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Commodity prices and inflation dynamics[1]

Commodity prices rose strongly in recent years until mid-2008, driving inflation up worldwide. This feature investigates aspects of the impact of the rise in food and energy prices on headline inflation and its dynamics using a dataset for CPI inflation and its food and energy components that includes the major advanced and emerging economies. Our evidence suggests 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.

JEL classification: E31, E52.

Commodity prices have risen dramatically in recent years, before falling back markedly since mid-2008 as the financial crisis has led to downward revisions in expectations of future demand growth. The rising commodity prices of recent years have driven inflation higher worldwide. How should monetary policymakers react? If the food and energy price shocks are transitory, with upward spikes that are quickly reversed leaving the medium-term aggregate price path unchanged, policymakers would probably want to ignore them. Even if commodity prices do not revert to their previous level, the temporary inflationary impulse from a rise in the level of commodity prices themselves will soon drop out, and such a relative price shift could be safely accommodated. The alternative – keeping inflation close to policymakers' objective in the short term – would create output costs that could be unduly large. Nevertheless, it is essential that monetary policy resist any second-round effects of higher commodity prices on inflation expectations and wages, and thereby on future inflation itself.

Monetary policymakers face a number of challenges in dealing with higher inflation arising from increases in commodity prices. Prime among them is the fact that in real time it is difficult to distinguish relative price shifts from a rise in aggregate inflation due to strong aggregate demand. Because commodity prices are relatively flexible and might respond to shocks faster than the prices of other goods and services, their increase could signal more general

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. The authors would like to thank Clara García and Philippe Hainaut for excellent research assistance, and Piti Disyatat, Dietrich Domanski, Luci Ellis, Michael King and Marion Kohler for helpful comments and discussions.

inflationary pressures. Moreover, it is difficult to identify either whether increases in commodity prices are transitory or permanent, or whether they are likely to generate second-round effects on headline inflation.

This special feature investigates several aspects of the impact of rising food and energy prices on the level and dynamics of inflation in a cross section of mature and emerging economies. We study the potential for second-round effects by analysing whether CPI inflation excluding food and energy has tended to revert to headline inflation, and conclude that it has not, which suggests an absence of strong second-round effects. We also investigate whether food or energy prices help to forecast inflation, and find that the former have tended to do so to a greater extent than the latter.

When making a cross-country comparison of the impact of food and energy prices on headline inflation, it is desirable to have data that are consistent across countries. With this in mind, we employ a cross-country dataset for CPI inflation and its food and energy components that includes the major advanced and emerging economies, and in whose construction some progress has been made towards such cross-country consistency (Domanski et al (2008)). Next, we discuss the impact of rising commodity prices on inflation. The following section analyses the aspects of inflation dynamics relevant for monetary policymakers discussed above, and the last section concludes.

Rise in commodity prices and inflation

Commodity prices rose dramatically until mid-2008 …

Commodity prices rose dramatically in recent years until mid-2008 (Graph 1). Oil prices reached record highs in mid-2008, rising to $145 per barrel (Brent), 470% higher than at the start of 2000. This increase has been due to the combination of increasing global demand, in particular from strong growth in emerging economies, supply disruptions and downward revisions in expectations of future oil supply. Food prices have increased substantially, partly as rising per capita incomes raised food consumption in emerging economies at the same time that there were temporary supply disruptions. Between the start of 2000 and mid-2008, food prices rose by 150% according to the Commodity Research Bureau's spot index of foodstuffs.

… but have fallen back more recently

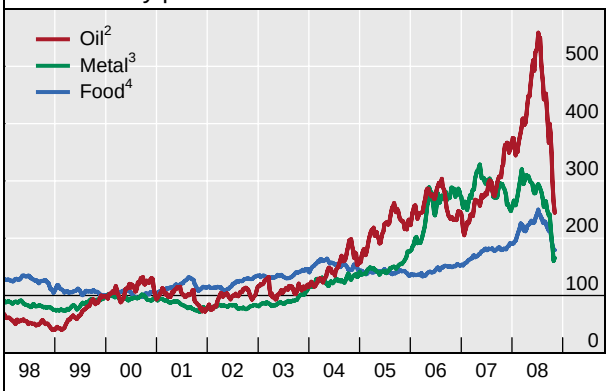
More recently, as the financial crisis has led to downward revisions in expectations of future demand growth, commodity prices have fallen back markedly. Oil prices, for example, declined to around $65 per barrel (Brent) by the end of October, still 150% higher than the level prevailing at the start of 2000. And as a result of incipient supply responses and fewer weather-related supply disruptions, food prices have also moderated recently.

