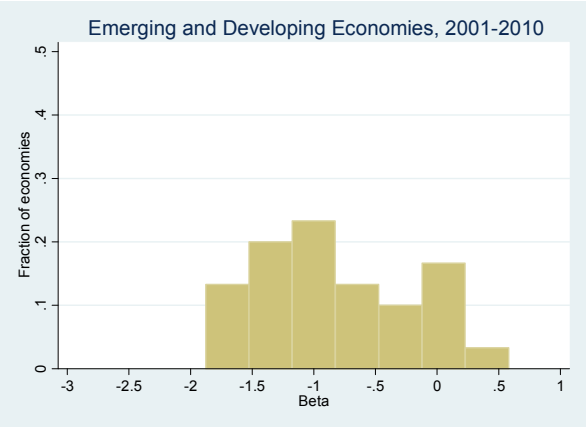
One way of looking at the impact of inflation dynamics in the context of commodity-price shocks is to assess the speed at which headline inflation reverts to core inflation. Following Cecchetti and Moessner (2008), if headline inflation reverts quickly to core inflation, food and energy price shocks are temporary, and second-round effects limited. We estimate the following regression for advanced and emerging and developing economies.

$$\pi_t^{headline} - \pi_{t-12}^{headline} = \alpha + \beta\left(\pi_{t-12}^{headline} - \pi_{t-12}^{core}\right) + \varepsilon_t \qquad (1)$$

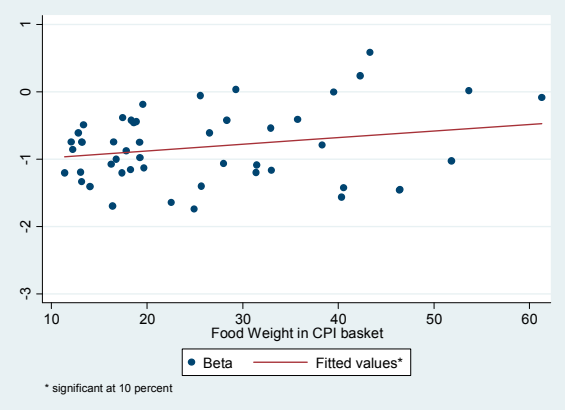
If headline inflation reverts to core, $\beta$ should be negative.

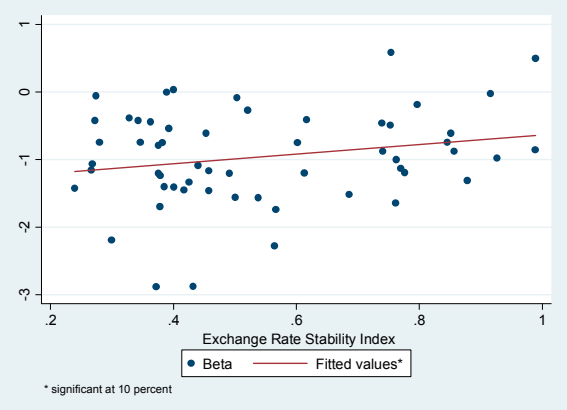
We find that in most cases the estimated betas are indeed negative and statistically different from zero, which corresponds to headline inflation reverting to core. Overall, the coefficients tend to be smaller for advanced countries (mean=-1.1, median=-1.2) than for emerging and developing countries (mean=-0.8, median=-0.9.) In other words, headline inflation in advanced economies has been reverting to core faster. Moreover, once we compare the estimated coefficients for the periods of 1990-2000 and 2001-2010, we find that the coefficients for the advanced countries tended to become smaller. Data restrictions, however, did not allow us to draw definite conclusions on a similar evolution of the coefficients for the emerging and developing economies.




We examined correlations between key institutional and macroeconomic characteristics of economies and the speed of the reversion. We find little evidence for such correlations, except for the fact that the larger share of food in CPI and higher degree of exchange rate stability are associated with a higher reversion speed of headline to core inflation, as shown on the charts below.



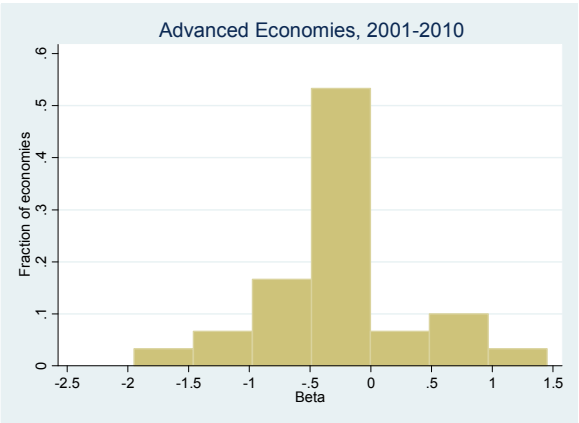



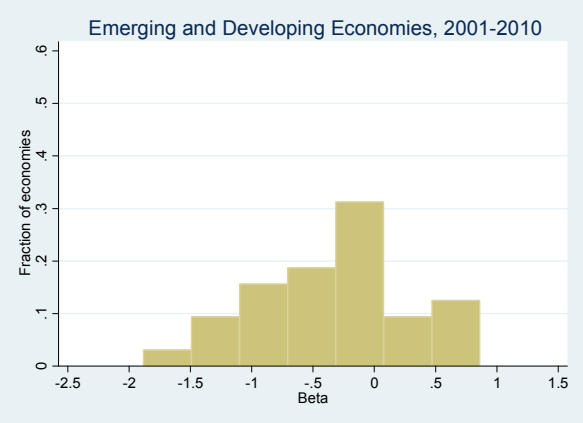

Other institutional and macroeconomic characteristics, such as openness, degree of financial dollarization, financial development, labor market flexibility, inflation targeting regime, central bank autonomy, monetary policy transparency, governance and public debt, are not significantly correlated with the speed of reversion. Even when we control for the development level of countries (advanced vs. emerging/developing economies) and examine the correlations over shorter time periods, the results remain inconclusive.

Next, we assess whether core inflation reverts to headline inflation. If this were the case, it would indicate that shocks to headline inflation, such as those caused by commodity price spikes, would feed into inflation expectations and price setting, fueling core inflation. We run a similar regression as before:

$$\pi_t^{core} - \pi_{t-12}^{core} = \alpha + \beta\left(\pi_{t-12}^{core} - \pi_{t-12}^{headline}\right) + \varepsilon_t \qquad (2)$$

If $\beta$ is equal to 0, this implies that core does not revert to headline inflation, whereas a coefficient of -1 implies full reversion. We find that for both advanced and emerging and developing economies, the median betas are around -0.25, suggesting the presence of second-round effects. However, for 25 countries out of 62 countries we failed to reject the hypothesis that beta is equal to 0, i.e. the hypothesis that core inflation is not reverting to headline.



## V. PHILLIPS-CURVE ESTIMATIONS

Next, we estimate country-by-country Phillips curves augmented by commodity prices, broadly following Hooker (2002) and De Gregorio, Landerretche, and Neilson (2008).[10] The dependent variable is 12-month monthly CPI headline inflation, and the independent variables encompass lagged values of inflation to capture inertia in the inflation process, the current and lagged values of the output gap as a measure of economic slack, and international food and fuel prices[11]. For each country, we select the lag length minimizing the Akaike-criterion. Given the serial correlation induced by overlapping observations, we compute the standard errors with the Newey-West estimator.

$$\pi_t = \alpha + \delta \cdot \sum_{i=1}^{n} \pi_{t-i} + \phi \cdot \sum_{i=0}^{m} OutputGap + \theta \cdot \sum_{i-0}^{p} \pi_{t-i}^{WorldFood} + \vartheta \cdot \sum_{i=0}^{q} \pi_{t-i}^{WorldFuel} + \varepsilon_t \qquad (3)$$

The pass-throughs are then computed as $PT_{food} = \frac{\sum_{i=0}^{p} \theta}{1-\sum_{i=1}^{n} \delta}$, and $PT_{fuel} = \frac{\sum_{i=0}^{q} \vartheta}{1-\sum_{i=1}^{n} \delta}$.[12]

Charts 1-4 show the estimated pass-throughs for food and fuel for the period 2001-2010. As expected, and in line with finding in IMF (2011), the pass-throughs are larger for developing countries both for food and fuel. The dispersion of the pass-throughs is also larger in developing countries, possibly reflecting the use of price controls and subsidies in some of these countries. The results are very similar for pass-throughs of food price inflation denominated in domestic currency.

Next, we relate the estimated pass-throughs to the country characteristics and policy frameworks discussed earlier. We examine simple bivariate scatter plots and estimate simple bivariate regressions.

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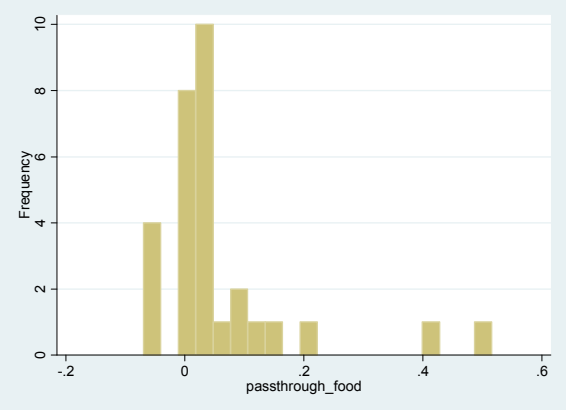
[10] See also Borio and Filardo (2007).

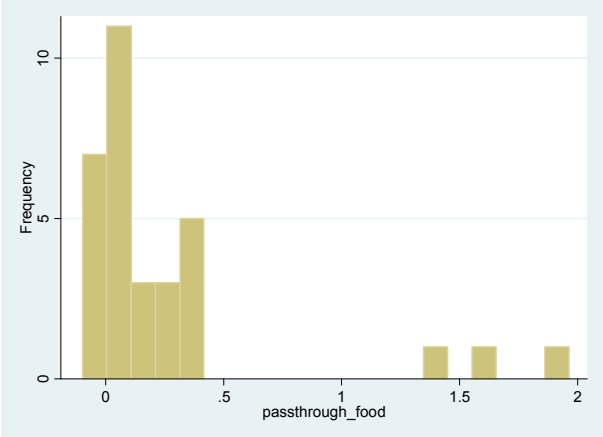
[11] Typically, commodity price inflation included into Phillips curves measures the changes in commodity prices denominated in foreign currency. We estimate both specifications with food prices expressed in US dollars and converted to domestic currency to account for variations in the exchange rates. The reported results refer to the ones obtained by using dollar-denominated prices (unless otherwise marked) but the main conclusions are common to both specifications.

