

# Key Elements of Global Inflation<sup>1</sup>

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## Abstract

Against the background of large fluctuations in world commodity prices and global growth, combined with ongoing structural changes relating to globalisation, this paper examines some of the key factors affecting global inflation. The paper investigates the effects of shocks affecting relative prices and structural changes on global inflation by: estimating a global vector autoregression (GVAR) to examine how oil price shocks feed through to core and headline inflation; calculating the impact of increased imports from low-cost countries on manufacturing import prices; and estimating Phillips curves in order to shed light on whether the inflationary process in OECD countries has changed over time, particularly with respect to the roles of import prices, unit labour costs and the output gap. Overall, the paper finds that there seem to be various significant pressures on global trade prices and labour markets associated with structural factors. These are possibly partly due to globalisation which, in addition to changes in monetary policy, seem to be behind some of the changes in the inflation process over the period examined in this paper.

## 1. Introduction

This paper considers the various factors affecting global inflation, with a focus on shocks affecting relative prices and longer-term structural changes. It is split into two main parts. The first part provides the relevant background to the analysis by looking at longer-term trends as well as current developments in global inflation. We document how OECD inflation has fallen dramatically since the 1970s and consider the possible reasons behind this decline, as well as looking at more recent inflation developments – particularly in the context of the rise in oil and other commodity prices since the turn of the century. Some stylised facts regarding the linkages between global inflation and output gaps and how this might be changing over time are also examined.

The second part of the paper investigates the role of ongoing structural factors and relative price shocks in the global inflationary process. Globalisation has been accompanied in developed economies by a higher share of imports of

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1. The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank. We are greatly indebted to Tadios Tewolde for excellent assistance with the econometric estimation. We also extend our thanks as well to U Baumann, P Hiebert, J Hutchinson, B Landau, A Patarau, R Pereira and D Taglioni for their valuable help, input and comments. We are also grateful to Hans-Joachim Klockers for comments. We are also extremely grateful to the discussants of the paper (Heather Anderson – Monash University and CAMA; David Sondermann – University of Münster), as well as the other participants – particularly Lutz Kilian – at the Münster workshop and RBA/CAMA Conference for their very useful comments.

manufactured goods from low-cost countries, which may put downward pressure on both manufacturing import prices and inflation, while increased global demand (particularly in the non-OECD countries) may have exerted upward pressure on commodity prices, particularly oil prices. At the same time, globalisation seems to be affecting labour markets and unit labour costs in the OECD economies. Even so, monetary policy ultimately determines inflation, and regime changes in monetary policy over past decades may have also changed the inflationary process.

The investigation of the role of these relative price shocks and structural factors for global inflation proceeds in various steps. First, the impact and persistence of changes in oil prices on headline and core inflation is quantified for the euro area and US economies using a GVAR model of the world economy.<sup>2</sup> This provides up-to-date parameter estimates of how changes in oil prices might feed into the inflationary process.

Second, the impact of increased import penetration from low-cost countries on euro area import prices of manufactures is estimated. This impact is decomposed into two components: the first due to changes in the import share (the ‘share effect’) capturing the impact of the relatively lower price level of countries that are low-cost suppliers; and the second due to differences in import price inflation differentials between countries that are low- and high-cost suppliers.

Third, Phillips curves are estimated to shed light on whether the inflationary process in the OECD economies has changed over time, particularly with respect to the roles of import prices, unit labour costs, the output gap and monetary policy.

The overall structure of the paper proceeds as follows. Section 2 provides the relevant background to the analysis referred to above. Section 3 examines and explains the various relative price and structural aspects of global inflation in more detail by: estimating a GVAR model to assess the quantitative impact and persistence of changes in oil and food prices on headline and core inflation for the United States and the euro area; estimating the impact of increased imports from low-cost countries on euro area import prices of manufactures; and estimating Phillips curves for OECD economies to examine the roles of import prices, unit labour costs, output gaps and monetary policy in the inflationary process in the OECD. Section 4 concludes.

## **2. Past and Current Trends in Global Inflation and Activity**

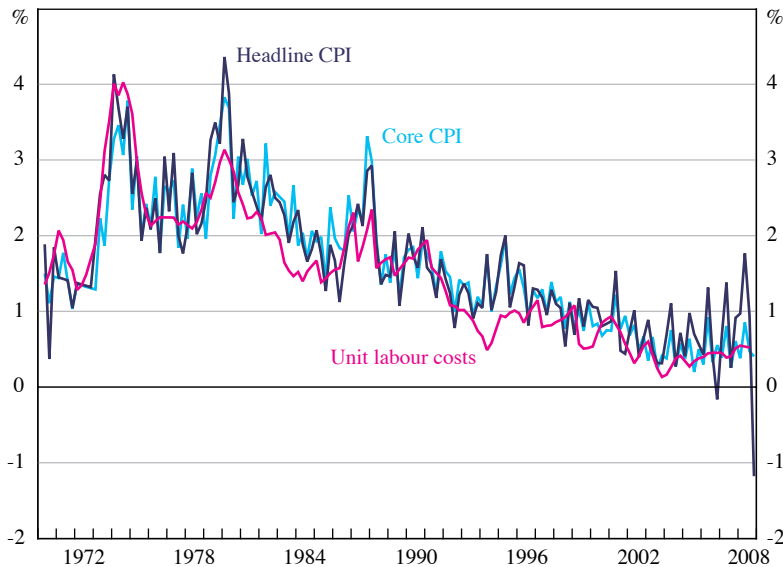
We begin with an overview of past and current trends in OECD inflation. Figure 1 shows quarterly growth since the start of the 1970s of core and headline CPI measures as well as unit labour costs for the OECD as a whole. The series are characterised by longer-term trend declines which tend to flatten out in the 2000s. Some of the major reasons given in the literature for the longer-term declines in inflation and

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2. For a description of the GVAR approach, see Pesaran, Schuermann and Weiner (2004) and Dees *et al* (2007).

unit labour costs include: improvements in the credibility of monetary policy and the associated movement to low and well-anchored inflation expectations; changes in import prices and increased competitive pressures in goods and labour markets due to globalisation; and various reforms aimed at making labour and product markets more flexible.

**Figure 1: Consumer Price Index and Total Unit Labour Costs for the OECD Aggregate**  
Quarterly growth



Sources: OECD; authors' calculations

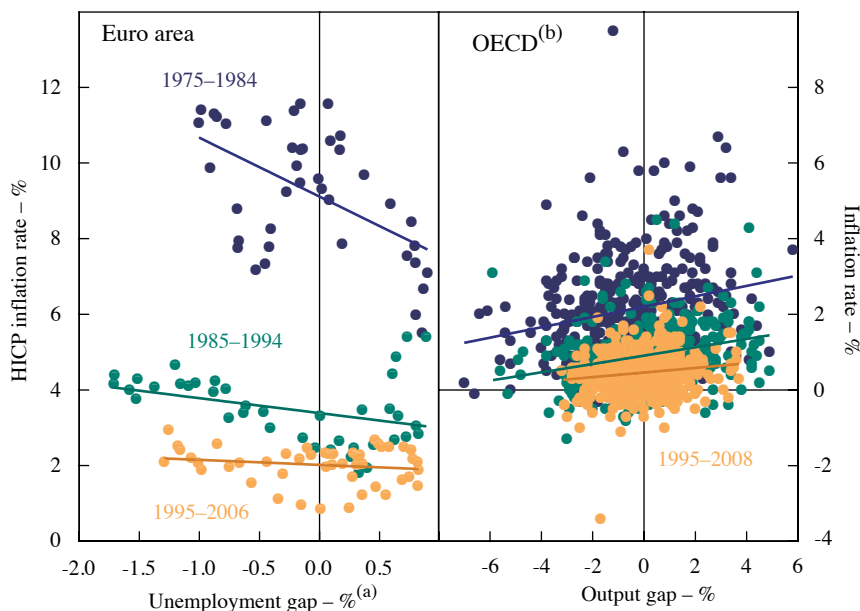
Turning to more recent developments, headline inflation started rising again in the mid 2000s, following continual and persistent increases in food and oil prices, while core inflation and growth in unit labour costs remained fairly stable (partly due to strong growth in global productivity). Of course, the sharp decline in oil prices in the second half of 2008 resulted in a strong fall in headline inflation. Overall, the message is that inflation – particularly core inflation which excludes energy and food – seems to have remained fairly stable in the 2000s despite the strong rise in oil prices over most of the period. This implies that inflationary expectations remain well anchored.