Inflation has risen globally due to higher food and energy prices

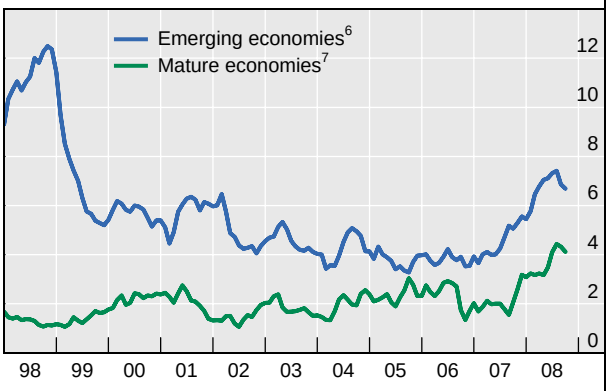
The rise in food and energy prices has been propelling global inflation upwards in recent years (Graph 1). In mature economies inflation doubled from about 2% several years ago to 4% in mid-2008, and in emerging economies it increased from about 4% to approximately 8%. The relatively higher increase in emerging economy inflation is at least in part a consequence of the larger weight of food in the consumption basket in countries with lower income per capita (IMF (2007)). In the sample of countries considered here, the weight of food in the CPI is around 30% in emerging economies, more than twice the

Commodity prices and inflation

Commodity prices[1]



Headline inflation[5]



[1] Beginning of 2000 = 100. [2] UK Brent. [3] London Metal Exchange Index composed of aluminium, copper, lead, nickel, tin and zinc. [4] Commodity Research Bureau Spot Index Foodstuffs. [5] Twelve-month changes in consumer prices, in per cent. Weighted averages based on 2005 GDP and PPP exchange rates. [6] Brazil, China, Chinese Taipei, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, the Philippines, Poland, Singapore, Slovakia, South Africa, Thailand and Turkey. [7] Canada, Denmark, the euro area, Japan, Norway, Sweden, Switzerland, the United Kingdom and the United States.

Sources: IMF; OECD; CEIC; Datastream; national data; BIS calculations. Graph 1

average of 13% in mature economies. Partly as a result, food price increases contributed close to 4 percentage points to the rise in headline inflation in emerging economies in mid-2008, compared with only around 1 percentage point in mature economies (Table 1). In addition, CPI food price inflation tended to be higher in emerging than in mature economies in mid-2008. By contrast, the weight of energy in the consumption basket is more comparable across mature and emerging economies, so it has little impact on the differences in the degree to which inflation has risen around the world. Finally, while headline inflation has increased significantly, core inflation – which excludes food and energy prices that contributed to the strong rise in headline inflation – has remained more subdued in both mature and emerging economies (Graph 2).

Inflation dynamics

In the following, we analyse the aspects of inflation dynamics relevant for monetary policymakers discussed above. Specifically, we address the following three questions: (a) Is headline inflation reverting to core or vice versa? (b) Do food and energy prices help forecast inflation? (c) How persistent are CPI food and energy price inflation?

This feature employs a cross-country dataset for CPI inflation and its food and energy components that includes the major advanced and emerging economies. The CPI food price series is defined as food and non-alcoholic beverages or the closest available series; the CPI energy price series is defined as electricity, gas and other fuels plus fuels and lubricants for personal transport equipment, or the closest available series.[2]

[2] The Classification of Individual Consumption by Purpose (COICOP) is a reference classification published by the United Nations Statistics Division. For CPI food prices, the dataset uses the classification COICOP 01, and for CPI energy prices COICOP 04.5 plus

Headline inflation and its contributors in mid-2008[1]