[12] Strictly speaking, these pass-throughs represent the effect of a permanent change in oil and food price *inflation* on CPI inflation. While this may not be conceptually the right measure one would like to obtain, it represents a good proxy for the size of the transmission of international price shocks in the absence of cointegrating relationships between price levels. See also IMF (2011).

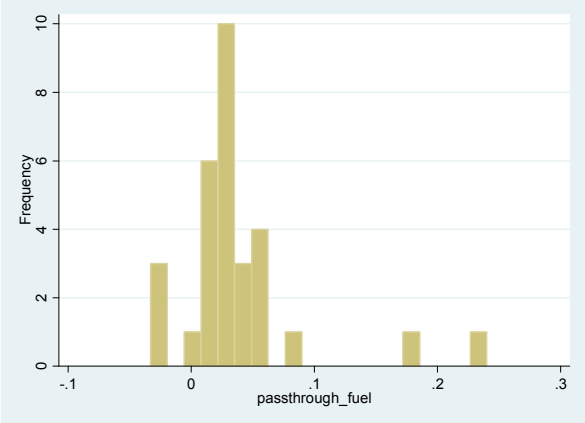
**International Food Price Pass-through, Advanced economies**



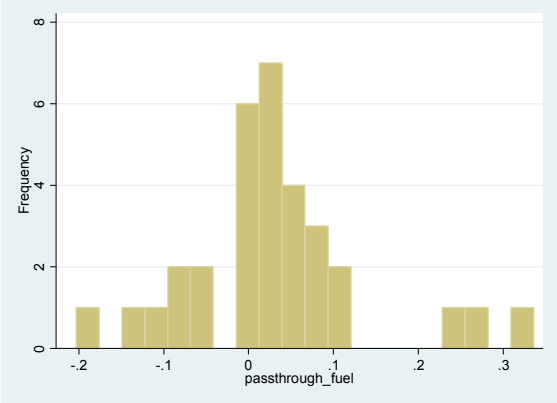

**International Food Price Pass-through, Developing countries**




**International Fuel Price Pass-through, Advanced economies**




**International Fuel Price Pass-through, Developing Countries**



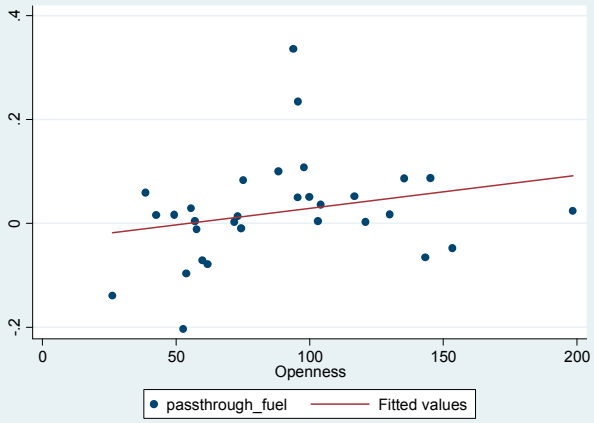

Overall, there is surprisingly little correlation between the pass-throughs and key country characteristics or policy frameworks. Some of the exceptions are shown below. The correlations are generally stronger for developing countries than for advanced economies.

In line with common presumption, there is some evidence that domestic prices in open economies are more affected by international commodity price changes than less open ones. Moreover, for developing countries, the bivariate evidence is consistent with the notion that the impact of food price shocks is correlated with a country's food share in the CPI. Higher central bank autonomy and better governance are associated with a smaller impact of commodity price shocks. However, the correlation between central bank autonomy and pass-throughs is less apparent when international food price shocks are measured in foreign currency.

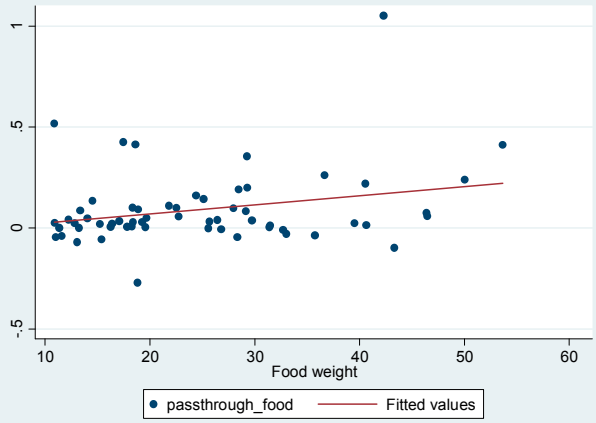
There is some indication that the economies with a higher level of dollarization are more affected by the international food price shocks. As expected, higher uncertainty about monetary policy as measured by a higher standard deviation of survey inflation expectations (from *Consensus Forecasts*) is associated with a higher pass-through of international food price shocks.[13] However, this correlation is less evident with pass-throughs of food price inflation in foreign currency.

None of the other variables is strongly correlated with the size of the pass-throughs. In particular, there is little indication that inflation-targeting countries have lower pass-throughs. Only food weight, governance, and central bank autonomy are significantly correlated with the size of the pass-throughs measured in foreign and domestic currencies.

**Fuel Pass-Throughs and Openness: Developing Countries**

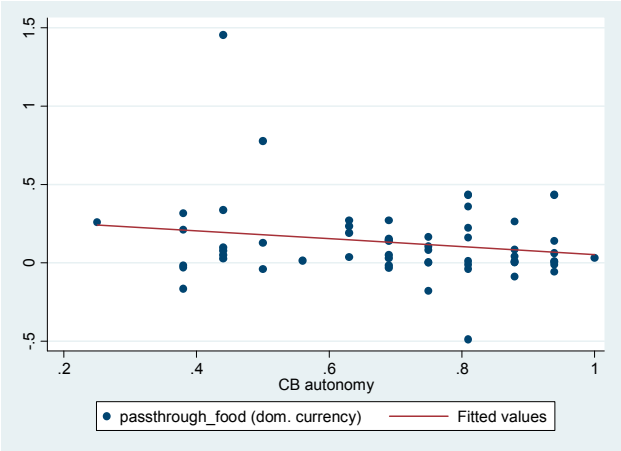



**Food Pass-Throughs and Food Share in CPI**

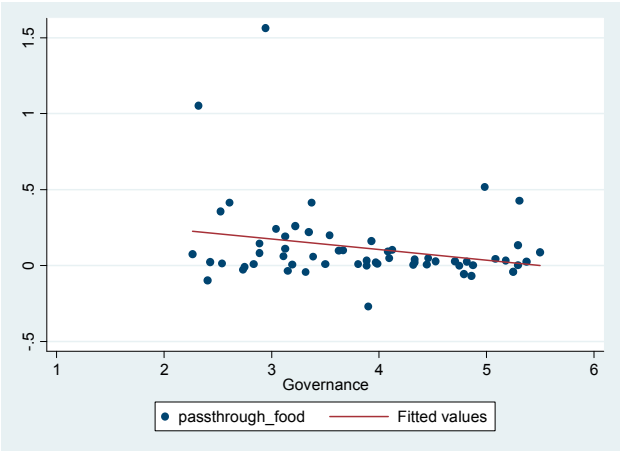



[13] Consensus Forecasts has data on expectations for 12-month CPI inflation at the end of the current and at the end of the next year. To proxy for 12-month inflation expectations, we construct a weighted average of these two measures, with relative weights dependent on the month of the year (in January, the current end-year forecast is given full weight, in February 11/12, and so forth.)

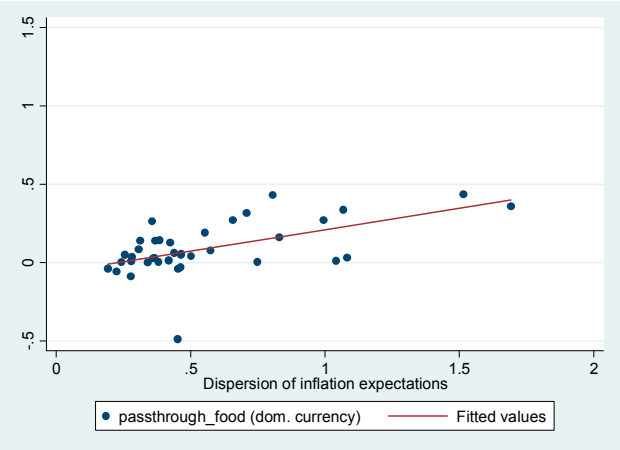
**Food Pass-Throughs and Central Bank Autonomy**




**Food Pass-Throughs and Governance**




**Food Pass-Throughs and Dispersion of Inflation Expectations**




## Panel Estimates

While the above country-by-country estimations of commodity price changes have the advantage of not imposing constraints across countries, they also entail limitations since they only allow for a limited, cross-country correlation analysis of the estimated average pass throughs and country characteristics. For this reason, we also take a different route by conducting panel estimations of augmented Phillips curves for the whole sample of countries for the period 2001-2010. Whereas this approach obviously imposes (possibly excessive) constraints, it allows us to study in a richer, dynamic manner how time-varying country characteristics influence the pass-through, while also controlling for cross-country correlations in the error terms.

In addition to the traditional output gap measure, we also include into the Phillips curve specification a proxy for marginal costs.[14] Since a typical firm in a small open economy is likely to use imported intermediate goods in production, we approximate real marginal costs with the deviation of real effective exchange rates (a proxy of the real cost of imported inputs) from a trend.[15] As argued by Celasun, Gelos, and Prati (2004), the real effective exchange rate is not only a measure of marginal costs, it is closely related to domestic

[14] Galí and Gertler (1999) emphasized the role of marginal costs in the Phillips curve.
[15] See Celasun, Gelos, and Prati (2004).

demand pressures: When the real effective exchange rate is above trend, the domestic price level is below the price level of trading partners (adjusted for the long-run trend), and demand pressures will emerge to bring the domestic price level toward foreign prices.[16]

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$$\pi_{i,t} = \alpha_i + \delta \cdot \sum_{i=1}^{n} \pi_{i,t-i} \phi \cdot \sum_{i=0}^{m} OutputGap + + \phi \cdot \sum_{i=0}^{m} RER\_dev + \theta \cdot \sum_{i-0}^{p} \pi_{i,t-i}^{WorldFood} + \quad (4)$$
$$\gamma \cdot \sum_{i-0}^{p} \pi_{i,t-i}^{WorldFood} \cdot Country\_Char + \vartheta \cdot \sum_{i=0}^{q} \pi_{i,t-i}^{WorldFuel} + \lambda \cdot \sum_{i=0}^{q} \pi_{i,t-i}^{WorldFuel} \cdot Country\_Char + \varepsilon_{i,t}$$

For a subset of countries we also have survey inflation expectations from *Consensus Forecasts*. We carry out separate estimations for this group of countries, including expected inflation (as measured by the mean of the surveys) in addition to lagged inflation in the estimations. Furthermore, in these cases we also have information on the dispersion (standard deviation) of inflation forecasts; since this measure can serve well as a proxy for the anchoring of inflation expectations, we also interact it with oil and food price shocks, similarly to other characteristics. While the use of survey expectations has become relatively widespread in recent years (see, among others, Fuhrer (2011) and Cerisola and Gelos (2009), employing information on their dispersion in Phillips curves is not standard and has to our knowledge not yet been carried out in this form.

$$\pi_{i,t} = \alpha_i + \beta \cdot E_t \pi_{i,t+1} + \delta \cdot \sum_{i=1}^{n} \pi_{i,t-i} + \phi \cdot \sum_{i=0}^{m} OutputGap + \omega \cdot \sum_{i=0}^{m} RER\_dev + \theta \cdot \sum_{i-0}^{p} \pi_{i,t-i}^{WorldFood} +$$
$$\gamma \cdot \sum_{i-0}^{p} \pi_{i,t-i}^{WorldFood} \cdot Country\_Char + \vartheta \cdot \sum_{i=0}^{q} \pi_{i,t-i}^{WorldFuel} + \lambda \cdot \sum_{i=0}^{q} \pi_{i,t-i}^{WorldFuel} \cdot Country\_Char + \varepsilon_{i,t} \quad (5)$$

The estimations were conducted with fixed effects, allowing for heteroskedasticity, serial correlation and cross-country dependence in the error terms, using the Driscoll and Kraay (1998) estimator. Due to collinearity problems, we limit the interactions we include in each estimations.

