

PRELIMINARY VERSION, NOT TO BE QUOTED.

"Key drivers of global inflation"¹

by

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Paper to be presented at workshop at University of Munster June 16-17:

*“Challenges to Inflation in an Era of Relative Price Shocks” (co-organised by
University of Munster and Reserve Bank of Australia)*

Abstract

Against the background of large fluctuations in world commodity prices and global growth, combined with ongoing structural changes related to globalization exerting various pressures on global trade prices and unit labour costs, this paper assesses the key drivers of global inflation also in the light of proposed and ongoing policy responses. The paper considers the various factors putting upward and downward pressures on global inflation, distinguishing between conjunctural and structural factors as well as risks. One key result of the analysis is that Consensus forecasts as well as expectations of financial markets suggest that longer-term inflationary expectations seem to be well anchored in most major economies across the globe despite the extreme current volatility of the world economy.

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 R. Dreiskena, A. Galesi, P. Hiebert, J. Hutchinson, M. Lombardo, A. Patarau, R. Pereira, D. Taglioni, M. Trott for their valuable help, inputs and comments. We are also grateful to Hans-Joachim Klockers for comments. Filippo di Mauro is Head of the External Developments Division, European Central Bank. Robert Anderton is Adviser in the External Developments Division, European Central Bank, and Professor, School of Economics, University of Nottingham, UK.

1. Introduction

Against the background of large fluctuations in world commodity prices and world growth, combined with ongoing structural aspects of globalization exerting various pressures on global trade prices and unit labour costs, this paper assesses the key drivers of global inflation, also in the light of proposed and actual policy responses. The paper considers the various factors putting upward and downward pressures on global inflation, distinguishing between conjunctural and structural factors as well as risks. In particular, this paper examines:

- Recent developments as well as the outlook for global activity and inflation based on Consensus forecasts as well as financial market measures of inflation expectations and the outlook for oil prices;
- The risk of deflation in the US based on various techniques using traditional macroeconomic models and Bayesian VAR models;
- The quantitative impact and persistence of changes in oil and food prices on headline and core inflation for the euro area and US economies using a GVAR model of the world economy;
- The role of ongoing structural factors and relative price shocks in the global inflationary process. For example, globalisation has been accompanied in the euro area and other economies by a higher share of imports of manufactured goods from low-cost countries which has put downward pressure on both manufacturing import prices and inflation, while putting increased global demand particularly in the non-OECD countries has exerted upward pressures on commodity prices, particularly oil prices. At the same time, globalisation seems to have put downward pressure on real unit labour costs in the OECD economies.
- Finally, the paper investigates how recent proposed policy responses, most notably fiscal stimulus packages may affect global growth and inflation.

As regards *deflation*, this can be defined as a decline in the level of prices, having three main characteristics:

- i. it is generalised, i.e. it affects all prices.
- ii. it is persistent, i.e. it lasts for some time, usually over several years;²
- iii. is expected by economic agents, in the sense that they expect further price reductions and hence postpone consumption, etc.³

The severity of the global economic downturn is contributing to an increasingly strong reversal of the inflationary pressures evident earlier in 2008. This, coupled with the strong declines in commodity prices in the second half of 2008 (although oil prices have recently rebounded strongly), has even raised the possibility of deflation. However, not every decline in the level of prices constitutes a deflation. Prices might also fall if, following an exogenous shock, the equilibrium price level is lowered; such an adjustment is referred to as *disinflation*, which can entail a temporary negative inflation in order for the price level to achieve its new equilibrium level. By contrast, full-fledged deflation triggered by a collapse of aggregate demand amid the global downturn would obviously be a serious cause for concern. Frequently, such a global recessionary scenario is also associated with a dis-functioning of financial markets – reflected in a contraction of money and credit supply – which deepens and prolongs the downturn. Such a scenario would also pose serious challenges for monetary policy given the zero-bound of nominal interest rates and the disruption of the monetary transmission process.

However, the sharp fall in oil and non-energy commodity prices during the second half of 2008 is also associated with welfare gains (in oil-importing countries) and should stimulate economic growth rather than a recession. In addition, monetary policy has reacted strongly and significant reductions in interest rates combined with substantial fiscal stimulus across the globe will provide support for growth and may lead to inflationary pressures.

This paper takes a global perspective and assesses the various factors putting upward and downward pressures on global inflation. In Section 2, we look at the linkages

² Some commentators have recently defined deflation as a fall in prices for four consecutive quarters as such a period of falling prices could lead to expectations of further reductions in prices in the future.