	Headline[2]	Food[3]		Energy[4]		Non-food non-energy	
		Weight[5]	Contrib[6]	Weight[5]	Contrib[6]	Contrib[6]	Actual[2]
Mature economies[7]	3.7	13.3	0.7	7.7	1.4	1.7	2.1
Emerging economies[8]	8.1	29.5	3.8	7.7	0.9	3.5	5.4

[1] June 2007 to June 2008; unweighted averages of the economies cited; contributions and non-food non-energy actual figures are BIS calculations for purposes of cross-country comparisons and may differ from national sources; contributions may not sum to reported totals due to rounding. [2] Change in consumer prices, in per cent. [3] Food and non-alcoholic beverages (COICOP 01) or closest available series. [4] Electricity, gas and other fuels (COICOP 04.5), plus fuels and lubricants for personal transport equipment (COICOP 07.2.2) or closest available series. [5] As a percentage of headline CPI. [6] Contribution, in percentage points. [7] Australia, Canada, the euro area, Japan, Sweden, Switzerland, the United Kingdom and the United States. [8] Brazil, China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Mexico, the Philippines, Poland, Singapore, South Africa, Thailand and Turkey.

Sources: OECD; CEIC; Datastream; national data; BIS calculations. Table 1

Core inflation measure excludes food and energy prices

We consider a core inflation measure obtained by excluding food and energy prices from headline inflation, for which we have a cross-country dataset available.[3] The properties of such core inflation measures, as well as of alternative core measures – such as measures based on excluding the most volatile components, or taking median inflation rates across a number of individual prices – have previously been studied for a number of countries, eg in OECD (2005), Rich and Steindel (2005), Blinder and Reis (2005), Marques et al (2003) and Bryan and Cecchetti (1994). For example, Rich and Steindel (2005) evaluate seven different core inflation measures for the United States on criteria including ease of design, accuracy in tracking trend inflation and predictive content for future movements in aggregate inflation. The core measures they consider include inflation excluding food and energy, inflation excluding energy, median inflation and exponentially smoothed inflation. They find that there is no individual measure of core inflation that can be considered superior to other measures based on these criteria.

Nature of shocks to commodity prices matters for inflation dynamics

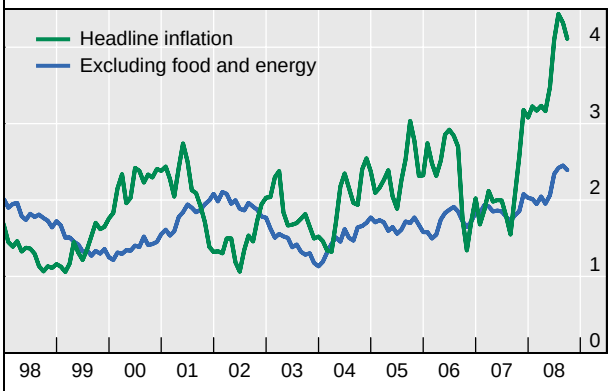
The nature of the shocks to commodity prices matters for the impact of rising commodity prices on inflation dynamics. If the source of the recent increases in food and energy price inflation has been the increased income and wealth in strongly growing emerging economies, in particular in East and southern Asia, this could simply lead to a one-off change in the level of food and energy prices if this happened once and for all. However, with economic development in those regions continuing, we might expect that each month there would be a group of new consumers demanding more food and energy, so that demand would shift continuously, which could lead to a more persistent effect on inflation and a smaller degree of reversion of headline inflation to core. By contrast, if higher food and energy prices have mainly been due to

COICOP 07.2.2, or the closest available series. Data for the OECD countries are all consistent and come from OECD sources. For some emerging market countries (eg Brazil), data are consistent, but for some others (eg China, India, Malaysia, the Philippines and Thailand) they are not, and instead the closest available series are taken.