The main results are the following (see the tables below):

- The output gap and the marginal cost measure have the expected signs and enter with significant coefficients. In the specification with inflation expectations, expected inflation enters significantly, but with a low coefficient (possibly because some of the key drivers of expected inflation are included as independent variables).

[16] Given the endogeneity of the real effective exchange rate, we instrument it with its own lags and a proxy for foreign demand, the trade-weighted import volume excluding oil.

- **Fuel intensity.** As expected, the fuel price pass-through is higher for countries that are more fuel-intensive. For example, a 10 percent international fuel price shock would translate into 0.4 percent increase in inflation in the countries in the top 20$^{th}$ percentile for fuel intensity against 0.01 percent in the bottom 20$^{th}$ percentile.

- **Food weight in CPI.** Similarly, a higher share of food in the CPI is associated with a stronger inflationary impact. A 10 percent international food price shock, for example, is associated with 1.4 percent increase in inflation in the countries in the top 20$^{th}$ percentile for food share in CPI basket against only 0.3 percent in the bottom 20$^{th}$ percentile.

- **Openness.** Overall, the effect of higher food and fuel price inflation on domestic inflation is not stronger in more open economies than in more closed ones.

- **Exchange-rate stability.** Here again, the evidence is not statistically significant.

- **Labor market flexibility.** Indices of labor market flexibility are not significantly correlated with the inflation impact.

- **High inflation environment.** The impact of commodity prices is substantially higher when inflation already exceeds 10 percent. In countries where inflation exceeds that threshold, the impact of food and fuel inflation is significantly stronger than in countries with lower inflation.

- **Inflation targeting.** The estimates reveal a statistically significant, but minor effect of the presence of IT regimes on the inflationary impact of commodity price shock. A 10 percent increase in international fuel price inflation, for example, is associated with only a 0.2 percentage point lower long-term inflationary impact for inflation targeters. The effect of inflation targeting survives the inclusion of indices of central bank autonomy and governance.

- **Central Bank autonomy.** In line with a-priori expectations, the sign of the sum of interaction coefficients is negative, with higher indices of central bank autonomy associated with a lower inflationary impact. However, the effect is not statistically significant.

- **Governance.** Countries with better governance frameworks seem to find it easier to contain the inflationary impact of food price shocks. This result holds even when controlling for the presence of IT regimes. For example, in response to an increase in food inflation by 10 percent, a country at the bottom 20$^{th}$ percentile in the governance rating will experience a 0.9 percentage point higher increase in inflation than a country in the top 20$^{th}$ percentile.

- **Dispersion of inflation expectations.** The effect is ambiguous and not statistically significant. In line with a-priori expectations, a higher dispersion of inflation expectations is associated with a higher inflationary impact of international food price shocks, but the reverse is true for fuel (although the magnitude of the effect is very small in the latter case).

- **Financial development.** A higher degree of financial development (as measured by a larger M3-to-GDP ratio) is associated with a slightly higher impact of commodity price shocks, contrary to what one may expect (not shown).

- **Public debt.** Higher public debt levels are negatively associated with the size of transmission of external commodity shocks to domestic inflation (not shown). The coefficients are significant in both specifications with food and fuel price interaction terms. As in the case of labor market flexibility, this counterintuitive result could stem from an omitted variable bias.

- **Importers dummy.** The coefficients for the interaction terms with fuel and food prices are not significant (not shown).

- **Financial development.** The ratio of broad money over GDP is not statistically significantly associated with the inflationary impact of commodity prices.