In addition to the impact of commodity prices and unit labour costs, global economic activity and output gaps should also influence world inflation. However, more recent downturns in global GDP may not have such strong downward impacts on global inflation in comparison to previous recessions, as there may have been a flattening of Phillips curves over recent decades. For example, in the euro area, a flattening in the relationship between inflation and the unemployment gap may have occurred over the past few decades, while a similar story holds for some of the

key OECD countries for inflation and the output gap (Figure 2).<sup>3</sup> Nevertheless, it is not clear whether this reflects: a growing influence of global or foreign measures of economic slack on domestic inflation (as implied by Borio and Filardo 2007, for example); greater credibility of monetary policy associated with lower and well-anchored inflation expectations; ‘good luck’ (fewer adverse macroeconomic or other shocks); or structural reforms. In contrast, theoretical arguments imply a steepening of the Phillips curve in response to globalisation, as competitive forces make prices more flexible in response to changing costs or measures of economic slack (see Ball 2006 or Rogoff 2006, for example).

Following on from various other papers including Kamin, Marazzi and Schindler (2004); Pain *et al* (2006); Borio and Filardo (2007); Mody and Ohnsorge (2007); Eickmeier and Moll (2009); and Sekine (2009), the next section of this paper aims to shed light on the above developments and stylised facts.

**Figure 2: Inflation and the Unemployment/Output Gap**



- Notes: (a) Defined as the deviation of unemployment from trend unemployment measured by an HP filter  
 (b) Based on data for nine countries (see Section 3.3 for further details, including definition for the output gap)

Sources: ECB; OECD; authors' calculations

3. This possible flattening of Phillips curves is discussed in further detail in IMF (2006, Chapter 3), Pain, Koske and Sollie (2006), Bean (2007) and Anderton and Hiebert (2009).

### 3. Structural Aspects of Global Inflation

There seem to be a number of relative price shocks at the global level which appear to be related to globalisation. In the case of import prices (for OECD economies), there are two opposing effects: on the one hand, strong growth in the non-OECD economies in recent years seems to explain at least part of the significant rise in the prices of oil and non-energy commodities since 1999 (up to the first half of 2008); on the other hand, rising imports from low-cost countries are putting downward pressure on manufacturing import prices. Turning to the labour market, recent decades have seen wage moderation which may also be related to globalisation. In particular, the massive increase in the global supply of labour associated with China, India and the former Soviet bloc joining the global economy, and the associated 'offshoring' or threat of offshoring (the practice of outsourcing business activities to foreign providers), may have reduced the bargaining power of workers in more developed economies. There may also have been downward pressure on unit labour costs via an increase in productivity related to greater competition, offshoring and the rise in globalisation.

In this section we investigate the role of these relative price shocks and structural changes in various steps. First, we quantify the impact and persistence of changes in oil prices on headline and core inflation for the euro area and US economies using a GVAR model. This provides up-to-date parameter estimates of how recent changes in oil prices might feed into the inflationary process. Second, we estimate the impact of increased import penetration from low-cost countries on euro area import prices of manufactures. This impact is decomposed into two components: that which is due to changes in the import share (the 'share effect') capturing the impact of the lower price level of low-cost import suppliers; and that due to import price inflation differentials between low- and high-cost country suppliers. Third, Phillips curves are estimated to shed light on whether the inflationary process in the OECD countries has changed over time, particularly with respect to the roles of import prices, unit labour costs, the output gap and monetary policy.

#### 3.1 Impacts of oil price shocks using a GVAR

In this section, a GVAR is constructed to examine the impacts of oil price increases on output and inflation, showing separate results for headline and core inflation. This will provide a greater understanding of the contribution to inflation of rising oil prices over most of the 2000s, particularly as the GVAR will be estimated over the period January 1999 to December 2007 and, therefore, provide results for the impact of oil price increases over the most recent period. In summary, our results for the euro area and the United States show that the effects of oil prices on inflation seem to be weaker than in the past and do not tend to feed into core inflation. This seems to be partly the result of counter-inflationary monetary policy, which has kept inflation expectations well anchored. One caveat is that the simulations implicitly assume both linear and symmetric responses to the oil price regardless of the magnitude and sign of oil price shocks, which may not be the case.

### 3.1.1 The GVAR model<sup>4</sup>

A GVAR model is estimated based on the specification of Pesaran *et al* (2004) which was further developed by Dees *et al* (2007). The GVAR consists of a number of economies, each modelled individually as a VARX\* (that is, a VAR model augmented by weakly exogenous variables), with each country model comprising domestic and foreign variables. For example, consider a VARX\*( $p_i, q_i$ ) for a generic country  $i$ :

$$\Phi_i(L, p_i)x_{it} = \alpha_{i0} + \alpha_{i1}t + \Lambda_i(L, q_i)x_{it}^* + \Psi_i(L, q_i)d_t + u_{it}, \quad \text{for } t = 1, \dots, T, \quad (1)$$

where  $x_{it}$ ,  $x_{it}^*$  and  $d_t$  are the sets of country-specific (domestic), foreign-specific and global variables, respectively.

The country-specific variables,  $x_{it}$ , are: monthly core inflation  $\pi_{it}^c$  based on the CPI excluding energy and food price components, expressed as an annualised rate; the monthly headline inflation  $\pi_{it}^h$  expressed as an annualised rate; the industrial production index ( $y_{it}$ ) deflated by the producer price index; the nominal short-term interest rate ( $i_{it}$ ); and the nominal effective exchange rate ( $e_{it}$ ). The foreign variables for country  $i$ ,  $x_{it}^*$ , are computed as weighted averages of the corresponding variables of the other countries, using cross-country bilateral trade flows as weights.<sup>5</sup> The global variables,  $d_t$ , are oil  $P_t^o$  and food  $P_t^f$  prices denominated in US dollars.

Each country model is estimated by assuming weak exogeneity for both domestic and foreign variables (this assumption allows the individual estimation of each country model, thereby avoiding the estimation of the whole GVAR, which would be too onerous).

The GVAR model covers 33 economies, including both developed and developing economies.<sup>6</sup> The data are monthly.

After estimating each of the country models, the results are connected through link matrices and then stacked together to build the GVAR model. We then investigate the dynamic properties of our GVAR by means of the generalised impulse response functions (GIRFs), proposed in Koop, Pesaran and Potter (1996) and further developed in Pesaran and Shin (1998).<sup>7</sup>

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4. The specification of the GVAR model, as well as the reported empirical results, are provided in Galesi and Lombardi (2009).
  5. The weights are fixed over time, and computed in the usual way for GVAR models as averages of exports and imports for the period 1999–2007. However, given the key role of imports in transmitting inflationary pressures, the GVAR model using import-based weights was also estimated. As there was no significant change in the results, we only report the results using the weights based on the averages of exports and imports.
  6. These are either individual countries, such as the United States or the United Kingdom, or regional aggregates. The euro area is modelled as a single entity based on the GDP-weighted average of the following countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Slovenia and Spain.
  7. In the GVAR framework, the GIRFs are more appealing than the traditional Sims' (1980) orthogonalised impulse response functions, since they are invariant to the ordering of the variables and the countries. Given that there is no clear economic *a priori* knowledge to establish a reasonable ordering of the countries, it is preferable to employ the GIRFs. Moreover, even if the GIRFs assess the effects of observable-specific rather than identified shocks, the typical (and atheoretical) GVAR analysis is based on the investigation of the geographical transmission of country-specific or global shocks, thus this limitation is not material.