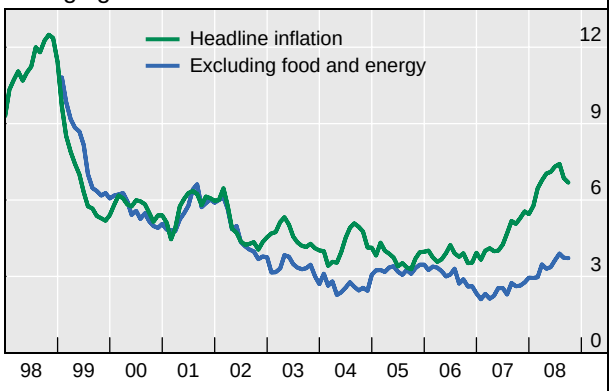
[3] CPI inflation excluding food and energy is referred to in the following for simplicity as core inflation.

Headline and core inflation[1]

Mature economies[2]



Emerging economies[2]



[1] Twelve-month changes in consumer prices, in per cent; weighted averages based on 2005 GDP and PPP exchange rates. [2] See notes to Graph 1 for the list of mature and emerging economies.

Sources: CEIC; Datastream; OECD; national data; BIS calculations. Graph 2

adverse supply shocks, the impact on inflation might be expected to be more transitory – unless either the supply shocks are themselves persistent, or they lead to second-round effects on inflation.

(a) Is headline inflation reverting to core or vice versa?

Has headline inflation been reverting to core?

If headline inflation has been reverting to core, this would provide some comfort to policymakers. It would mean that increases in food and energy inflation have been temporary and have not led to persistently rising headline inflation that could arise from persistent upside shocks to commodity prices or from second-round effects due to higher inflation expectations and accelerating wages. For the United States, there is some evidence that this has been the case as headline inflation has tended to revert to inflation excluding food and energy prices in recent years (Kiley (2008)). US monetary policymakers have also commented on the tendency of headline inflation in the United States to move to inflation excluding food and energy prices in recent years (Rosengren (2008)). For the euro area, as we mention below, the results depend on which measure of core inflation is used (OECD (2005)).

Here we study the question of whether CPI headline inflation reverts to core by considering the following regression:

$$\pi_{i,t}^{headline} - \pi_{i,t-12}^{headline} = \alpha_i + \beta_i(\pi_{i,t-12}^{headline} - \pi_{i,t-12}^{core}) + \varepsilon_{i,t} \qquad (1)$$

where i labels the 19 economies considered,[4] using monthly data on year-over-year inflation rates over the past 15 years. If headline inflation reverts to core, we expect a negative coefficient β_i on the wedge between headline and core inflation.

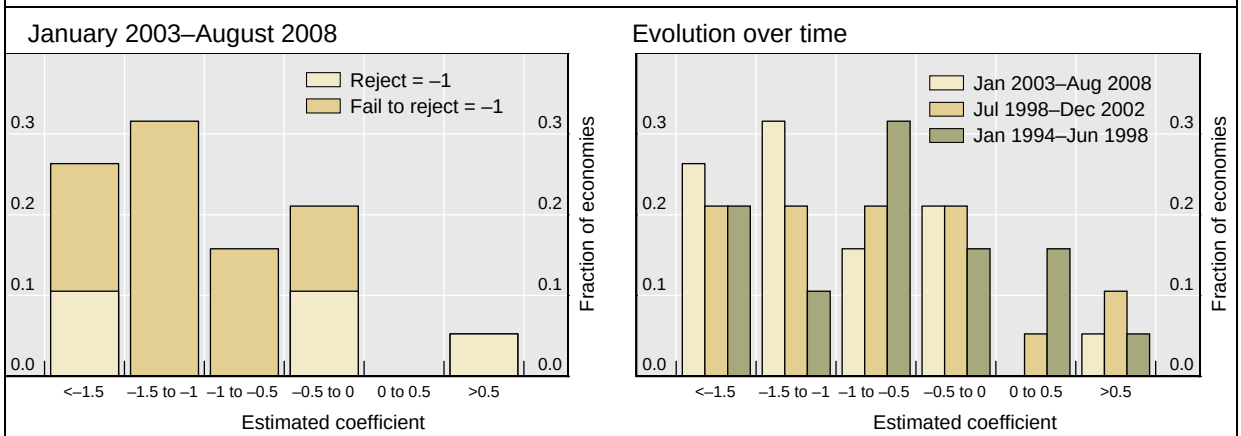
[4] The 19 economies comprise those for which we have CPI food and energy price data available for the past 15 years, namely Canada, Denmark, the euro area, Japan, Norway, Sweden, Switzerland, the United Kingdom, the United States, China, Chinese Taipei, Hong Kong SAR, Hungary, Indonesia, Korea, Mexico, Singapore, South Africa and Thailand.