# Table 1. Phillips Curves - Panel Estimations

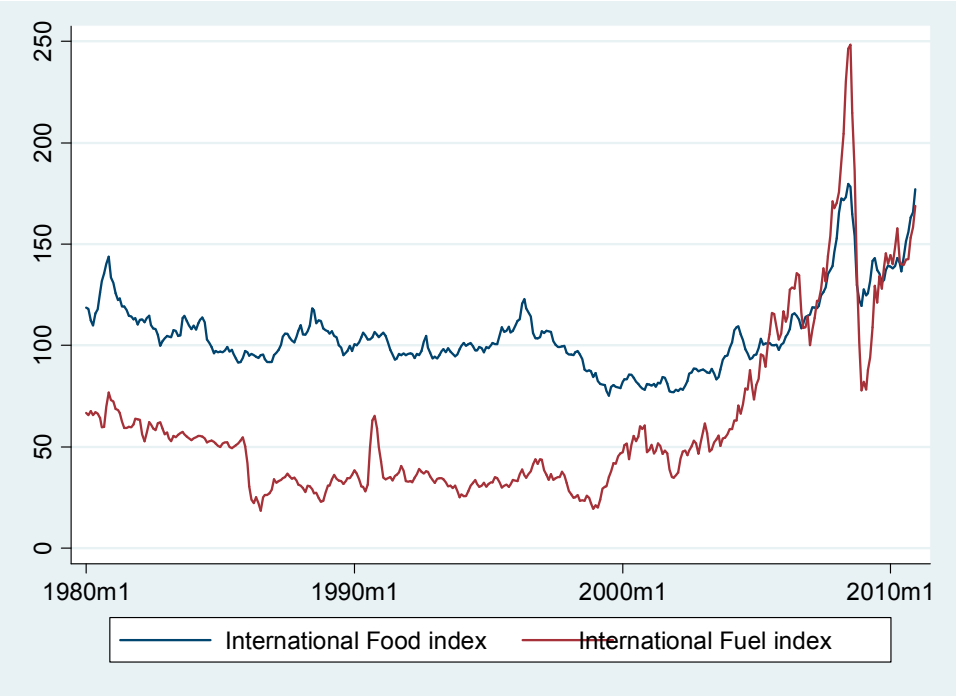
| 12-MONTH CPI HEADLINE INFLATION | OIL INTENSITY | | FOOD WEIGHT | | OPENNESS | | | | EXCHANGE RATE STABILITY | | | | LABOR | | | | INFLATION>10 PERCENT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | |
| | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. |
| CPI inflation[-1] | 1.28321 *** | 0.035 | 1.16452 *** | 0.028 | 1.28985 *** | | 1.28987 *** | 0.033 | 1.28627 *** | 0.034 | 1.28272 *** | 0.033 | 1.28988 *** | 0.033 | 1.28915 *** | 0.034 | 1.28076 *** | 0.032 | 1.27850 *** | 0.033 |
| CPI inflation[-2] | -0.23732 *** | 0.046 | -0.14981 *** | 0.035 | -0.24378 *** | 0.050 | -0.24582 *** | 0.050 | -0.23497 *** | 0.051 | -0.23425 *** | 0.049 | -0.24302 *** | 0.050 | -0.24310 *** | 0.051 | -0.23874 *** | 0.046 | -0.23880 *** | 0.046 |
| CPI inflation[-3] | -0.04522 | 0.035 | -0.06022 | 0.040 | -0.03045 | 0.038 | -0.02804 | 0.037 | -0.03704 | 0.038 | -0.04085 | 0.038 | -0.03570 | 0.039 | -0.03207 | 0.039 | -0.04028 | 0.036 | -0.04062 | 0.036 |
| CPI inflation[-4] | 0.00869 | 0.035 | 0.02332 | 0.032 | -0.00318 | 0.037 | -0.00329 | 0.037 | -0.00229 | 0.038 | 0.00918 | 0.038 | 0.00229 | 0.038 | 0.00059 | 0.037 | 0.01056 | 0.036 | 0.01187 | 0.036 |
| CPI inflation[-5] | -0.05458 ** | 0.022 | -0.03897 ** | 0.019 | -0.05536 ** | 0.025 | -0.05564 ** | 0.025 | -0.05478 ** | 0.025 | -0.05988 ** | 0.025 | -0.05670 ** | 0.025 | -0.05781 ** | 0.025 | -0.05716 ** | 0.023 | -0.05652 ** | 0.023 |
| SUM | **0.95478** *** | | **0.93884** *** | | **0.95708** *** | | **0.95708** *** | | **0.95719** *** | | **0.95692** *** | | **0.95676** *** | | **0.95675** *** | | **0.95514** *** | | **0.95443** *** | |
| **Output gap** | -0.04451 * | 0.024 | -0.09656 *** | 0.030 | -0.10087 *** | 0.035 | -0.10306 *** | 0.034 | -0.10119 *** | 0.034 | -0.10262 *** | 0.032 | -0.10546 *** | 0.033 | -0.10909 *** | 0.035 | -0.09275 *** | 0.030 | -0.09673 *** | 0.030 |
| Output gap[-1] | 0.06266 *** | 0.024 | 0.26648 *** | 0.067 | 0.20215 ** | 0.078 | 0.19809 ** | 0.077 | 0.19999 ** | 0.077 | 0.20051 *** | 0.073 | 0.21536 *** | 0.073 | 0.20856 ** | 0.080 | 0.18049 ** | 0.070 | 0.18229 ** | 0.070 |
| Output gap[-2] | | | -0.18142 ** | 0.073 | -0.06803 | 0.071 | -0.05588 | 0.072 | -0.06503 | 0.071 | -0.06235 | 0.068 | -0.07947 | 0.071 | -0.06200 | 0.073 | -0.06075 | 0.066 | -0.05590 | 0.065 |
| Output gap[-3] | | | -0.00327 | 0.053 | -0.15618 ** | 0.070 | -0.16520 ** | 0.069 | -0.15446 ** | 0.070 | -0.15856 ** | 0.067 | -0.15485 ** | 0.071 | -0.15935 ** | 0.071 | -0.12666 * | 0.066 | -0.12992 * | 0.065 |
| Output gap[-4] | | | 0.15867 ** | 0.068 | 0.22471 *** | 0.077 | 0.22207 *** | 0.076 | 0.21909 *** | 0.077 | 0.21967 *** | 0.075 | 0.22303 *** | 0.076 | 0.21862 *** | 0.078 | 0.18665 ** | 0.075 | 0.18513 ** | 0.075 |
| Output gap[-5] | | | -0.21950 ** | 0.091 | -0.07548 ** | 0.036 | -0.07040 * | 0.036 | -0.07198 * | 0.037 | -0.07006 * | 0.036 | -0.07098 * | 0.036 | -0.07107 * | 0.037 | -0.06838 ** | 0.033 | -0.06611 * | 0.034 |
| Output gap[-6] | | | 0.10776 ** | 0.044 | | | | | | | | | | | | | | | | |
| SUM | **0.01815** *** | | **0.03215** *** | | **0.02630** *** | | **0.02562** *** | | **0.02641** *** | | **0.02658** *** | | **0.02763** *** | | **0.02566** *** | | **0.01860** ** | | **0.01878** ** | |
| **REER gap** | -5.84833 *** | 0.874 | -3.58203 *** | 0.579 | -5.87228 *** | 0.844 | -5.85642 *** | 0.852 | -5.93414 *** | 0.860 | -5.85540 *** | 0.841 | -5.86416 *** | 0.860 | -5.89132 *** | 0.867 | -5.76113 *** | 0.816 | -5.75546 *** | 0.817 |
| REER gap[-1] | 2.15233 ** | 0.923 | 1.69305 *** | 0.630 | 2.25124 ** | 0.970 | 2.24693 ** | 0.980 | 2.14056 ** | 0.930 | 2.09466 ** | 0.960 | 2.24991 ** | 0.977 | 2.29704 ** | 0.991 | 2.11735 ** | 0.931 | 2.10578 ** | 0.925 |
| REER gap[-2] | 2.17159 *** | 0.818 | | | 1.08607 | 1.242 | 1.05718 | 1.242 | 1.19178 | 1.231 | 1.16663 | 1.231 | 1.05379 | 1.224 | 1.00280 | 1.241 | 0.93852 | 1.195 | 0.92488 | 1.192 |
| REER gap[-3] | | | | | 0.03293 | 0.796 | 0.05806 | 0.793 | 0.08088 | 0.802 | -0.05889 | 0.784 | -0.04539 | 0.791 | 0.01376 | 0.794 | 0.22541 | 0.782 | 0.21546 | 0.781 |
| REER gap[-4] | | | | | 1.15226 * | 0.603 | 1.14297 * | 0.608 | 1.16061 * | 0.593 | 1.24423 ** | 0.592 | 1.18105 * | 0.600 | 1.18231 * | 0.611 | 1.19108 ** | 0.573 | 1.19929 ** | 0.569 |
| SUM | **-1.52441** *** | | **-1.88898** *** | | **-1.34978** *** | | **-1.35128** *** | | **-1.36031** *** | | **-1.40877** *** | | **-1.42480** *** | | **-1.39542** *** | | **-1.28877** *** | | **-1.31005** *** | |
| **Food inflation** | 0.00316 *** | 0.001 | -0.00262 | 0.003 | | | -0.00226 | 0.005 | | | 0.00521 * | 0.003 | 0.00504 * | 0.003 | -0.00839 | 0.006 | 0.00374 *** | 0.001 | 0.00675 ** | 0.003 |
| Food inflation[-1] | | | | | 0.00623 * | 0.003 | 0.00938 | 0.006 | 0.00590 * | 0.003 | 0.00006 | 0.004 | -0.00006 | 0.005 | 0.00197 | 0.005 | | | -0.00431 | 0.003 |
| Food inflation[-2] | | | | | -0.00873 ** | 0.004 | -0.00731 * | 0.004 | -0.00759 * | 0.004 | -0.00606 | 0.004 | -0.00677 | 0.004 | 0.01774 * | 0.009 | | | | |
| Food inflation[-3] | | | | | 0.01204 ** | 0.005 | 0.01252 ** | 0.006 | 0.01126 ** | 0.005 | 0.00994 * | 0.005 | 0.01150 ** | 0.005 | 0.01272 ** | 0.005 | | | | |
| Food inflation[-4] | | | | | -0.00772 ** | 0.004 | -0.01953 *** | 0.007 | -0.00780 * | 0.004 | -0.00605 * | 0.003 | -0.00743 ** | 0.004 | -0.04447 *** | 0.017 | | | | |
| Food inflation[-5] | | | | | | | 0.01498 * | 0.008 | | | | | | | 0.04101 ** | 0.016 | | | | |
| Food inflation[-6] | | | | | | | -0.00616 | 0.006 | | | | | | | -0.02267 * | 0.012 | | | | |
| SUM | **0.00316** *** | | **-0.00262** | | **0.00181** | | **0.00163** | | **0.00177** | | **0.00310** * | | **0.00228** * | | **-0.00208** | | **0.00374** *** | | **0.00244** ** | |
| **Fuel inflation** | 0.00453 *** | 0.001 | 0.00667 *** | 0.001 | 0.00653 *** | 0.001 | 0.00621 *** | 0.001 | 0.00483 *** | 0.002 | 0.00609 *** | 0.001 | 0.00618 *** | 0.001 | 0.00615 *** | 0.001 | 0.00633 *** | 0.001 | 0.00590 *** | 0.001 |
| Fuel inflation[-1] | -0.00167 | 0.001 | -0.00109 | 0.001 | -0.00105 | 0.001 | -0.00059 | 0.001 | -0.00104 | 0.001 | -0.00080 | 0.001 | -0.00597 ** | 0.003 | -0.00073 | 0.001 | -0.00168 | 0.001 | -0.00089 | 0.001 |
| Fuel inflation[-2] | -0.00374 *** | 0.001 | -0.00484 *** | 0.001 | -0.00449 *** | 0.001 | -0.00456 *** | 0.001 | 0.00144 | 0.003 | -0.00442 *** | 0.001 | 0.00631 | 0.006 | -0.00434 *** | 0.001 | -0.00398 *** | 0.001 | -0.00394 *** | 0.001 |
| Fuel inflation[-3] | | | 0.00158 ** | 0.001 | | | | | -0.00436 ** | 0.002 | | | -0.00749 ** | 0.004 | | | | | | |
| SUM | **-0.00088** | | **0.00232** *** | | **0.00098** | | **0.00106** * | | **0.00087** | | **0.00087** | | **-0.00097** | | **0.00108** * | | **0.00067** | | **0.00107** ** | |
| **Food weight*(Fuel or Food inf.)** | | | 0.00030 ** | 0.000 | | | | | | | | | | | | | | | | |
| SUM | | | **0.00030** ** | | | | | | | | | | | | | | | | | |
| **Oil intensity*(Fuel or Food inf.)** | 0.00039 *** | 0.000 | | | | | | | | | | | | | | | | | | |
| SUM | **0.00039** *** | | | | | | | | | | | | | | | | | | | |
| **Openness*(Fuel or Food inf.)** | | | | | 0.00000 | 0.000003 | 0.00007 ** | 0.000 | | | | | | | | | | | | |
| Openness[-1]*(Fuel or Food inf.) | | | | | | | -0.00009 ** | 0.000 | | | | | | | | | | | | |
| Openness[-4]*(Fuel or Food inf.) | | | | | | | 0.00012 ** | 0.000 | | | | | | | | | | | | |
| Openness[-5]*(Fuel or Food inf.) | | | | | | | -0.00015 ** | 0.000 | | | | | | | | | | | | |
| Openness[-6]*(Fuel or Food inf.) | | | | | | | 0.00007 * | 0.000 | | | | | | | | | | | | |
| SUM | | | | | **0.00000** | | **0.00010** | | | | | | | | | | | | | |
| **Exchange rate stability*(Fuel or Food inf.)** | | | | | | | | | 0.00299 * | 0.002 | | | | | | | | | | |
| Exchange rate stability [-2]*(Fuel or Food inf.) | | | | | | | | | -0.01026 *** | 0.004 | | | | | | | | | | |
| Exchange rate stability [-3]*(Fuel or Food inf.) | | | | | | | | | 0.00769 ** | 0.003 | -0.00026 | 0.002 | | | | | | | | |
| SUM | | | | | | | | | **0.00043** | | **-0.00026** | | | | | | | | | |
| **Labor*(Fuel or Food inf.)** | | | | | | | | | | | | | | | 0.00205 *** | 0.001 | | | | |
| Labor[-1]*(Fuel or Food inf.) | | | | | | | | | | | | | 0.00087 ** | 0.000 | -0.00430 *** | 0.001 | | | | |
| Labor[-2]*(Fuel or Food inf.) | | | | | | | | | | | | | -0.00188 ** | 0.001 | 0.00599 ** | 0.003 | | | | |
| Labor[-3]*(Fuel or Food inf.) | | | | | | | | | | | | | 0.00134 ** | 0.001 | -0.00692 ** | 0.003 | | | | |
| Labor[-4]*(Fuel or Food inf.) | | | | | | | | | | | | | | | 0.00393 ** | 0.002 | | | | |
| SUM | | | | | | | | | | | | | **0.00033** | | **0.00076** | | | | | |
| **Inflation>10 percent*(Fuel or Food inf.)** | | | | | | | | | | | | | | | | | | | | |
| Inflation>10 percent[-1]*(Fuel or Food inf.) | | | | | | | | | | | | | | | | | 0.00244 * | 0.001 | 0.00858 *** | 0.003 |
| SUM | | | | | | | | | | | | | | | | | **0.00244** * | | **0.00858** *** | |
| **Constant** | 0.176 *** | 0.038 | 0.184 *** | 0.039 | 0.170 *** | 0.037 | 0.16589 *** | 0.038 | 0.171 *** | 0.037 | 0.166 *** | 0.037 | 0.166 *** | 0.037 | 0.165 *** | 0.038 | 0.173 *** | 0.038 | 0.176 *** | 0.037 |
| **Number of obs** | 7369 | | 5128 | | 6603 | | 6603 | | 6459 | | 6645 | | 6565 | | 6482 | | 7371 | | 7371 | |
| **Number of groups** | 65 | | 62 | | 65 | | 65 | | 64 | | 64 | | 65 | | 65 | | 65 | | 65 | |
| **R2** | 0.974 | | 0.956 | | 0.974 | | 0.97430 | | 0.974 | | 0.974 | | 0.974 | | 0.974 | | 0.974 | | 0.974 | |