### 3.1.2 GVAR generalised impulse response functions of an oil price shock

A positive one standard error shock to the nominal oil prices is simulated and the impulse response functions are presented in Figure 3.<sup>8</sup> The simulations are provided for the euro area and the United States (results for other parts of the world are documented in Galesi and Lombardi 2009). (Galesi and Lombardi also present simulations of responses to food price shocks.) The key issues to be addressed are: whether there is significant pass-through of oil price shocks to core inflation; and are the inflationary effects persistent? We examine the extent to which oil price shocks result in second-round effects by comparing the responses of headline and core inflation.

Each impulse response shows the dynamic response of each domestic variable to standard error unit shocks to oil prices over two years. Confidence intervals are presented at the 90 per cent significance level, although it is anticipated that for a number of reasons some of the responses may not be statistically significant, including the use of volatile monthly data.<sup>9</sup> The positive standard error unit shock to nominal oil prices corresponds to an increase of about 6 per cent in the oil price index in one month. The impact on other key commodities – such as food prices – is not significant.<sup>10</sup>

The impulse responses for headline inflation indicate the direct inflationary effects due to oil price increases. US headline inflation rises on impact by 1.1 per cent, then returns to baseline after three months. The observed effect on euro area inflation is roughly half of the magnitude of the effects for the United States; euro area headline inflation increases by about 0.6 per cent on impact, then declines and returns to the baseline after approximately two months. The differences in results between the euro area and the United States are consistent with Anderton and di Mauro (2007), who show that the oil intensity of production in the euro area is about 75 per cent of that of the United States (when the oil intensity of production is proxied by oil demand divided by GDP in real terms).<sup>11</sup>

The impact of the oil price shock on *core inflation* is not statistically significant for the United States, implying that oil price shocks did not result in second-round effects from January 1999 to December 2007 (consistent with the findings

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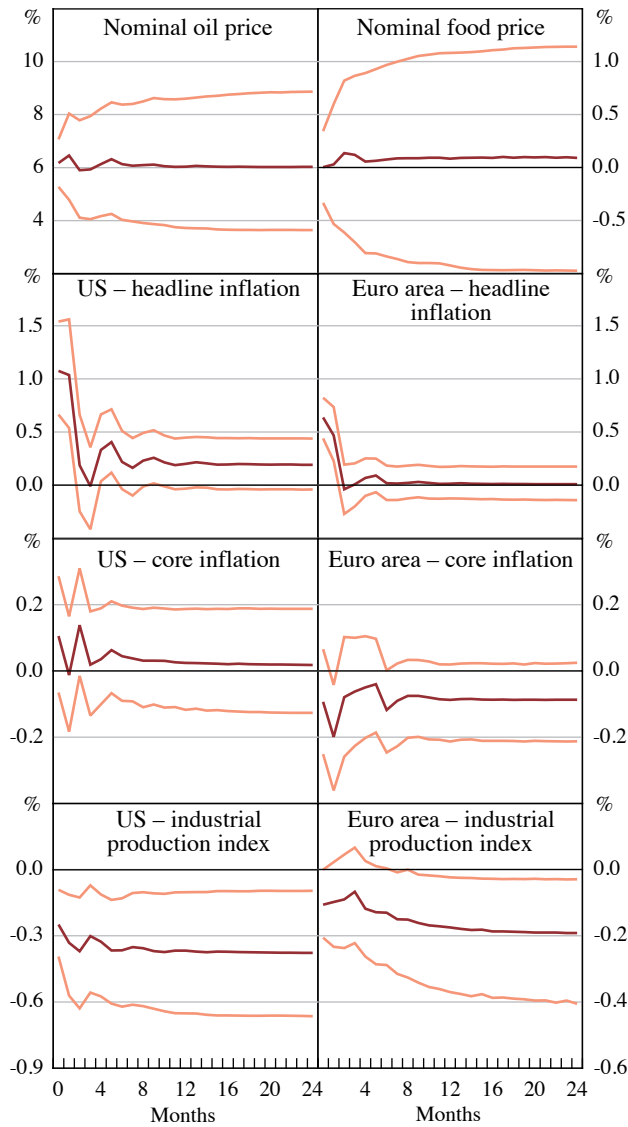
8. Setting the shock equal to one standard error is common practice in the empirical literature. Given that the GVAR is a linear model, resizing the shock is straightforward.

9. The estimation of the GVAR model using monthly data necessarily implies the presence of high volatility in our estimates. The country-specific parameter estimates are derived from unrestricted estimations: in the context of a short-run analysis such as in this section, we prefer not to impose economic-based restrictions in the cointegrating space of each country's vector error correction (VECMX\*) model, which are likely to be rejected by the appropriate tests.

10. We had expected to observe a significant positive dynamic correlation between oil and food prices. This counterintuitive finding could be due to the fact that the global variables in the GVAR model are endogenous, so that the effect on food prices of an oil price shock is dampened by the response of other variables in the system.

11. In addition, higher energy taxes in the euro area compared to the United States may also partly explain these differences, since they dampen the effect of oil price hikes in the euro area.

**Figure 3: Generalised Impulse Responses of a Positive Unit (Standard Error) Shock to Oil Prices**  
Percentage change



Source: Galesi and Lombardi (2009)



of Hooker 2002). Similarly, no second-round effects are found for the euro area. These results are in line with the policies of the United States and the euro area's monetary authorities to limit the nominal consequences of oil shocks, in line with maintaining low and well-anchored inflation expectations.<sup>12</sup>

Turning to the real side, US industrial production falls on impact by 0.25 per cent in response to the rise in oil prices, declining by almost 0.4 per cent below baseline after two years. Smaller effects are observed for the euro area, where the oil price increase is associated with an initial decline of industrial output of 0.1 per cent, and further falls to 0.2 per cent below the baseline after two years. Again, the impact on industrial production in the euro area may be smaller than in the United States due to the lower oil intensity of production in the euro area.

Overall, the impact of an oil price shock on inflation and output seem to be in line with the results of Blanchard and Galí (2007), who find that oil price shocks now have smaller effects compared to the past on prices and wages as well as output and employment, primarily due to: a decrease in real wage rigidities; an increase in the credibility of monetary policy resulting in smaller impacts of oil price shocks on expected inflation; and the decrease in the share of oil in consumption and production.

The GVAR model is also used to simulate a positive standard error unit shock to nominal food prices (not shown), but overall the results for the United States and euro area are much the same. The effects are mainly limited to headline while core inflation is unresponsive. However, the detailed results do show a small positive impact on US core inflation from the rise in food prices.

In summary, our results for the euro area and the United States show that oil price impacts temporarily affect headline inflation but that the impacts may be weaker than in the past and do not tend to feed into core inflation.<sup>13</sup> The latter may be partly the result of monetary policy which has kept inflation expectations low and well anchored. However, the simulations implicitly assume both linear and asymmetric responses to increases and decreases in oil prices, which may not be the case.<sup>14</sup> Nevertheless, these results are consistent with the regression analysis of Cecchetti and Moessner (2008) regarding the impact of the rise in food and energy prices on inflation. They find that in recent years core inflation has not tended to follow headline inflation in response to oil and food price shocks, implying that commodity

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12. Other evidence supporting the assertion that inflation expectations are well anchored is provided by ECB (2009), which reports that various measures of longer-term inflation expectations for both the United States and euro area fluctuate in a fairly narrow band consistent with monetary policy objectives and price stability.

13. Other models for the euro area and the United States may find impacts on core inflation from oil price shocks – see, for example, the results for the euro area by Landau and Skudelny (2009). Hence, the reported GVAR should be interpreted with caution and as indicating qualitative results – that is, the impact on core inflation is small, but not necessarily nonexistent.