³ On this, cf. the speech “Careful with (the ‘d’) words!”, by L. Bini Smaghi, 25 November 2008.

between global downturns and inflation and review the activity and inflation outlook according to Consensus forecasts and financial market measures of inflation expectations, followed by an assessment of the risks of deflation in the US in Section 3. Section 4 analyses structural aspects of global inflation, including the outlook for oil prices as well as using a GVAR model to assess the quantitative impact and persistence of changes in oil and food prices on headline and core inflation for various countries and regional economies. The role of structural price impacts stemming from the globalisation process are also examined, such as the higher share of euro area imports of manufactured goods from low-cost countries which, in turn, has put downward pressure on both manufacturing import prices and inflation. Finally, in Section 5 the paper investigates how recent proposed policy responses, most notably fiscal stimulus packages, may affect the global growth and inflation outlook as well as discussing the case of Japan's past deflationary episode and the lessons learned in terms of policy responses. Section 6 concludes.

2.1 Past and current trends in global inflation

Charts 1-3 show quarterly growth for core and headline inflation as well as unit labour costs since the start of the 1970s for the individual OECD countries and the OECD aggregate (thick line). The series are broadly characterised by trend declines which flatten out in the 2000s. While headline inflation (Chart 2) starts rising again in the mid-2000s, following continual and persistent increases in food and oil prices, core inflation (Chart 1) seems to remain fairly stable and growth in total economy unit labour costs (Chart 3) actually declines to a lower level (partly due to strong growth in global activity and productivity). Indeed, Eickmeier and Moll (2008) and Sekine (2009) find that unit labour costs played an important role in holding down inflation in many OECD countries since the 1980s. Of course, at the end of the sample period, the sharp decline in oil prices in the second half of 2008 results in a sharp fall in headline inflation. However, overall, the message seems to be 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 seems to imply that global (OECD) inflationary expectations remain well anchored.

Chart 1: CPI for all items, excluding food and energy, in selected OECD Countries and OECD aggregate. (q-on-q growth, %)

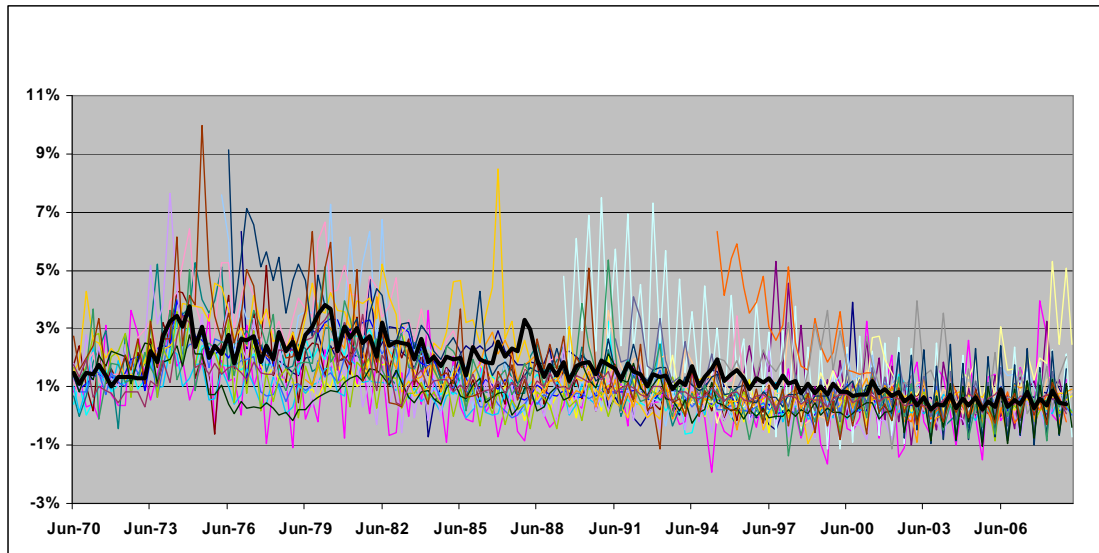
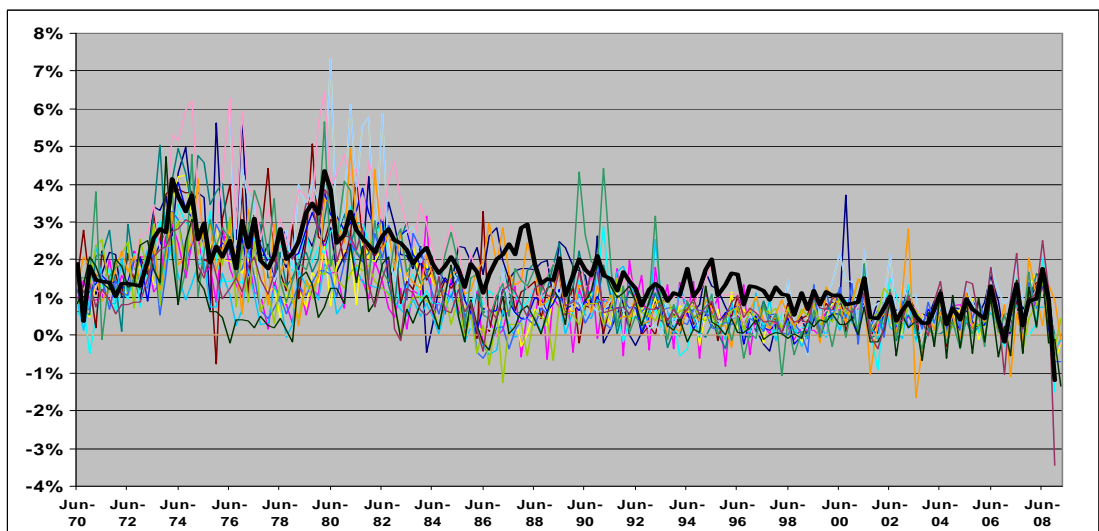