| 12-MONTH CPI HEADLINE INFLATION | INFLATION TARGETING | | | | CB AUTONOMY | | | | GOVERNANCE | | | | INFLATION TARGETING AND GOVERNANCE | | | | INFLATION TARGETING AND CB AUTONOMY | | | | INFLATION EXPECTATIONS AND DEVIATIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | | FUEL | | FOOD | |
| | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. | Coef | Std. Err. |
| CPI inflation[-1] | 1.28708 *** | 0.032 | 1.28235 *** | 0.032 | 1.29700 *** | 0.035 | 1.29754 *** | 0.034 | 1.29959 *** | 0.033 | 1.29938 *** | 0.033 | 1.29949 *** | 0.033 | 1.29620 *** | 0.033 | 1.29644 *** | 0.035 | 1.29700 *** | 0.034 | 1.17501 *** | 0.030 | 1.18038 *** | 0.030 |
| CPI inflation[-2] | -0.23456 *** | 0.047 | -0.24036 *** | 0.046 | -0.25510 *** | 0.051 | -0.25985 *** | 0.051 | -0.26049 *** | 0.046 | -0.25997 *** | 0.048 | -0.26037 *** | 0.046 | -0.25726 *** | 0.047 | -0.25412 *** | 0.051 | -0.25974 *** | 0.051 | -0.14810 *** | 0.042 | -0.15749 *** | 0.039 |
| CPI inflation[-3] | -0.02604 | 0.040 | -0.04041 | 0.036 | -0.02974 | 0.039 | -0.02321 | 0.038 | -0.02425 | 0.036 | -0.02126 | 0.035 | -0.02418 | 0.036 | -0.02591 | 0.035 | -0.02912 | 0.039 | -0.02311 | 0.037 | -0.10082 *** | 0.031 | -0.11213 *** | 0.031 |
| CPI inflation[-4] | -0.06958 *** | 0.022 | 0.01351 | 0.035 | -0.00883 | 0.036 | -0.00784 | 0.036 | -0.00911 | 0.037 | -0.01089 | 0.038 | -0.00915 | 0.037 | -0.00503 | 0.037 | -0.00986 | 0.037 | -0.00782 | 0.036 | 0.08519 *** | 0.027 | 0.07891 *** | 0.028 |
| CPI inflation[-5] | | | -0.05921 ** | 0.023 | -0.04661 ** | 0.023 | -0.04954 ** | 0.023 | -0.04843 * | 0.024 | -0.04942 * | 0.025 | -0.04848 * | 0.025 | -0.05062 ** | 0.025 | -0.04631 * | 0.024 | -0.04932 ** | 0.023 | -0.10239 *** | 0.022 | -0.02661 | 0.032 |
| CPI inflation[-6] | | | | | | | | | | | | | | | | | | | | | | | -0.05749 ** | 0.025 |
| SUM | **0.95690** *** | | **0.95588** *** | | **0.95672** *** | | **0.95711** *** | | **0.95730** *** | | **0.95783** *** | | **0.95730** *** | | **0.95738** *** | | **0.95703** *** | | **0.95701** *** | | **0.90889** *** | | **0.90557** *** | |
| **Output gap** | -0.09557 *** | 0.030 | -0.10112 *** | 0.030 | -0.08949 *** | 0.029 | -0.09344 *** | 0.031 | -0.06416 * | 0.033 | -0.08984 *** | 0.034 | -0.06424 * | 0.033 | -0.09593 *** | 0.033 | -0.09551 *** | 0.030 | -0.09404 *** | 0.031 | -0.06479 | 0.046 | | |
| Output gap[-1] | 0.18654 *** | 0.069 | 0.21337 *** | 0.074 | 0.17243 ** | 0.069 | 0.17827 ** | 0.073 | 0.12135 * | 0.072 | 0.17976 ** | 0.077 | 0.12111 * | 0.072 | 0.18742 ** | 0.075 | 0.17933 ** | 0.070 | 0.17863 ** | 0.073 | 0.20168 ** | 0.091 | 0.08139 ** | 0.035 |
| Output gap[-2] | -0.05963 | 0.064 | -0.11502 | 0.085 | -0.05977 | 0.067 | -0.05934 | 0.068 | -0.02120 | 0.066 | -0.05195 | 0.070 | -0.02108 | 0.066 | -0.05519 | 0.068 | -0.05742 | 0.066 | -0.05924 | 0.068 | -0.11511 | 0.083 | -0.06954 | 0.070 |
| Output gap[-3] | -0.14377 ** | 0.065 | -0.09916 | 0.073 | -0.11881 * | 0.066 | -0.12056 * | 0.066 | -0.09684 | 0.063 | -0.15736 ** | 0.071 | -0.09613 | 0.063 | -0.16079 ** | 0.067 | -0.12689 * | 0.066 | -0.12079 * | 0.066 | -0.03626 | 0.070 | 0.00502 | 0.064 |
| Output gap[-4] | 0.19436 ** | 0.075 | 0.24475 *** | 0.089 | 0.17961 ** | 0.074 | 0.18021 ** | 0.074 | 0.08798 ** | 0.041 | 0.21692 *** | 0.078 | 0.08709 ** | 0.041 | 0.22047 *** | 0.076 | 0.18323 ** | 0.075 | 0.18059 ** | 0.074 | 0.18481 * | 0.096 | 0.14015 | 0.088 |
| Output gap[-5] | -0.06065 * | 0.034 | -0.19273 * | 0.103 | -0.06489 * | 0.033 | -0.06352 * | 0.033 | | | -0.06942 * | 0.036 | | | -0.07021 * | 0.036 | -0.06222 * | 0.033 | -0.06418 * | 0.033 | -0.25376 ** | 0.120 | -0.24103 ** | 0.117 |
| Output gap[-6] | | | 0.07291 | 0.049 | | | | | | | | | | | | | | | | | 0.11999 ** | 0.056 | 0.12289 ** | 0.057 |
| SUM | **0.02128** *** | | **0.02300** *** | | **0.01907** ** | | **0.02161** *** | | **0.02713** *** | | **0.02811** *** | | **0.02675** *** | | **0.02577** *** | | **0.02052** *** | | **0.02097** *** | | **0.03657** *** | | **0.03887** *** | |
| **REER gap** | -5.80452 *** | 0.812 | -5.75152 *** | 0.818 | -5.68490 *** | 0.783 | -5.67022 *** | 0.779 | -5.75061 *** | 0.812 | -5.78497 *** | 0.835 | -5.76141 *** | 0.809 | -5.83970 *** | 0.824 | -5.72381 *** | 0.779 | -5.69241 *** | 0.773 | -3.18505 *** | 0.496 | -3.15542 *** | 0.462 |
| REER gap[-1] | 2.18248 ** | 0.954 | 2.12520 ** | 0.945 | 2.09885 ** | 0.919 | 2.07593 ** | 0.913 | 2.06308 ** | 0.960 | 2.17315 ** | 0.961 | 2.06662 ** | 0.960 | 2.12575 ** | 0.959 | 2.12280 ** | 0.923 | 2.07564 ** | 0.915 | 1.06260 | 0.753 | 0.91677 | 0.866 |
| REER gap[-2] | 0.95528 | 1.213 | 0.87786 | 1.191 | 1.01783 | 1.212 | 0.99327 | 1.190 | 1.08178 | 1.216 | 1.16751 | 1.233 | 1.09116 | 1.214 | 1.23046 | 1.219 | 0.98732 | 1.204 | 1.00844 | 1.186 | -0.45343 | 0.713 | -0.75178 | 0.749 |
| REER gap[-3] | 0.35173 | 0.802 | 0.24201 | 0.781 | 0.13672 | 0.791 | 0.18152 | 0.774 | 0.08782 | 0.771 | -0.06566 | 0.788 | 0.10067 | 0.770 | -0.09932 | 0.782 | 0.19894 | 0.788 | 0.20800 | 0.775 | 1.50865 * | 0.756 | 1.98288 * | 1.136 |
| REER gap[-4] | 0.91748 | 0.563 | 1.19561 ** | 0.552 | 1.11091 * | 0.586 | 1.08291 * | 0.598 | 1.18269 * | 0.610 | 1.23783 ** | 0.606 | 1.21715 * | 0.615 | 1.30825 ** | 0.607 | 1.15025 * | 0.602 | 1.14195 * | 0.603 | -1.09760 ** | 0.437 | -1.17401 *** | 0.389 |
| REER gap[-5] | | | | | | | | | | | | | | | | | | | | | -0.52461 | 0.599 | -0.26492 | 0.547 |
| REER gap[-6] | | | | | | | | | | | | | | | | | | | | | 1.26765 *** | 0.432 | 1.07591 ** | 0.446 |
| SUM | **-1.39754** *** | | **-1.31084** *** | | **-1.32058** *** | | **-1.33659** *** | | **-1.33524** *** | | **-1.27213** *** | | **-1.28582** *** | | **-1.27457** *** | | **-1.26450** *** | | **-1.25838** *** | | **-1.42179** *** | | **-1.37056** *** | |
| **Food inflation** | 0.00650 ** | 0.003 | 0.00603 ** | 0.003 | 0.00376 *** | 0.001 | 0.00533 * | 0.003 | | | | | | | 0.00455 | 0.003 | 0.00584 ** | 0.003 | 0.00535 * | 0.003 | 0.00135 | 0.001 | | |
| Food inflation[-1] | -0.00132 | 0.004 | -0.00032 | 0.004 | | | -0.00023 | 0.004 | 0.00828 ** | 0.003 | 0.01515 ** | 0.006 | 0.00830 ** | 0.003 | 0.00218 | 0.004 | -0.00086 | 0.004 | -0.00023 | 0.004 | | | 0.00469 | 0.003 |
| Food inflation[-2] | -0.00478 | 0.004 | -0.00053 | 0.005 | | | 0.01131 | 0.009 | -0.01035 ** | 0.004 | -0.01010 ** | 0.004 | -0.01036 ** | 0.004 | -0.00887 ** | 0.004 | -0.00433 | 0.004 | 0.01120 | 0.009 | | | -0.00834 * | 0.004 |
| Food inflation[-3] | 0.00833 * | 0.005 | -0.00184 | 0.006 | | | -0.01903 | 0.013 | 0.01093 ** | 0.005 | 0.01206 ** | 0.005 | 0.01090 ** | 0.005 | 0.03006 *** | 0.009 | 0.00755 * | 0.004 | -0.01895 | 0.013 | | | 0.00395 | 0.003 |
| Food inflation[-4] | -0.00578 * | 0.003 | 0.00166 | 0.004 | | | 0.02937 ** | 0.014 | -0.00657 * | 0.004 | -0.00705 ** | 0.003 | -0.00648 * | 0.004 | -0.02056 ** | 0.009 | -0.00547 * | 0.003 | 0.02991 ** | 0.014 | | | | |
| Food inflation[-5] | | | | | | | -0.03455 ** | 0.017 | | | | | | | 0.00053 | 0.004 | | | -0.03449 ** | 0.017 | | | | |
| Food inflation[-6] | | | | | | | 0.01579 * | 0.008 | | | | | | | 0.00212 | 0.004 | | | 0.01574 * | 0.008 | | | | |
| SUM | **0.00295** ** | | **0.00500** *** | | **0.00376** *** | | **0.00798** ** | | **0.00229** * | | **0.01006** *** | | **0.00237** ** | | **0.01000** *** | | **0.00273** ** | | **0.00853** ** | | **0.00135** | | **0.00030** | |
| **Fuel inflation** | 0.00601 *** | 0.001 | 0.00592 *** | 0.001 | 0.00642 *** | 0.001 | 0.00622 *** | 0.001 | 0.00701 *** | 0.001 | 0.00694 *** | 0.001 | 0.00700 *** | 0.001 | 0.00641 *** | 0.001 | 0.00613 *** | 0.001 | 0.00621 *** | 0.001 | 0.00742 *** | 0.001 | 0.00763 *** | 0.001 |
| Fuel inflation[-1] | -0.00081 | 0.001 | -0.00105 | 0.001 | -0.00115 | 0.001 | -0.00134 | 0.001 | -0.00193 | 0.001 | -0.00175 | 0.001 | -0.00192 | 0.001 | -0.00115 | 0.001 | -0.00090 | 0.001 | -0.00133 | 0.001 | -0.00317 ** | 0.001 | -0.00286 ** | 0.001 |
| Fuel inflation[-2] | -0.00430 *** | 0.001 | -0.00363 *** | 0.001 | 0.00170 | 0.002 | -0.00373 *** | 0.001 | -0.00391 *** | 0.001 | -0.00414 *** | 0.001 | -0.00391 *** | 0.001 | -0.00437 *** | 0.001 | 0.00212 | 0.002 | -0.00373 *** | 0.001 | -0.00344 *** | 0.001 | -0.00299 ** | 0.001 |
| Fuel inflation[-3] | -0.00106 | 0.001 | | | -0.00437 * | 0.002 | | | -0.00102 | 0.001 | | | -0.00103 | 0.001 | | | -0.00593 ** | 0.002 | | | 0.00192 | 0.001 | 0.00012 | 0.001 |
| Fuel inflation[-4] | 0.00232 ** | 0.001 | | | | | | | 0.00788 ** | 0.003 | | | 0.00760 ** | 0.003 | | | 0.00182 * | 0.001 | | | -0.00218 | 0.002 | -0.00109 | 0.002 |
| Fuel inflation[-5] | | | | | | | | | -0.00571 * | 0.003 | | | -0.00572 * | 0.003 | | | | | | | 0.00006 | 0.002 | -0.00066 | 0.002 |
| Fuel inflation[-6] | | | | | | | | | | | | | | | | | | | | | 0.00170 * | 0.001 | 0.00215 ** | 0.001 |
| SUM | **0.00217** *** | | **0.00123** ** | | **0.00260** ** | | **0.00115** * | | **0.00233** * | | **0.00105** * | | **0.00203** | | **0.00089** | | **0.00324** ** | | **0.00115** * | | **0.00230** *** | | **0.00230** *** | |
| **Inflation targeting*(Fuel or Food inf.)** | | | | | | | | | | | | | | | | | | | | | | | | |
| Inflation targeting[-4]*(Fuel or Food inf.) | -0.00092 * | 0.000 | -0.00956 ** | 0.004 | | | | | | | | | -0.00085 * | 0.000 | | | -0.00099 ** | 0.000 | -0.00263 * | 0.001 | | | | |
| Inflation targeting[-6]*(Fuel or Food inf.) | | | | | | | | | | | | | | | -0.00237 * | 0.001 | | | | | | | | |
| SUM | **-0.00092** * | | **-0.00321** ** | | | | | | | | | | **-0.00085** * | | **-0.00237** * | | **-0.00099** ** | | **-0.00263** * | | | | | |
| **CB Autonomy*(Fuel or Food inf.)** | | | | | | | | | | | | | | | | | | | | | | | | |
| CB Autonomy[-2]*(Fuel or Food inf.) | | | | | -0.00963 *** | 0.003 | -0.02275 * | 0.012 | | | | | | | | | -0.00981 *** | 0.003 | -0.02258 * | 0.012 | | | | |
| CB Autonomy[-3]*(Fuel or Food inf.) | | | | | 0.00748 * | 0.004 | 0.03647 ** | 0.018 | | | | | | | | | 0.00811 ** | 0.004 | 0.03639 * | 0.018 | | | | |
| CB Autonomy[-4]*(Fuel or Food inf.) | | | | | | | -0.05108 ** | 0.021 | | | | | | | | | | | -0.04982 ** | 0.021 | | | | |
| CB Autonomy[-5]*(Fuel or Food inf.) | | | | | | | 0.05476 ** | 0.022 | | | | | | | | | | | 0.05465 ** | 0.022 | | | | |
| CB Autonomy[-6]*(Fuel or Food inf.) | | | | | | | -0.02439 ** | 0.012 | | | | | | | | | | | -0.02427 ** | 0.012 | | | | |
| SUM | | | | | **-0.00215** | | **-0.00699** | | | | | | | | | | **-0.00170** | | **-0.00563** | | | | | |
| **Governance*(Fuel or Food inf.)** | | | | | | | | | | | | | | | | | | | | | | | | |
| Governance[-1]*(Fuel or Food inf.) | | | | | | | | | | | -0.00208 ** | 0.001 | | | | | | | | | | | | |
| Governance[-3]*(Fuel or Food inf.) | | | | | | | | | | | | | | | -0.00460 ** | 0.002 | | | | | | | | |
| Governance[-4]*(Fuel or Food inf.) | | | | | | | | | -0.00169 ** | 0.001 | | | -0.00150 ** | 0.001 | 0.00321 * | 0.002 | | | | | | | | |
| Governance[-5]*(Fuel or Food inf.) | | | | | | | | | 0.00144 ** | 0.001 | | | 0.00145 ** | 0.001 | | | | | | | | | | |
| SUM | | | | | | | | | **-0.00169** | | **-0.00208** ** | | **-0.00150** | | **-0.00139** ** | | | | | | | | | |
| **Inflation expectations** | | | | | | | | | | | | | | | | | | | | | **0.04108** *** | **0.011** | **0.04131** *** | **0.011** |
| **Stdev of inf. expectations*(Fuel or Food inf.)** | | | | | | | | | | | | | | | | | | | | | | | | |
| Stdev of inf. expectations[-1]*(Fuel or Food inf.) | | | | | | | | | | | | | | | | | | | | | 0.00142 ** | 0.001 | | |
| Stdev of inf. expectations[-2]*(Fuel or Food inf.) | | | | | | | | | | | | | | | | | | | | | | | 0.00386 *** | 0.001 |
| Stdev of inf. expectations[-3]*(Fuel or Food inf.) | | | | | | | | | | | | | | | | | | | | | -0.00336 ** | 0.001 | -0.00338 ** | 0.001 |
| Stdev of inf. expectations[-4]*(Fuel or Food inf.) | | | | | | | | | | | | | | | | | | | | | 0.00180 ** | 0.001 | | |
| SUM | | | | | | | | | | | | | | | | | | | | | **-0.00014** | | **0.00047** | |
| **Constant** | 0.155 *** | 0.036 | 0.167 *** | 0.036 | 0.166 *** | 0.036 | 0.168 *** | 0.036 | 0.162 *** | 0.036 | 0.166 *** | 0.037 | 0.162 *** | 0.036 | 0.160 *** | 0.037 | 0.163 *** | 0.036 | 0.168 *** | 0.036 | 0.140 *** | 0.049 | 0.157 *** | 0.053 |
| **Number of obs** | 7374 | | 7368 | | 7251 | | 7251 | | 6750 | | 6558 | | 6750 | | 6684 | | 7251 | | 7251 | | 3432 | | 3450 | |
| **Number of groups** | 65 | | 65 | | 64 | | 64 | | 64 | | 64 | | 64 | | 64 | | 64 | | 64 | | 41 | | 41 | |
| **R2** | 0.974 | | 0.974 | | 0.975 | | 0.975 | | 0.975 | | 0.975 | | 0.975 | | 0.975 | | 0.975 | | 0.975 | | 0.958 | | 0.957 | |