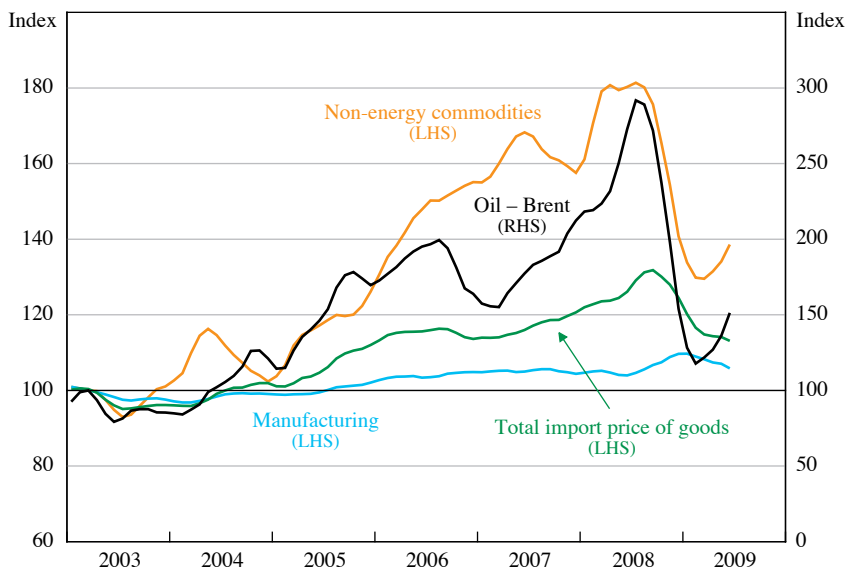
14. In addition, the GVAR results capture statistical/econometric relationships based on the data, and should be contrasted with the results obtained from more structural models such as Kilian (this volume) and Baumeister, Peersman and Van Robays (this volume).

prices do not now generally lead to second-round effects on inflation. These findings are also consistent with the work of Furlong and Ingenito (1996), who show that, as for oil prices, commodity prices also fail to predict core inflation.

### 3.2 Euro area evidence on import prices, labour markets and inflationary pressures

There are various structural factors that may be associated with downward pressure on inflation. Globalisation has been accompanied in the euro area by a higher share of imports of manufactured goods from low-cost countries, which may be the main reason why import prices for manufactures have been stagnant in recent years (Figure 4).

**Figure 4: Extra-euro Area Import Prices by Commodity**  
Three-month moving average, 2003:Q1 = 100, seasonally adjusted

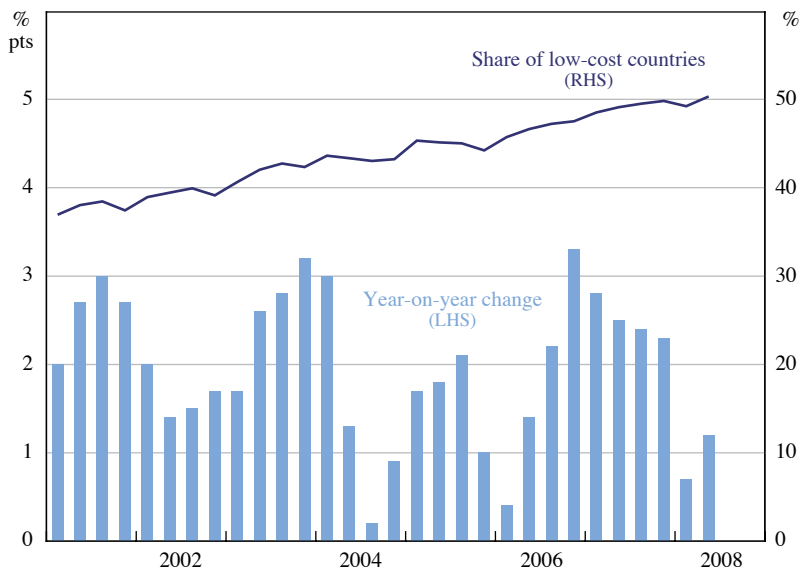


Sources: Eurostat; authors' calculations

Overall, it is estimated that the increase in euro area import penetration from low-cost countries, whose share increased from over one-third to more than a half since the start of the 2000s (Figure 5), may have dampened euro area import prices of manufactures by about 2 percentage points each year between 1996–2007. This is mostly due to the ‘share effect’ of China and the new EU member countries – that is, the downward impact on import prices of the rising import share of low-cost countries combined with the relatively lower price level of low-cost import suppliers. Meanwhile, the ‘price effect’ – which captures the impact of export price inflation differentials between low- and high-cost countries – makes a much smaller contribution to these downward pressures (Table 1). The methodology used

to decompose manufacturing imports into the share and price effect is described in detail in Appendix A. It is similar to that of Kamin *et al* (2004) who calculate the impact of the higher import share of China on US import price inflation. They find an average direct impact of China on US import inflation of around 1 percentage point per annum.

**Figure 5: Share of Extra-euro Area Manufacturing Imports from Low-cost Countries**



Sources: Eurostat; authors' calculations

**Table 1: Decomposition of Euro Area Manufacturing Import Prices**  
Per cent per annum

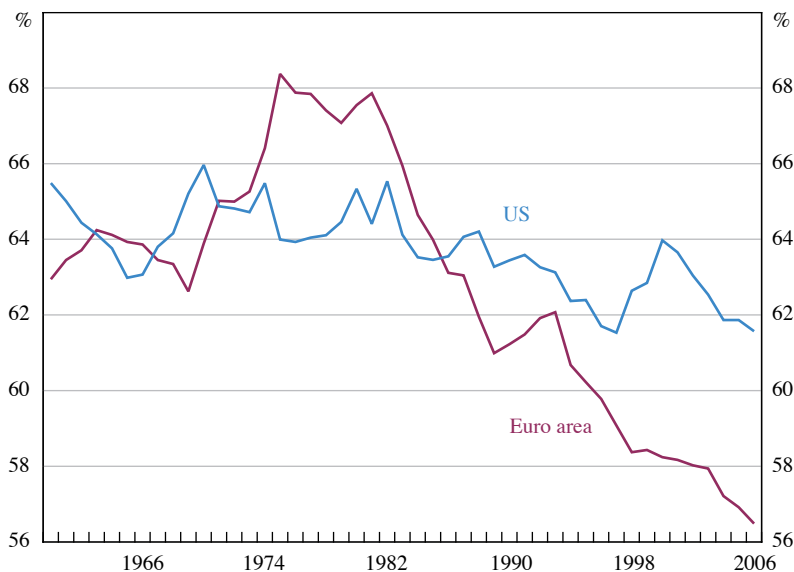
	1996–2007
<b>Manufacturing import price inflation</b>	<b>0.09</b>
High-cost countries effect	2.08
Low-cost countries effect	-1.99
China	-0.75
Share effect	-0.81
Price effect	0.06
New EU Member States	-0.26
Share effect	-0.66
Price effect	0.40
Rest of low-cost countries	-0.99
Share effect	-0.10
Price effect	-0.89

Source: Taglioni and Vergote (2009)

The low level of inflation of imported manufactured goods is one side of the *relative price effect* of globalisation. The other side is the higher prices of commodity imports, which at least in part reflects global demand pressures from those emerging economies that export manufactured goods (Figure 4 highlights the strong rise in import prices of commodities, at least up to mid 2008). However, such changes in relative prices need not have any enduring effect on aggregate inflation.

Apart from these direct relative price effects, globalisation may also put downward pressure on prices via increased competition in the labour and goods markets (see Anderton, Brenton and Whalley (2006) for a comprehensive analysis of how globalisation has affected labour markets). Turning to recent wage developments in the euro area, globalisation may have been one contributing factor to an extended period of wage moderation (for instance, offshoring or the threat of offshoring may reduce the wage demands of workers). Euro area real wage growth has been weaker than that of productivity, both in aggregate and within the manufacturing and services sectors (see Anderton and Hiebert (2009) for an extensive analysis of this issue). At the same time, there has been a long-term decline in the wage share of gross national income in the euro area, which since the mid 1980s has been even more severe than the fall in the United States, bringing this measure in both regions to historical lows (Figure 6). While this might be taken to indicate that the bargaining power of workers may have declined in the context of globalisation, extreme

**Figure 6: Long-term Developments in Labour Shares**  
Per cent of gross national income



Notes: Self-employment-adjusted labour shares – total domestic economy. The labour share is defined as the ratio of total compensation of employees to gross national income at current market prices.