Others have applied this regression to study inflation in the United States, the euro area, Japan, the United Kingdom and Canada for the sample period from 1996 to 2004 in OECD (2005), using a range of different core inflation measures.[5] Across these economies, the study by the OECD (2005) obtained coefficient estimates on the gap between headline and core inflation that were all negative, implying that headline inflation has tended to converge back towards core in these economies. The OECD (2005) study also found that while these coefficient estimates were statistically significantly different from zero for all of the 13 measures of core inflation considered in the case of the United States and Canada, the coefficients were only significantly different from zero for three of the 13 core measures in the case of the euro area. The coefficient estimates were found to be significantly negative for core measures excluding food and energy in the case of the United States, Canada and Japan, but negative and not significantly different from zero for core measures excluding food, alcohol, tobacco and energy in the case of the euro area and the United Kingdom (OECD (2005)).

We can see from Graph 3 that in almost all cases the point estimate of β_i from equation (1) is negative for the sample period starting in 2003 – chosen as the start date of the sample since commodity prices started to rise then (Graph 1). Moreover, in a majority of cases we fail to reject the hypothesis that the estimated coefficient equals –1, which would hold if headline inflation fully reverts to core (Graph 3).

However, there is a complication in finite samples. The constant term α in equation (1) allows for core inflation being a biased predictor of headline inflation over a given sample period, for example in cases where commodity price shocks are predominantly on the upside or downside. Indeed, over the

Frequency distribution of coefficient on wedge between headline and core inflation[1]



[1] Estimates of β from equation (1) using monthly data for 19 economies; see footnote 4 in the text for the list of economies. Test whether β equals –1 at the 5% level, using Newey-West adjusted standard errors.

Sources: OECD; CEIC; Datastream; national data; BIS calculations. Graph 3

[5] This specification has also been applied to US data for example in Clark (2001), and to Canadian data in Laflèche and Armour (2006). Clark (2001) finds that β is negative and significant at the one-year horizon for the sample period 1985–2000, with values ranging between around –1.3 and –0.8 for six different core inflation measures. Laflèche and Armour

period January 2003–August 2008 the constant term α was significantly positive in a majority of countries. Reflecting this, in a majority of economies we reject at the 5% significance level the joint hypothesis that α equals zero and β equals –1, ie the hypothesis that headline inflation fully reverts to core within one year. On the other hand, in a majority of countries we also reject the hypothesis that the coefficient β equals zero, which corresponds to a situation where headline inflation does not revert to core.[6] These results therefore do not allow us to draw definite conclusions on whether headline inflation has been reverting to core.

We also compare the results for the estimated coefficient β in the recent period with those of earlier periods of around five years' duration. While this comparison is only indicative, we can see from Graph 3 that the frequency distribution of the estimated coefficient has tended to shift to more negative values of the coefficient over time.

Has core inflation been reverting to headline?

To continue, we investigate the possibility of core inflation reverting to headline. If core inflation is reverting to headline, this would indicate a worrying development of second-round effects from higher commodity prices causing aggregate inflation expectations to rise, and thereby core inflation to catch up with headline inflation, which monetary policymakers would need to resist. We can investigate this issue by considering the regression:

$$\pi_{i,t}^{core} - \pi_{i,t-12}^{core} = \alpha_i + \delta_i(\pi_{i,t-12}^{core} - \pi_{i,t-12}^{headline}) + \varepsilon_{i,t} \qquad (2)$$

for the same 19 economies as those considered in equation (1). A value for the estimated coefficient on the difference between core and headline inflation, δ_i, of zero indicates that core inflation is not reverting to headline. We can see from Graph 4 that in the majority of cases we fail to reject the hypothesis that δ equals zero, ie that core inflation is not reverting to headline. Similarly, in the majority of cases we fail to reject the joint hypothesis that both the constant α and the coefficient δ equal zero. By contrast, in a majority of countries we do reject at the 5% significance level the joint hypothesis that α equals zero and δ equals –1, ie the hypothesis that core inflation fully reverts to headline.