## VI. THE 2008 FOOD-PRICE SHOCK

While the analysis so far has covered longer time periods, the dynamics may be different for large shocks. Pass-through estimations may suffer from various problems, including measurement issues and difficulties in specifying adequate Phillips curves for developing countries in the presence of recurrent structural breaks. These problems are less severe when focusing on an 'event study' surrounding a large shock. Therefore, we examine the 2008 food-price shock episode in more detail, to assess how countries coped with this large increase in international prices. We compute both the changes in headline and core (non-food) inflation six months before and after the peak of international food price inflation in March 2008, and explore the extent to which they are related to the country-level variables discussed earlier.[17]

**International Food and Fuel Price Indices, 1980-2010**




[17] Habermeier et al (2009) examine some pairwise correlations of country characteristics and policy variables, with the accumulated headline inflation from Dec 2006 through June 2008. Similarly, Pistelli and Riquelme (2010) analyze the impact of the commodity price boom-and-bust cycle during 2007 and 2008 with a sample of 44 countries focusing on a few structural variables.

**Changes in headline inflation**

As expected, countries with higher food shares confronted higher inflationary pressures (Table 2). However, variables proxying for the importance of fuel in the economy and the CPI were not consistently correlated with the inflationary impact. On the other hand, the energy intensity of the economies in the sample is clearly positively associated with the experienced increase in headline inflation. Similarly, to some extent, the inflationary impact was weaker for fuel importers, as expected.[18] We are not able to capture any significant impact of demand conditions; the output gap does not enter significantly in any of the regressions. We did not find any correlation with our measure of labor market flexibility, either.

Countries with more autonomous central banks saw a weaker increase in CPI inflation around the commodity price shock. However, interestingly, there is no statistically significant difference between the performance of inflation targeting versus non-inflation targeting economies.

The pre-existing inflation environment was key in determining the impact of the international commodity price shock on domestic prices: in line with Taylor's (2000) argument, countries with higher initial inflation levels experienced a much more marked increase in CPI inflation. The effect is sizeable: a country that had a headline inflation of, say, 3 percent in early 2007 saw on average a 1.5-2.5 percentage point lower raise in inflation than a country with an initial inflation of 8 percent.