Sources: Anderton and Hiebert (2009); EUROPA, 'AMECO' database; authors' calculations

caution should be made in drawing such conclusions given several caveats related to measurement issues<sup>15</sup> and the fact that much of this decline took place well before the recent phase of globalisation.<sup>16</sup> As for the impact of globalisation on prices, Pula and Skudelny (forthcoming), using calculations based on several methodologies, find a direct dampening effect of import openness on euro area producer price inflation of 0.1–1.0 percentage points per annum for the manufacturing sector over the period 1996 to 2004. These authors report a dampening impact on euro area consumer price inflation of 0.05–0.2 percentage points per annum based on aggregate data over the same period. Pain *et al* (2006) find a combined effect on consumer price inflation from lower non-commodity import price inflation and higher commodity import price inflation of up to 0.3 percentage points per annum over the period 2000 to 2005. Using similar methodologies, Glatzer, Gnan and Valderrama (2006) and Helbling, Jaumotte and Sommer (2006) report findings of a similar magnitude for other countries and regional groupings.

### 3.3 Phillips curves for the OECD economies

In this section, the roles of unit labour costs, import prices, the output gap and monetary policy in the inflation process for the OECD economies are examined in more detail. We are particularly interested to see if the impact of the output gap on inflation has changed over time as suggested in Section 2, whether the relative roles of import prices and unit labour costs have changed, and to evaluate how the inflation process might have changed due to changes in monetary policy.

Phillips curves are estimated based on quarterly data over the period 1970:Q1 to 2008:Q3, where we proxy the OECD by using data from nine individual OECD countries – Australia, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States. The specification is based on the following traditional backward-looking Phillips curve, along the lines of previous work (such as Pain *et al* 2006 and Eickmeier and Moll 2009):<sup>17</sup>

$$\Delta p_{i,t} = c + \sum_{j=1}^4 \alpha_j \Delta p_{i,t-j} + \beta ygap_{i,t} + \sum_{j=0}^4 \gamma_j \Delta ulc_{i,t-j} + \sum_{j=0}^4 \phi_j \Delta mp_{i,t-j} + seas + \varepsilon_t \quad (2)$$

where:  $\Delta p_{i,t}$  is the quarterly change in the log of the CPI for country  $i$ , with the explanatory variables comprising the log of past inflation; the output gap ( $ygap_{i,t}$ ); log differences of quarterly total economy unit labour costs ( $\Delta ulc_{i,t}$ ) and import prices of

15. Several measurement problems limit the reliability of the wage share, including the growing importance of non-wage remuneration (particularly for the increasing number of self-employed), which implies that this measure cannot be interpreted reliably as the share of income accruing to capital or labour.

16. See Anderton and Hiebert (2009) for more details of globalisation's possible impacts on the euro area labour market.

17. Although forward-looking New-Keynesian Phillips Curve models have many advantages, it seems that backward-looking models may be more stable in some respects (Stock and Watson 2007), hence we prefer to estimate a backward-looking Phillips curve.

goods and services ( $\Delta mp_{i,t}$ ); a constant ( $c$ ); and quarterly seasonal dummies ( $seas$ ).<sup>18</sup> As in previous papers, the output gap only enters the model contemporaneously without any lagged terms. *A priori*, positive signs are expected for the sum of the parameters corresponding to each of the explanatory variables.

This eclectic framework is a reduced-form model similar to specifications estimated in various other empirical papers.<sup>19</sup> The lagged inflation terms can be interpreted as representing the (backward-looking) inflation expectations of economic agents, but they also capture the dynamics of price adjustment and the degree of persistence of the inflation process. These, in turn, are related to wage and price rigidities, institutional factors and monetary policy. Excess aggregate demand is captured by the output gap, while other factors are captured by changes in import prices and unit labour costs, which could also be interpreted as supply-side influences.

Panel estimates of Equation (2) are obtained by pooling the data across nine major OECD countries, thereby providing an approximation of the parameters for the OECD as a whole. In effect, the same slope parameters are imposed across the different countries, but fixed effects allow each country to have a different intercept. The estimators could be biased as the lagged dependent variable is correlated with the fixed effects.<sup>20</sup> Consequently, the Arellano and Bond (1991) estimator based on the generalised method of moments (GMM) is frequently used in these circumstances. However, it is still correct to estimate the equation by least squares dummy variables (LSDV), which will still provide reasonable results in the present case as the time dimension is relatively large compared to the number of variables.<sup>21</sup>

Another econometric issue is whether the same slope parameters should be imposed across the different countries. A simple  $F$ -test shows that the restriction of equal slope parameters for each country is rejected.<sup>22</sup> However, we note that Baltagi and Griffin (1983) argue that the empirical test of equal slope parameters in panel estimation is frequently rejected despite the fact that there may be a strong economic rationale for imposing common slope parameters.

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18. All data including the output gaps, unless otherwise stated, are obtained from the OECD 'Economic Outlook' database.

19. See, for example, Lown and Rich (1997), Batini, Jackson and Nickell (2005), Borio and Filardo (2007), Mody and Ohnsorge (2007) and Sekine (2009).

20. The bias results from the correlation between the lagged dependent variable and the transformed residuals. Nickell (1981) shows that the lagged dependent variable is biased towards zero, but that the bias decreases as the sample period lengthens and disappears when it becomes infinitely long.

21. For example, Judson and Owen (1999) compare the bias of six different estimators of dynamic panel data models: the OLS estimator; the LSDV estimator; a corrected LSDV estimator as proposed by Kiviet (1995); two GMM estimators suggested by Arellano and Bond (1991); and the IV techniques used by Anderson and Hsiao (1982). Their findings are that the LSDV estimator performs just as well, or better than, the majority of the alternatives as  $T$  increases and is larger than  $N$ . In addition, Kiviet (1995) notes that although the LSDV estimator is biased, its standard deviations are very small compared to different IV estimators. Therefore, on the basis of the mean-square-error (MSE) criterion (efficiency versus bias), Kiviet argues that LSDV may be preferable to alternative estimators.

22. The  $F$ -test of equal slope parameters is  $F[126, 1\ 206] = 3.4558$ .

Our estimation strategy is to estimate a basic Phillips curve using different techniques and compare the results in the following way. First, the LSDV estimator is used. These results are then checked for robustness by estimating the same equation by GMM. Given the rejection of the common slope restriction, we also estimate the equation using the mean group (MG) estimator, which is the simple arithmetic average of the individual countries' coefficients. Four lags of each of the variables are included in Equation (2) (with the exception that the output gap is included contemporaneously as discussed above, but with its own lagged values used as instruments to avoid simultaneity problems). The results are shown in Table 2, which reports the sum of the coefficients for each variable for which lags are included, as well as an  $F$ -test and  $p$ -value of a Wald test of the hypothesis that the parameters are equal to zero.

The full sample results show that the signs of the variables are positive as expected, while the key variables are statistically significant across the three estimation techniques.<sup>23</sup> Hence, past inflation, unit labour costs, import prices and the output gap are all significant determinants of inflation. The long-run parameters for  $ulc$ ,  $mp$  and  $ygap$  are respectively:

$$\sum_{j=0}^4 \gamma_j / \left(1 - \sum_{j=1}^4 \alpha_j\right), \sum_{j=0}^4 \varphi_j / \left(1 - \sum_{j=1}^4 \alpha_j\right) \text{ and } \beta / \left(1 - \sum_{j=1}^4 \alpha_j\right). \quad (3)$$

Overall, the results tend to be similar across the three techniques, with the LSDV and GMM results particularly close. The exception with the MG estimator results is that the sum of the lagged inflation parameters tend to be somewhat smaller, and the sum of the unit labour cost parameters are larger, in comparison to the results for the other two estimators. In addition, the output gap term is less significant when using the MG estimator. In terms of the long-run parameters, the LSDV results imply that the *relative weights* of  $ulc$  and  $mp$  are around two-thirds and one-third respectively (that is, long-run parameters of about 0.54 and 0.21 respectively). These parameters are very similar in magnitude to those of Pain *et al* (2006) as well as Eickmeier and Moll (2009).