Core inflation has not tended to revert to headline in the majority of countries

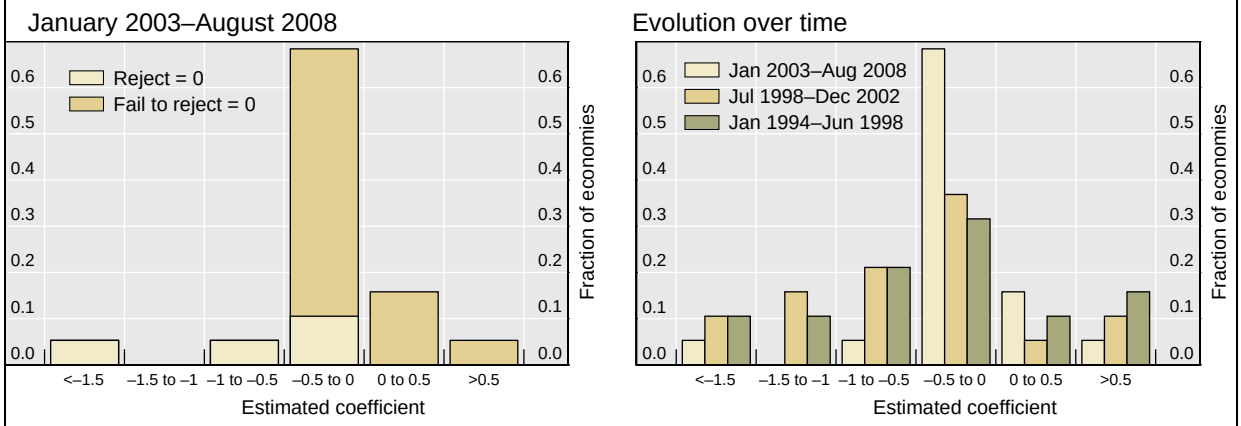
Moreover, over time the frequency distribution of the coefficient on the wedge between core and headline inflation, δ_i, has become more peaked at the interval from –0.5 to 0, while the frequencies in the tails of the distribution have decreased (Graph 4).

This evidence suggests that, generally, core inflation does not revert to headline inflation, and that, if anything, the incidence of core reverting to headline is now lower than a decade ago.

(2006) find that headline inflation has tended to revert to core, but they find little reversion of core inflation to headline.

[6] We also reject the joint hypothesis that both α and β equal zero in a majority of countries.

Frequency distribution of coefficient on wedge between core and headline inflation[1]



[1] Estimates of δ from equation (2) using monthly data for 19 economies; see footnote 4 in the text for the list of economies. Test whether δ equals zero at the 5% level, using Newey-West adjusted standard errors.

Sources: OECD; CEIC; Datastream; national data; BIS calculations. Graph 4

(b) Do food and energy prices help forecast inflation?

Do food and energy prices help forecast inflation?

Since monetary policy can affect inflation only with a lag, policymakers are interested in identifying timely signals of future inflation developments in order to produce the best inflation forecasts used to inform policy decisions. Here we investigate whether CPI food and energy prices have helped to forecast headline inflation by considering the following forecasting regression:

$$\pi_{i,t}^{headline} = \alpha_i + \sum_{k=1,12} \beta_{ik} \pi_{i,t-k}^{headline} + \sum_{k=1,12} \gamma_{ik} \pi_{i,t-k}^{food} + \varepsilon_{i,t} \qquad (3)$$

This regression answers the following question: does past food price inflation in country *i*, $\pi_{i,t-k}^{food}$, help to predict headline inflation, once we have taken account of the autocorrelation in headline inflation itself? This is the case if the sum of the coefficients on lagged food price inflation, $\gamma = \sum_{k=1}^{12} \gamma_{ik}$, is significantly different from zero. We run a similar regression for energy prices, by replacing past food price inflation with past energy price inflation, $\pi_{i,t-k}^{energy}$, in equation (3).[7]