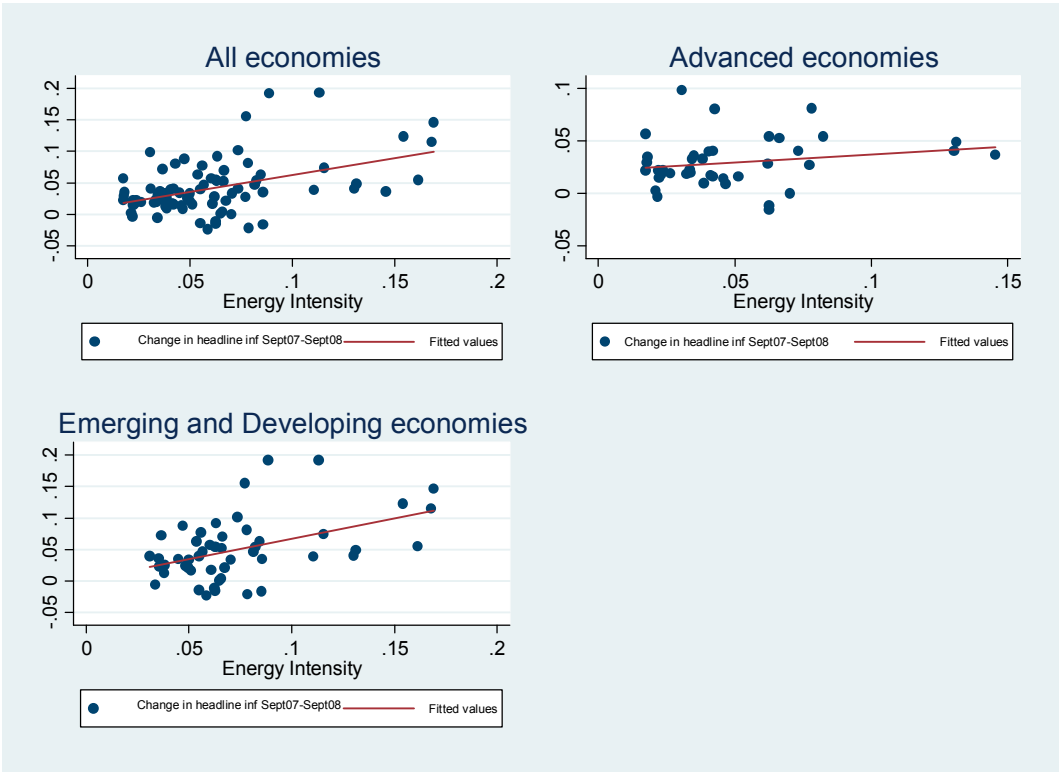
Not surprisingly, the policy reaction around the shock also mattered: countries with a tighter monetary stance – as measured by their real short-term interest rates and the change in the nominal effective exchange rate– experienced lower hikes in inflation rates. This was also the case for economies where fiscal policy was tighter.[19]

Lastly, we also explored the role of monetary policy uncertainty more directly. The dispersion of *Consensus Forecasts* survey projections for inflation in 2008 (measured as the standard deviation across forecasters at end-2007) estimates is positively correlated with inflation outcomes, but this is driven mainly by two outliers. Moreover, the index of monetary policy transparency is not associated with the impact on CPI inflation.

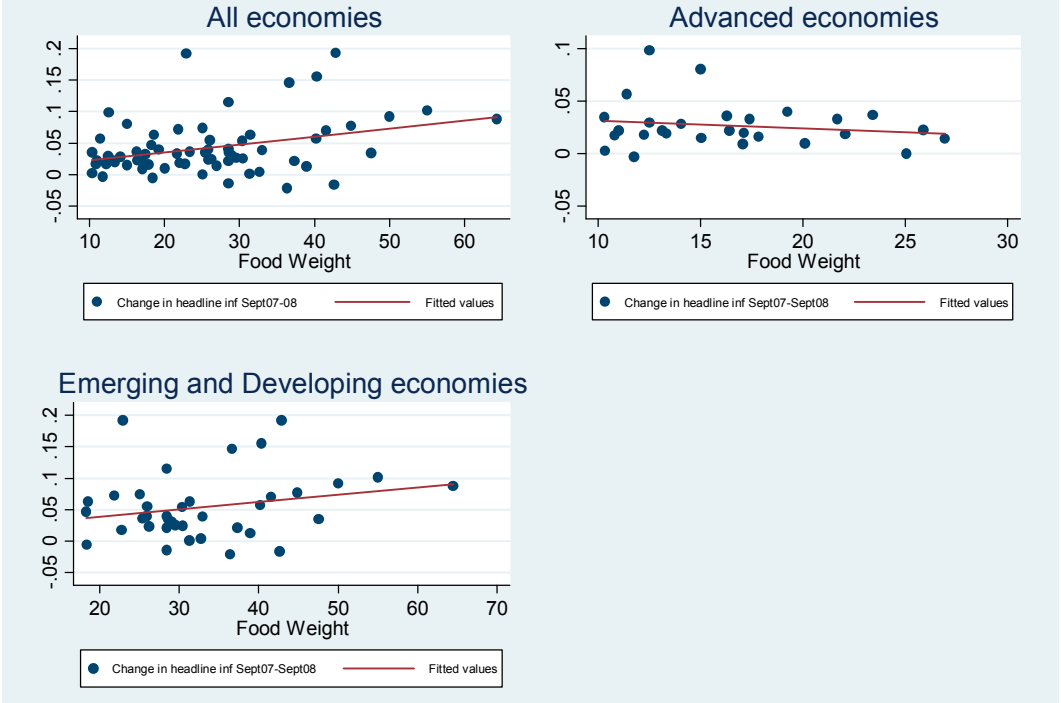
[18]The same was not true for food importers.

[19] Neither the change in real interest rates nor the fiscal impulse (measured as the change in the structural fiscal balance) were statistically significantly associated with inflation outcomes. The growth in money aggregates did not enter the regressions in a consistently statistically significant manner, either.

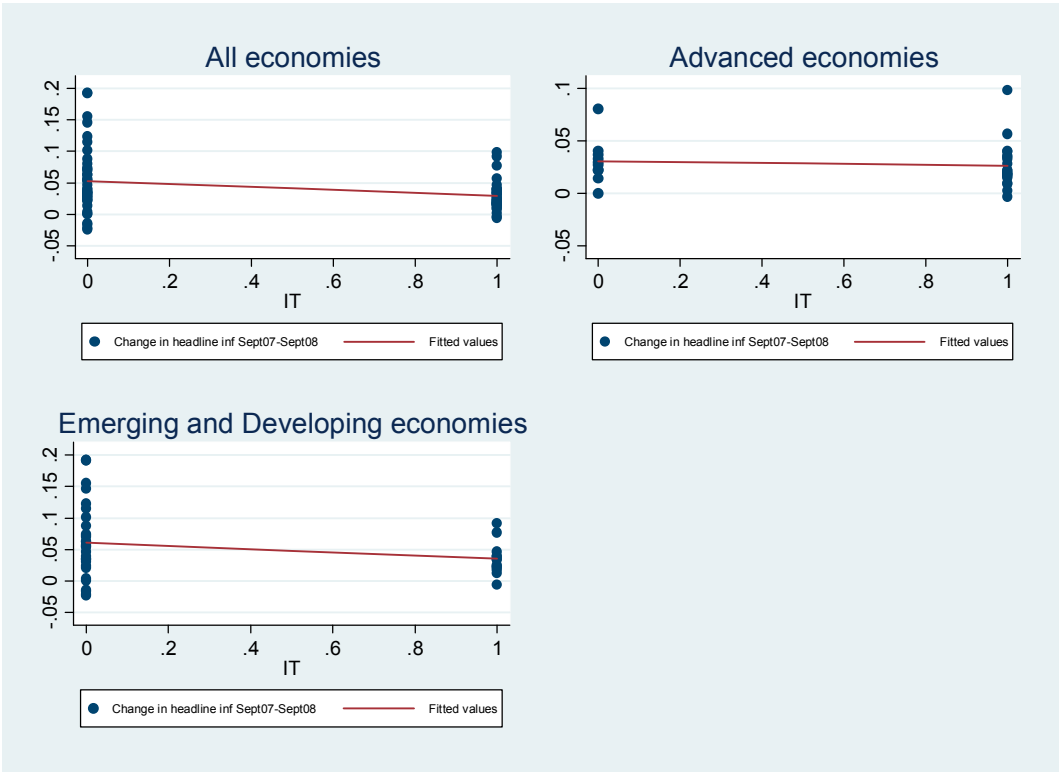
## Change in Headline Inflation around March 2008 and Energy Intensity



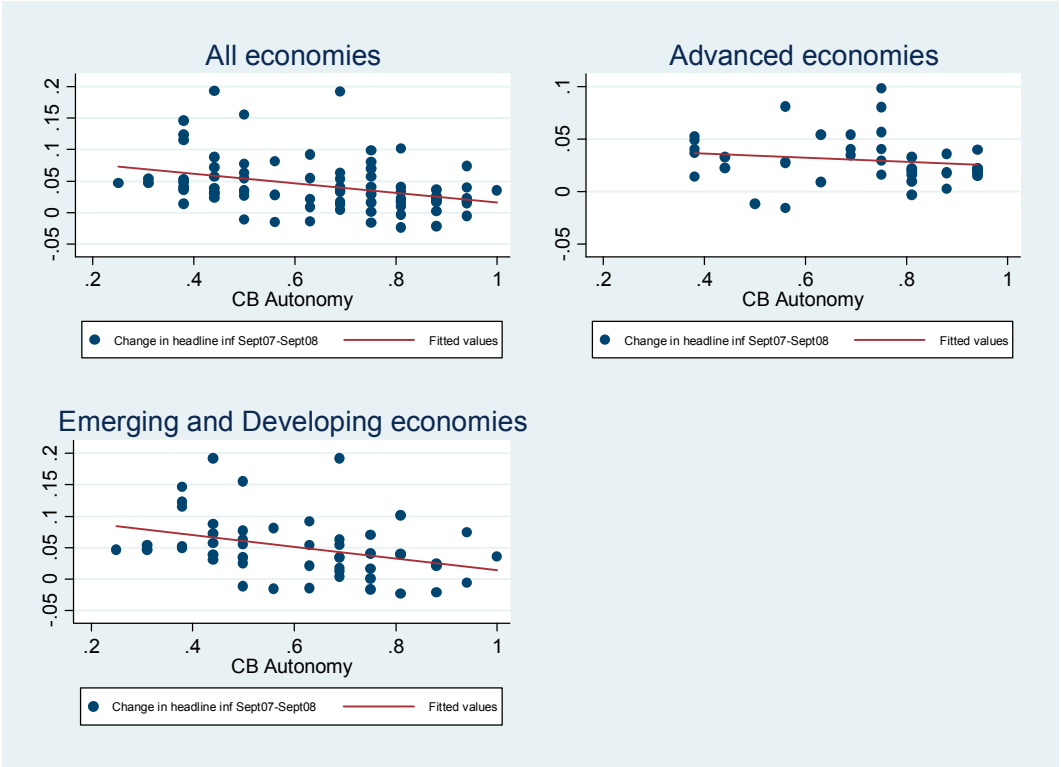

## Change in Headline Inflation around March 2008 and Food Weight in CPI



**Change in headline Inflation around March 2008 and IT Dummy**




**Change in Headline Inflation around March 2008 and Central Bank Autonomy**



## Table 2. Change in Headline CPI Inflation Around 2008 Shock

Dependent Variable: Change in 12-month CPI headline inflation between September 2007 and September 2009