Our next step is to see if there is any indication of a change in the parameters over time – which may be due to factors such as globalisation – by estimating the equations over different sample periods. Based on rolling-window parameter estimates and other information, two possible points for structural breaks are chosen: 1985 or 1995.<sup>24</sup> The results are reported in Table 3. Given the similarity of the full sample period results across the three different techniques, we only report the results for

23. The  $F$ -tests decisively reject the null hypothesis that the sum of the coefficients are zero for lagged inflation, unit labour costs and import prices.

24. The break in 1985 is consistent with the relationship between euro area inflation and the unemployment gap shown in Figure 2, while the break in 1995 corresponds to the period of increased globalisation when countries such as China and those from previously communist eastern Europe started to become more integrated in the world economy. The 1995 break is also found to be statistically significant by Pain *et al* (2006).

**Table 2: OECD Phillips Curves – LSDV, GMM and MG Estimator Panel Estimation Results**  
1971:Q2–2008:Q3

Variable	LSDV			GMM			MG		
	Coefficient	F-stat	t-stat	Coefficient	F-stat	t-stat	Coefficient	F-stat	t-stat
$\Delta P_{t-1, \dots, t-4}$	0.61	250.78 [0.000]		0.649	145.08 [0.000]		0.47		8.31 [0.000]
$\Delta ulc_{t, \dots, t-4}$	0.209	44.40 [0.000]		0.16	14.74 [0.000]		0.299		4.72 [0.000]
$\Delta mp_{t, \dots, t-4}$	0.079	62.75 [0.000]		0.079	45.40 [0.000]		0.1		6.77 [0.000]
$ygap_t$	0.000359		3.41 [0.000]	0.000373		3.31 [0.000]	0.000308		1.82 [0.000]
$c$	0.0014		3.54 [0.000]	0.0013		2.95 [0.003]	0.0011		4.13 [0.000]
Adjusted R <sup>2</sup>		0.762			0.759				0.6
Standard error of regression		0.0058			0.0058				0.004

Notes: LSDV = least squares dummy variables estimated by instrumental variables (*ygap* instrumented by own lagged values); GMM = Arellano and Bond generalised method of moments; MG = mean group estimator; F-tests relate to exclusion tests of the parameters (*p*-values in square brackets); unbalanced panel based on nine OECD countries; country-specific fixed effects and seasonal dummies included

Sources: OECD; authors' calculations



Table 3: OECD Phillips Curves – LSDV Panel Estimation Results over Different Sample Periods

Variable	Full sample				1971:Q2–1984:Q4				1985:Q1–2008:Q3				1971:Q2–1994:Q4				1995:Q1–2008:Q3				
	Coeff	F-stat	t-stat		Coeff	F-stat	t-stat		Coeff	F-stat	t-stat		Coeff	F-stat	t-stat		Coeff	F-stat	t-stat		
$\Delta P_{t-1, \dots, t-4}$	0.61	250.78	[0.000]		0.499	53.188	[0.000]		0.613	143.66	[0.000]		0.56	125.39	[0.000]		0.439	20.86	[0.000]		
$\Delta \text{itlc}_{t-1, \dots, t-4}$	0.209	44.39	[0.000]		0.217	16.37	[0.000]		0.199	17.58	[0.000]		0.223	32.29	[0.039]		0.1	1.87	[0.1712]		
Long-run	0.537				0.434				0.516				0.51				0.178				
$\Delta mp_{t-1, \dots, t-4}$	0.079	62.76	[0.000]		0.078	16.87	[0.000]		0.088	56.51	[0.000]		0.083	42.04	[0.000]		0.101	25.86	[0.000]		
Long-run	0.204				0.156				0.226				0.187				0.179				
$ygap_t$	0.000359			3.41	0.000624			2.81	0.000245			2.07	0.000378			2.79	0.000342			1.96	
Long-run	0.000921			[0.000]	0.001248			[0.005]	0.00063			[0.039]	0.000857			[0.005]	0.000609			[0.619]	
$c$	0.00139			3.54	0.0046			3.92	0.0006			1.64	0.0027			4.29	0.0009			1.65	
				[0.000]				[0.001]				[0.101]				[0.000]				[0.098]	
Adjusted R <sup>2</sup>		0.757				0.658				0.605				0.725				0.511			
Standard error of regression		0.0058				0.0078				0.004				0.0067				0.0036			

Notes: Panel estimates based on least squares dummy variables (LSDV) estimated by instrumental variables ( $ygap$  instrumented by own lagged values);  $F$ -tests relate to exclusion tests of the parameters ( $p$ -values in square brackets); unbalanced panel based on nine OECD countries; country-specific fixed effects and seasonal dummies included

Sources: OECD; authors' calculations

the LSDV estimator; we discuss the results of the other techniques only when they differ from the LSDV estimator.

A key result of this analysis is that the long-run output gap parameter is currently about half the size of that estimated for the earlier period when the sample is broken at 1985, and about two-thirds the magnitude of the earlier period when the sample is broken at 1995. This is even stronger for the MG estimator, which implies that the output gap parameter is not statistically significant in the most recent period.<sup>25</sup> The finding of a weaker impact of the output gap on inflation in the most recent period is in line with the anecdotal evidence as well as some hypotheses related to globalisation as discussed in Section 2.

Two other results stand out. First, there is a decline in the persistence of inflation (that is, the estimated sum of lagged dependent variable parameters declines from 0.56 for the pre-1995 sample to 0.44 for the post-1995 sample). This corresponds with other studies that find that the degree of inflation persistence has declined over time and may be related to changes in the credibility of monetary policy.<sup>26</sup> Second, there is an increase in the long-run parameter for import prices relative to unit labour costs.<sup>27</sup> This is consistent with the increase in the degree of import penetration over time – as measured by imports as a percentage of GDP – and therefore an increasing role for import prices in the determination of inflation.<sup>28</sup>

### 3.4 Global components of inflation

A related aspect of the relationships discussed above is that the importance of global factors for inflation seems to have increased relative to domestic factors (see Neely and Rapach 2008; Eickmeier and Moll 2009). Although further analysis on this issue is beyond the scope of this paper, it is worth summarising the contrasting evidence on this issue.<sup>29</sup> On the one hand, Borio and Filardo (2007) find a significant role for measures of global economic slack in Phillips curves of advanced economies (albeit with mixed results for the euro area), while studies such as Paloviita (2008) and Rumler (2007) find euro area inflation dynamics are better captured by an open economy specification. In a similar vein, Ciccarelli and Mojon (2005) find that for

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25. The *t*-statistics for the output gap (*ygap*) parameter using the MG estimator for the periods 1985:Q1–2008:Q3 and 1995:Q1–2008:Q3 are 0.801 and 0.256 respectively.

26. See, for example, Alogoskoufis (1992) and Anderton (1997). These results are also consistent with the GVAR simulation results in Section 3.1, which show that oil price shocks do not feed through to core inflation, possibly due to well-anchored inflation expectations following improvements in the credibility of monetary policy.

27. The size of the import price parameter increases relative to the unit labour costs parameter for both break points.

28. However, the increase in magnitude of the import price parameter may also be due to an increase in international competition – particularly due to rising imports from low-cost countries – which can put downward pressure on inflation.

29. Globalisation may have weakened the link of domestic liquidity on domestic prices or, alternatively, implied a higher role for foreign liquidity in domestic prices; Ruffer and Stracca (2006) find evidence of a significant spillover of global liquidity to the euro area economy.

several OECD countries, the global inflation rate moves largely in response to global real variables over short horizons and global monetary variables at longer horizons. In looking at inflation dynamics of highly disaggregated consumer price data, Monacelli and Sala (2007) find that a sizeable fraction of the variance of inflation is explained by macroeconomic factors attributable to ‘international’ factors for both Germany and France, but that such factors are more relevant in the goods/manufacturing sector than in the services sector. For the United Kingdom, Batini *et al* (2005) find external competitive pressures also seem to affect UK inflation via their impact on the equilibrium mark-up of domestic firms.