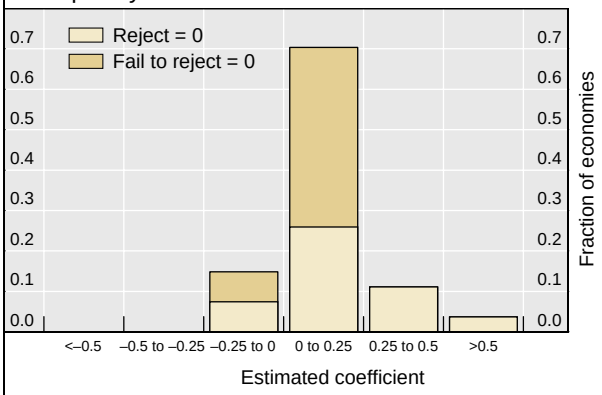
Some evidence to suggest that food prices help forecast inflation

Graph 5 reports the estimates for the sum of the coefficients on past food and energy price inflation for 27 economies. We find some evidence that food price inflation helps predict future headline inflation, but there is little reason to think that energy prices do. This could be related to the fact that food price inflation in the CPI tends to be more persistent than CPI energy price inflation, as discussed in the next section. However, the sample period starting in 2003 when commodity prices started to rise is relatively short, so that the power of the tests might be relatively low for drawing firm conclusions.

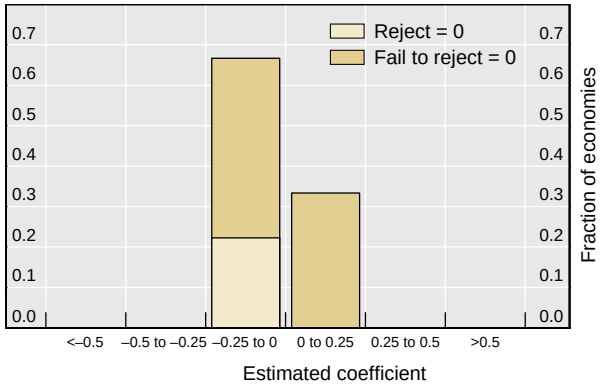
[7] If food or energy constitutes a significant share in the CPI, such as in some emerging economies, there could be some issue of multicollinearity in equation (3).

Forecasting headline inflation[1]

Frequency distribution of sum of coefficients on food



Frequency distribution of sum of coefficients on energy



[1] For food prices, estimates of the sum of coefficients on lagged food price inflation from equation (3) using monthly data on 12-month inflation rates for 27 economies (and similarly for energy by replacing food with energy inflation in the equation); see notes to Graph 1 for the list of economies. Test whether γ is zero at the 5% level. Regressions are monthly with 12 lags over the period from January 2003 to August 2008.

Sources: OECD; CEIC; Datastream; national data; BIS calculations. Graph 5

(c) How persistent are CPI food and energy price inflation?

In deciding how to react to price increases, such as those of food and energy prices, policymakers need to know whether the price increases are temporary or persistent. If it is the former, then commodity price increases are less likely to affect headline inflation over the medium-term horizon relevant for monetary policy, and the price increases can safely be ignored. If, however, food and energy price increases are very persistent, then they are more likely to affect inflation over the horizons relevant to policymakers. It is this second case, in which food and energy price changes affect inflation expectations creating the risk of second-round effects, which is of great concern to policymakers.

We measure the persistence of food price inflation (and similarly of energy price inflation) as the sum, $\rho = \sum_{k=1}^{12} \rho_{ik}$, of the autoregressive AR(12) coefficients on lagged food price inflation in the following regression, estimated over the past five and a half years:

$$\pi_{i,t}^{food,m} = \alpha_i + \sum_{k=1}^{12} \rho_{ik} \pi_{i,t-k}^{food,m} + \varepsilon_{i,t} \qquad (4)$$