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ***Including Policy Variables*** | | | |
| CPI Food Weight | 0.0013*** | 0.0011** | 0.0009** | 0.0007* | 0.0005 | | | | | 0.0009** |
| | (0.0004) | (0.0004) | (0.0005) | (0.0004) | (0.0004) | | | | | (0.0004) |
| Fuel importer Dummy | | -0.029** | -0.026** | -0.020* | -0.014 | | | | | |
| | | (0.012) | (0.012) | (0.011) | (0.011) | | | | | |
| IT Dummy | | | -0.012 | | | | | | | |
| | | | (0.011) | | | | | | | |
| Lagged inflation | | | | 0.50*** | 0.48*** | | 0.39*** | 0.31** | 0.36*** | 0.49*** |
| | | | | (0.13) | (0.13) | | (0.12) | (0.14) | (0.11) | (0.1) |
| CB Autonomy | | | | | -0.06** | -0.04* | -0.06** | -0.04 | -0.04 | |
| | | | | | (0.03) | (0.02) | (0.03) | (0.03) | (0.023) | |
| Energy Intensity | | | | | | 0.33** | 0.20 | 0.33* | 0.21 | |
| | | | | | | (0.14) | (0.15) | (0.18) | (0.14) | |
| Governance | | | | | | -0.004 | | | | |
| | | | | | | (0.005) | | | | |
| ST real interest rate | | | | | | | -0.002** | -0.003*** | -0.003** | |
| | | | | | | | (0.001) | (0.001) | (0.001) | |
| 2007 Fiscal Structural balance | | | | | | | | -0.003* | | |
| | | | | | | | | (0.002) | | |
| Change in NEER /2 | | | | | | | | | | -0.18*** |
| | | | | | | | | | | (0.06) |
| Obs. | 66 | 66 | 66 | 66 | 65 | 77 | 63 | 45 | 63 | 65 |
| R-squared | 0.12 | 0.20 | 0.21 | 0.35 | 0.37 | 0.40 | 0.42 | 0.55 | 0.51 | 0.40 |

Standard errors in parentheses *** denotes p-value<0.01, **denotes p-value<0.05, * denotes p-value<0.10
/1 Orthogonalized component to central bank autonomy when the latter variable is included in the regression.
/2 Increase implies appreciation

**Changes in core inflation**

A probably even more relevant issue is to understand differences in the transmission to non-food inflation. As discussed earlier, more credible monetary frameworks should help contain the spillover from commodity prices to core inflation. The impact on core inflation was clearly lower in developing countries with more autonomous central banks, and to some extent in countries with better governance structures (Table 3). The effect is economically significant: raising the degree of autonomy from the bottom to the top fifth percentile of the index distribution would on average be associated with 3.5 percentage points lower increase in core inflation. However, again there no evidence of a stronger performance of inflation-targeters.

Similarly as in the case of headline inflation, the food share in the CPI is positively correlated with the impact on core inflation. However, this is not the case for proxies of the role of fuel.

The transmission to core inflation was higher for countries with higher CPI inflation levels. Policy variables do not enter significantly the regressions, except for the degree of exchange rate movements, with appreciations of the nominal real exchange rate associated with a lower impact on core inflation.

The role of monetary policy in preventing a propagation of the shock to core inflation is supported by a clear negative cross-country association between the increase in core inflation and the level of short-term real interest rates, as well as with the degree of nominal exchange rate appreciation.

## Table 3. Change in Core Inflation Around 2008 Shock

Dependent Variable: Change in 12-month CPI headline inflation between September 2007 and September 2009

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ***Including Policy Variables*** | | |
| Food weight in CPI | 0.0009*** | 0.0009*** | 0.0009** | 0.0007** | 0.0004 | | | | | 0.0009*** |
| | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | | | | | (0.0002) |
| Fuel Importer Dummy | | 0.0046 | 0.005 | 0.007 | 0.012 | | | | | |
| | | (0.01) | (0.01) | (0.01) | (0.01) | | | | | |
| IT Dummy | | | -0.004 | | | | | | | |
| | | | (0.01) | | | | | | | |
| Lagged CPI Inflation | | | | 0.38*** | 0.44*** | | 0.55*** | 0.55*** | 0.52*** | 0.22** |
| | | | | (0.13) | (0.13) | | (0.12) | (0.15) | (0.12) | (0.10) |
| CB Autonomy | | | | | -0.07*** | -0.06** | -0.08*** | -0.07** | -0.07*** | |
| | | | | | (0.02) | (0.02) | (0.02) | (0.03) | (0.03) | |
| Energy Intensity | | | | | | 0.225 | 0.203 | 0.183 | 0.232 | |
| | | | | | | (0.16) | (0.17) | (0.18) | (0.17) | |
| Governance | | | | | | -0.01** | | | | |
| | | | | | | (0.004) | | | | |
| ST Real Interest rate | | | | | | | -0.001 | -0.001 | -0.001 | |
| | | | | | | | (0.001) | (0.001) | (0.001) | |
| Fiscal structural balance | | | | | | | | -0.001 | | |
| | | | | | | | | (0.001) | | |
| Change in NEER /2 | | | | | | | | | | -0.19*** |
| | | | | | | | | | | (0.033) |
| Obs. | 48 | 48 | 48 | 48 | 47 | 54 | 38 | 31 | 38 | 48 |
| R2 | 0.16 | 0.16 | 0.17 | 0.30 | 0.38 | 0.51 | 0.59 | 0.60 | 0.61 | 0.60 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
/1 Orthogonalized component to central bank autonomy when the latter variable is included in the regression.
/2 Increase implies appreciation

## VII. CONCLUSIONS

This study has carried out an extensive assessment of the effects of international commodity price shocks on domestic inflation across a wide range of countries, using a variety of methods. A few lessons can be drawn:

- Countries with certain structural characteristics are more prone to experience sustained inflationary effects from commodity price shocks. These characteristics include the weight of food in CPI and the oil intensity of the economy. Around the 2008 shock, net fuel importers also faced somewhat lower inflationary pressures, in line with terms-of-trade effects.

- Countries can, however, influence the degree to which domestic inflation reacts to international commodity price movements: better overall governance, more central bank autonomy, and, to a lesser extent, the adoption of inflation-targeting frameworks seem to help anchor inflation expectations and reduce second-round effects. However, the evidence suggests that the overall confidence in institutions may be more important than whether a country declares itself formally as an inflation targeter or not.

- Policy actions also matter: around the 2008 commodity shock, tighter monetary policy (as measured by the real interest rate) helped contain the inflationary impact. To a lesser degree, this is also true for tight fiscal policy.

- If inflation is already relatively high to begin with, commodity price shocks have a substantially higher pass-through to domestic inflation.

Further research could examine more systematically the formation of inflation expectations around commodity price shocks and their influence in shaping inflation dynamics; more work using microeconomic information on price movements around such shocks could also lead useful insights.

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## Appendix I: List of countries included

**Advanced economies**

Austria
Belgium
Canada
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hong Kong
Iceland
Ireland
Israel
Italy
Japan
Korea, South
Malta
Netherlands
New Zealand
Norway
Portugal
Singapore
Slovenia
Spain
Sweden
Switzerland
Taiwan
UK
USA

**Emerging and Developing Economies**

Albania
Algeria
Argentina
Bahrain
Botswana
Brazil
Bulgaria
Chile
Colombia
Costa Rica
Croatia
Ecuador
Egypt
Ghana
Hungary
India
Iran
Jordan
Kazakhstan
Kuwait
Latvia
Lebanon
Lithuania
Macao
Macedonia
Malaysia
Mauritius
Mexico
Nigeria
Oman
Pakistan
Peru
Philippines
Poland
Qatar
Romania
Russia
Saudi Arabia
South Africa

Thailand
Tunisia
Turkey
Uganda
Ukraine
United Arab Emirates
Uruguay
Venezuela
Vietnam

## Appendix II. List of variables used

| Variable | Units | Description | Source |
|---|---|---|---|
| Headline inflation | Percent | CPI inflation | Haver Analytics and WEO database |
| Core inflation | Percent | Core CPI inflation | Haver Analytics and WEO database |
| Global food inflation | Percent | Yearly change in the index of food prices | WEO database |
| Global fuel inflation | Percent | Yearly change in the index of fuel prices | WEO database |
| Output gap | Percent | Based on HP filter | WEO database |
| REER Gap | Percent | REER deviation from trend, based on HP filter | IMF |
| **Structural characteristics of the economy** | | | |
| Openness | Percent | Calculated as sum of exports and imports divided by GDP | Haver Analytics and WEO database |
| Food share in CPI | Percent | Share of food items in CPI baskets | Haver Analytics and WEO database |
| Fuel Intensity | Percent | Calculated as annual oil consumption divided by GDP | EIA |
| Degree of financial dollarization | Percent | Foreign exchange deposits over total deposits | Levy Yeyati (2006) (with 2010 database update) and IFS |
| Financial development | Percent | Broad money as a share of GDP | IFS |
| Fiscal dominance | Percent | General government public debt in percent of GDP | IMF |
| **Monetary and exchange-rate regimes** | | | |
| Inflation Targeting regime | Dummy | 1 if the country's monetary policy framework is inflation targeting | Roger (2009) |
| CB autonomy index | Index number | 1 corresponds to the highest level of the Central bank autonomy | Arnone et al (2007) |
| Turnover | Number of central bank governors per year | Turnover rate of central bank governors | Crowe-Meade (2007) |
| Exchange rate stability | Index number | The exchange rate stability index ranges from 0 to 1 | AREAR (IMF) |
| **Institutional characteristics** | | | |
| Governance | Index number | A rating reflecting bureaucratic quality, corruption, democratic accountability and law and order. | International Country Risk Guide |
| Regulatory quality | Index number | Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. | World Bank |
| Labor market flexibility | Index number | Captures different types of labor market regulations. Ranges from 0 to 10. (Higher values denote a more flexible labor market.) | 2011 Economic Freedom Dataset |