On the other hand, many other studies have failed to identify a significant role for measures of global economic slack in Phillips curves of advanced economies. Specifically for the euro area, Calza (2008) finds limited evidence in support of the ‘global output gap hypothesis’. Indeed, Musso, Stracca and van Dijk (2007) find that a flattening of the slope of the euro area Phillips curve occurred mainly in the 1980s, before the current globalisation phase. Ball (2006), Ihrig *et al* (2007), Woodford (2007) and Wynne and Kersting (2007) argue that measures of global economic slack have a negligible effect on inflation dynamics, while Pain *et al* (2006) link the heightened sensitivity of domestic inflation in OECD economies to foreign economic conditions to an import price channel alone. On the basis of a New-Keynesian Phillips Curve model, Sbordone (2008) finds it difficult to argue that an increase in trade could have generated a large enough increase in market competition in the United States to reduce the slope of the inflation-marginal cost relationship.

#### 4. Conclusions

Against the background of large fluctuations in world commodity prices and world growth, combined with ongoing structural changes relating to globalisation, this paper assesses some of the key determinants of global inflation. The paper considers various relative price and structural impacts on global inflation by examining three sources of evidence: a GVAR that examines how oil price shocks feed through to core and headline inflation; estimates of the impact of increased imports from low-cost countries on manufacturing import prices; and estimates of Phillips curves to shed light on whether the inflationary process in the OECD countries had changed over time, particularly with respect to the role of import prices, unit labour costs and output gaps.

The GVAR simulations – focusing on behaviour since around the turn of the century – suggest that oil price shocks have non-significant (or very limited) impacts on core inflation in the euro area and the United States. This may reflect a reduction in second-round effects due to well-anchored inflation expectations. Looking at import prices suggests that globalisation had a dampening effect on OECD inflation until the mid 2000s. This was associated with low prices of imports of manufactured goods through increased global supply of goods and labour from low-cost countries. More recently, this effect may have been offset by strong increases in the prices of commodities such as oil (at least until the first half of 2008) resulting from heightened

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global demand pressures. At the same time, international competitive pressures have also contributed to reducing inflationary pressures in the OECD economies via wage moderation and lower growth of unit labour costs. Finally, over a somewhat longer sample period, estimated Phillips curves provide tentative evidence that the impact of the output gap on the inflation of OECD economies may be becoming weaker over time, possibly due to the effects of globalisation and/or changes in monetary policy. By contrast, import prices have grown in importance in the inflation process – in line with their increasing weight in the CPI – while the persistence of inflation has declined, perhaps due to changes in monetary policy that have contributed to low and well-anchored inflation expectations.

## Appendix A: Estimating the Impact of Low-cost Countries on the Euro Area's Manufacturing Import Price

To decompose the changes in the euro area manufacturing import unit value (which is a proxy for the import price) into the effects arising from a change in the geographical distribution of imports between low- and high-cost countries (and among them, China, new EU Member States and the remaining low-cost countries, hereafter referred to as CN, NMS and ROLC, respectively) two factors have to be considered separately. A *share effect* (what would have been observed if only the geographical import shares had changed), and a *price effect* (what would have been observed if only the import price from low-cost countries had changed relative to that of the high-cost countries).

### The methodology used to decompose import price inflation

The euro area absolute import unit value is a weighted average of the import unit values from various countries of provenance. Hence, the percentage change in the euro area import unit value from period  $t-n$  to period  $t$  can be deduced from Equation (A1), which takes into consideration the fact that the sum of the weights adds to 1, and sets the group of high-cost countries as the reference point:

$$\frac{\Delta p_t}{p_{t-n}} = \sum_j \left[ \frac{p_{j,t} - p_{HC,t}}{p_{t-n}} \Delta \alpha_{j,t} \right] + \sum_j \alpha_{j,t-n} \left[ \frac{\Delta p_{j,t}}{p_{j,t-n}} \frac{p_{j,t-n}}{p_{t-n}} - \frac{\Delta p_{HC,t}}{p_{HC,t-n}} \frac{p_{HC,t-n}}{p_{t-n}} \right] + \frac{\Delta p_{HC,t}}{p_{HC,t-n}} \frac{p_{HC,t-n}}{p_{t-n}} \quad (A1)$$

where:  $j = \{CN, NMS, ROLC\}$ ;  $HC$  are the high-cost countries;  $p$  is the import price; and  $\Delta p$  is the change in the price.

In Equation (A1), for each low-cost country  $j$ , the first and second terms capture the direct effect of imports from that country on the change in the euro area import price:

- The first term is the share effect – that is, the effect of a change in the import share from a particular country given its price differential against the reference (high-cost) group of countries. If the country's import price is lower than that of the reference country, then an increase in its import share will change the composition of imports towards cheaper goods and will therefore have a negative effect on the overall import price. The size of the share effect depends on both the magnitude of the change in the share, and the import price differential of country  $j$  against the reference country.
- The second term in the equation represents the price effect. It captures the change in the euro area import price due to different export price inflation rates of country  $j$  and the reference country. If the export price of country  $j$  increases by more (decreases by less) than that of the reference country, then given the geographical composition of imports, country  $j$  will have a positive (negative) impact on the

overall euro area import price. The impact increases with the import share of country  $j$ .

- Finally, the third term in the decomposition represents the residual effect due to price developments in the high-cost countries.

This methodology is subject to four main caveats:

- First, the aggregate euro area import unit value series computed is slightly different from the unit value series officially published by Eurostat. The differences arise mainly due to methodological differences in the aggregation. In contrast to the computed unit value series, the Eurostat series is based on the Fischer index.
- Second, the results of the magnitude of the share and price effects depend on the grouping of the countries, and therefore on the reference country. This paper focuses on the effect of imports from the low-cost countries – CN, NMS and ROLC – so the reference country in this case is the aggregate of high-cost countries. However, it should be noted that if the aim were to analyse the effects of imports from just one country *vis-à-vis* all other import partners, the results would be different. For example, if the focus were purely on Chinese imports, the share effect of China against the rest of the import partners would be lower than that against just the high-cost countries. The price effect would also be affected, although *a priori* it is not possible to know in which direction.
- Third, when setting the high-cost countries as the reference, it is implicitly assumed that the low-cost countries (countries with linearly independent weights in the aggregation) are competing against the high-cost countries, but not among themselves. So by construction, an increase in country  $j$ 's import share is thus always a substitution for imports from the high-cost countries, but not for imports from any other low-cost country or country group.
- Fourth, import shares in value terms are used for the aggregation of the import unit value, thus in addition to structural developments this also captures valuation effects. The alternative would be to use import share in volume terms. However, the Eurostat Comext database reports volumes measured in weight units (multiples of kilograms) that are difficult to interpret at an aggregate level.