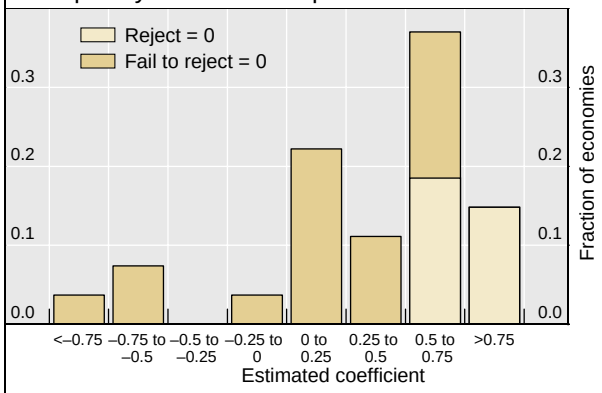
Here, $\pi_{i,t}^{food,m}$ is the monthly change in seasonally adjusted food prices (seasonally adjusted using the X–12 procedure). The sum of autoregressive coefficients, proposed by Andrews and Chen (1994), is a common measure used in the literature on inflation persistence. It is related to the speed with which inflation converges back to its baseline value following a shock.

Food price inflation seems to be more persistent than energy inflation

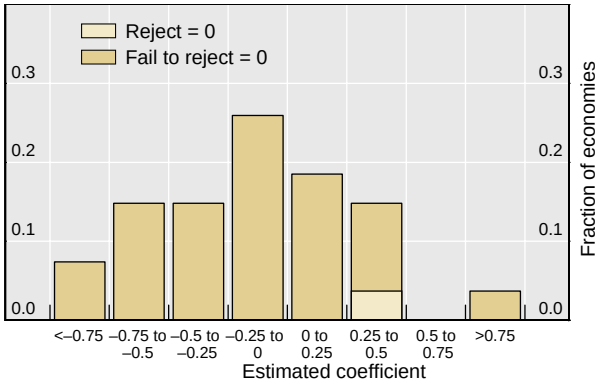
In a majority of countries, we fail to reject the hypothesis that the sum of the coefficients on lagged food price inflation is significantly different from zero (Graph 6). This is also the case for energy price inflation. Food price inflation nevertheless seems to exhibit somewhat greater persistence than energy price inflation. The estimated measure of persistence, ρ, for food price inflation is significantly greater than zero in more countries than is the case for energy

Food and energy inflation persistence[1]

Frequency distribution of persistence for food



Frequency distribution of persistence for energy



[1] Estimates of ρ from equation (4) using monthly data for 27 economies (and similarly for energy by replacing food with energy inflation in the equation); see notes to Graph 1 for the list of economies. Tests whether ρ is zero at the 5% level. Regressions are monthly with 12 lags over the period from January 2003 to August 2008.

Sources: OECD; CEIC; Datastream; national data; BIS calculations. Graph 6

price inflation (Graph 6). Moreover, the mean of the values for this measure of persistence which are significantly different from zero is higher for food prices than for energy. However, given the relatively short sample period, the statistical power of these tests might be relatively low, so we caution against drawing any firm conclusions. Furthermore, this measure of persistence can depend importantly on the length of the sample period as well as on whether shifts in the mean of inflation are allowed for in the estimation.[8] Cecchetti and Debelle (2006) show that, for a range of mature economies, the estimated persistence tends to be lower for shorter sample periods and if mean shifts are allowed for. In another study, Angeloni et al (2006) find time variation in estimated persistence for CPI food and energy price inflation in the euro area and the United States.

The finding in the forecasting regression above suggests that food price inflation seems to have greater additional explanatory power for headline inflation than energy price inflation. This may be related to the fact that food price inflation in the CPI has tended to be somewhat more persistent than energy price inflation.

Conclusions

In this special feature, we have investigated aspects of the impact of the rise in food and energy prices on the level and dynamics of headline inflation. We found that in recent years core inflation has generally not tended to revert to headline inflation in a majority of (but not all) countries considered. This evidence suggests an absence of strong second-round effects of higher commodity prices on inflation in a majority of countries over the period considered.

[8] An overview of the implications of inflation persistence for monetary policy design can be found in Levin and Moessner (2005).

We also report evidence suggesting that in recent years food price inflation has tended to have greater additional explanatory power for future headline inflation than energy price inflation, and seems to have been somewhat more persistent. However, the sample period starting in 2003 when commodity prices started to rise is relatively short, so that the power of the tests might be relatively low for drawing firm conclusions.

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