## References

- Alogoskoufis GS (1992), 'Monetary Accommodation, Exchange Rate Regimes and Inflation Persistence', *Economic Journal*, 102 (412), pp 461–480.
- Anderson TW and C Hsiao (1982), 'Formulation and Estimation of Dynamic Models Using Panel Data', *Journal of Econometrics*, 18(1), pp 47–82.
- Anderton R (1997), 'Did the Underlying Behaviour of Inflation Change in the 1980s? A Study of 17 Countries', *Weltwirtschaftliches Archiv*, 133(1), pp 22–38.
- Anderton R, P Brenton and J Whalley (eds) (2006), *Globalisation and the Labour Market: Trade, Technology and Less-Skilled Workers in Europe and the United States*, Routledge, London.
- Anderton R and F di Mauro (2007), 'The External Dimension of the Euro Area: Stylised Facts and Initial Findings', in F di Mauro and R Anderton (eds), *The External Dimension of the Euro Area: Assessing the Linkages*, Cambridge University Press, London, pp 8–51.
- Anderton R and P Hiebert (2009), 'The Impact of Globalisation on the Euro Area Macroeconomy', University of Nottingham Globalisation and Economic Policy Research Paper No 09/14.
- Arellano M and SR Bond (1991), 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations', *Review of Economic Studies*, 58(2), pp 277–297.
- Ball LM (2006), 'Has Globalization Changed Inflation?', NBER Working Paper No 12687.
- Baltagi BH and JM Griffin (1983), 'Gasoline Demand in the OECD: An Application of Pooling and Testing Procedures', *European Economic Review*, 22(2), pp 117–137.
- Batini N, B Jackson and S Nickell (2005), 'An Open-Economy New Keynesian Phillips Curve for the UK', *Journal of Monetary Economics*, 52(6), pp 1061–1071.
- Bean C (2007), 'Globalisation and Inflation', Bank of England *Quarterly Bulletin*, 46(4), pp 468–475.
- Blanchard OJ and J Galí (2007), 'The Macroeconomic Effects of Oil Price Shocks: Why Are the 2000s so Different from the 1970s?', NBER Working Paper No 13368.
- Borio C and A Filardo (2007), 'Globalisation and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation', BIS Working Paper No 227.
- Calza A (2008), 'Globalisation, Domestic Inflation and Global Output Gaps: Evidence from the Euro Area', ECB Working Paper No 890.
- Cecchetti SG and R Moessner (2008), 'Commodity Prices and Inflation Dynamics', *BIS Quarterly Review*, December, pp 55–66.
- Ciccarelli M and B Mojon (2005), 'Global inflation', ECB Working Paper No 537.
- Dees S, F di Mauro, MH Pesaran and LV Smith (2007), 'Exploring the International Linkages of the Euro Area: A Global VAR Analysis', *Journal of Applied Econometrics*, 22(1), pp 1–38.
- ECB (European Central Bank) (2009), 'Expectations and the Conduct of Monetary Policy', *Monthly Bulletin*, May, pp 75–90.

- Eickmeier S and K Moll (2009), 'The Global Dimension of Inflation – Evidence from Factor-Augmented Phillips Curves', ECB Working Paper No 1011.
- Furlong F and R Ingenito (1996), 'Commodity Prices and Inflation', Federal Reserve Bank of San Francisco *Economic Review*, 2, pp 27–47.
- Galesi A and M Lombardi (2009), 'External Shocks and International Inflation Linkages: A Global VAR Analysis', ECB Working Paper No 1062.
- Glatzer E, E Gnan and MT Valderrama (2006), 'Globalization, Import Prices and Producer Prices in Austria', Oesterreichische Nationalbank *Monetary Policy & the Economy*, Q3/06, pp 24–43.
- Helbling T, F Jaumotte and M Sommer (2006), 'How Has Globalization Affected Inflation?', *World Economic Outlook – Globalization and Inflation*, World Economic and Financial Surveys, IMF, Washington DC, pp 97–134.
- Hooker MA (2002), 'Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regime', *Journal of Money, Credit and Banking*, 34(2), pp 540–561.
- Ihrig J, SB Kamin, D Lindner and J Marquez (2007), 'Some Simple Tests of the Globalization and Inflation Hypothesis', Board of Governors of the Federal Reserve System International Finance Discussion Paper No 891.
- IMF (International Monetary Fund) (2006), *World Economic Outlook – Globalization and Inflation*, World Economic and Financial Surveys, IMF, Washington DC.
- Jaumotte F and I Tytell (2007), 'The Globalization of Labor', in *World Economic Outlook – Spillovers and Cycles in the Global Economy*, World Economic and Financial Surveys, IMF, Washington DC, pp 161–192.
- Judson RA and AL Owen (1999), 'Estimating Dynamic Panel Data Models: A Guide for Macroeconomists', *Economics Letters*, 65(1), pp 9–15.
- Kamin SB, M Marazzi and JW Schindler (2004), 'Is China "Exporting Deflation"?', Board of Governors of the Federal Reserve System International Finance Discussion Paper No 791.
- Kiviet JF (1995), 'On Bias, Inconsistency, and Efficiency of Various Estimators in Dynamic Panel Data Models', *Journal of Econometrics*, 68(1), pp 53–78.
- Koop G, MH Pesaran and SM Potter (1996), 'Impulse Response Analysis in Nonlinear Multivariate Models', *Journal of Econometrics*, 74(1), pp 119–147.
- Landau B and F Skudelny (2009), 'Pass-Through of External Shocks along the Pricing Chain: A Panel Estimation Approach for the Euro Area', ECB Working Paper No 1104.
- Lown CS and RW Rich (1997), 'Is There an Inflation Puzzle?', *Economic Policy Review*, 3(4), pp 51–77.
- Mody A and F Ohnsorge (2007), 'Can Domestic Policies Influence Inflation?', IMF Working Paper No 07/257.
- Monacelli T and L Sala (2007), 'The International Dimension of Inflation: Evidence from Disaggregated Consumer Price Data', paper prepared for the *Journal of Money, Credit and Banking* (JMCB)-Federal Reserve Board Conference on 'Domestic Prices in an Integrated World Economy', Washington DC, 27–28 September.
- Musso A, L Stracca and D van Dijk (2007), 'Instability and Nonlinearity in the Euro Area Phillips Curve', ECB Working Paper No 811.



- Neely CJ and DE Rapach (2008), 'Is Inflation an International Phenomenon?', Federal Reserve Bank of St. Louis Working Paper No 2008-025C.
- Nickell SJ (1981), 'Biases in Dynamic Models with Fixed Effects', *Econometrica*, 49(6), pp 1417–1426.
- Pain N, I Koske and M Sollie (2006), 'Globalisation and Inflation in the OECD Economies', OECD Economics Department Working Paper No 524.
- Paloviita M (2008), 'Estimating Open Economy Phillips Curves for the Euro Area with Directly Measured Expectations', Bank of Finland Research Discussion Paper No 16/2008.
- Pesaran MH, T Schuermann and SM Weiner (2004), 'Modeling Regional Interdependencies Using a Global Error-Correcting Macroeconometric Model', *Journal of Business & Economic Statistics*, 22(2), pp 129–162.
- Pesaran MH and Y Shin (1998), 'Generalized Impulse Response Analysis in Linear Multivariate Models', *Economics Letters*, 58(1), pp 17–29.
- Pula G and F Skudelny (forthcoming), 'Globalisation and Euro Area Prices and Labour Markets – Some Evidence on the Impact of Low-Cost Countries', in R Anderton and G Kenny (eds) (forthcoming), *Globalisation and Macroeconomic Performance*, Cambridge University Press, Cambridge.
- Rogoff KS (2006), 'Impact of Globalization on Monetary Policy', in *The new Economic Geography: Effects and Policy Implications*, a Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, pp 265–305.
- Rüffer R and L Stracca (2006), 'What Is Global Excess Liquidity, and Does It Matter?', ECB Working Paper No 696.
- Rumler F (2007), 'Estimates of the Open Economy New Keynesian Phillips Curve for Euro Area Countries', *Open Economies Review*, 18(4), pp 427–451.
- Sbordone AM (2008), 'Globalization and Inflation Dynamics: The Impact of Increased Competition', Federal Reserve Bank of New York Staff Report No 324.
- Sekine T (2009), 'Another Look at Global Disinflation', BIS Working Paper No 283.
- Sims CA (1980), 'Macroeconomics and Reality', *Econometrica*, 48(1), pp 1–48.
- Stock JH and MW Watson (2007), 'Why Has U.S. Inflation Become Harder to Forecast?', *Journal of Money, Credit and Banking*, 39(s1), pp 3–33.
- Taglioni D and O Vergote (2009), 'Impacts of Low-Cost Countries on Extra-Euro Area Import Prices', internal mimeo, ECB.
- Woodford M (2007), 'Globalization and Monetary Control', paper prepared for the NBER Conference on 'International Dimensions of Monetary Policy', Girona, 11–13 June.
- Wynne MA and EK Kersting (2007), 'Openness and Inflation', Federal Reserve Bank of Dallas Staff Papers No 2.