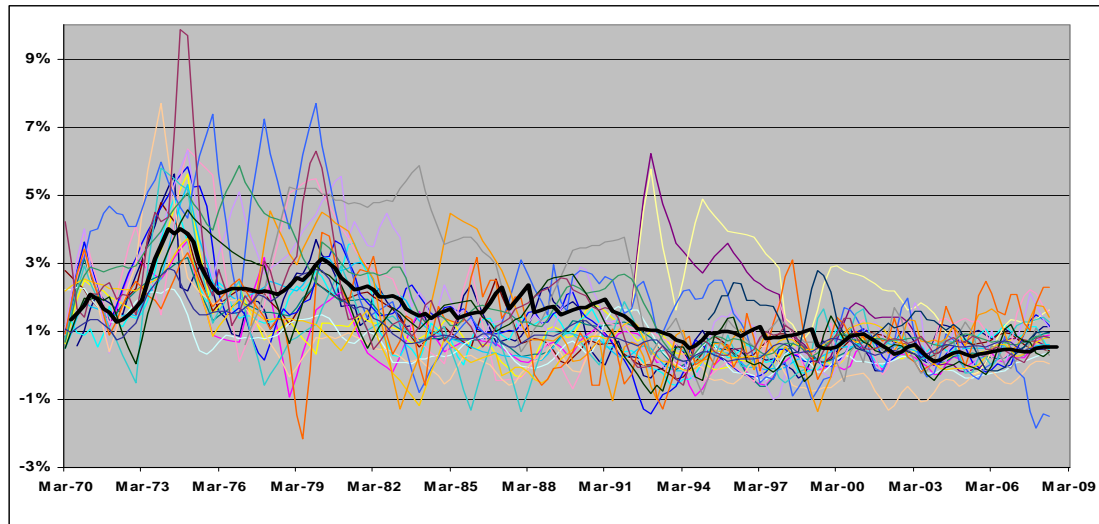
Chart 2: CPI for all items in selected OECD Countries and OECD aggregate.

(q-on-q growth, %)



Source: OECD

Chart 3: Unit labour costs (total economy) in selected OECD Countries and OECD aggregate. (q-on-q growth, %)

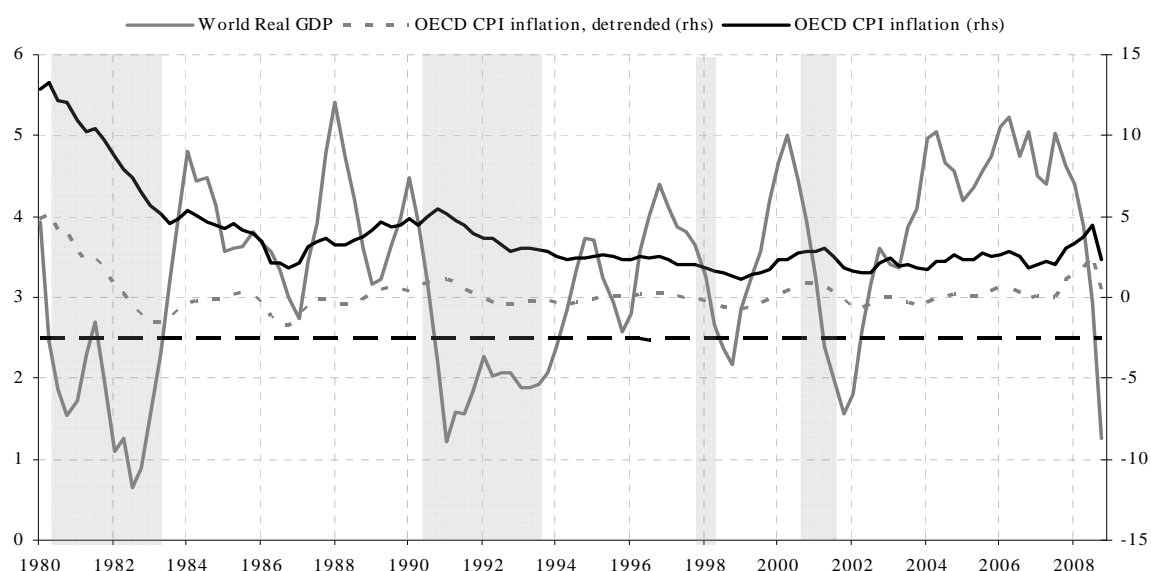


Source: OECD

2.2 Global downturns and world inflation

In addition to the impacts of falling commodity prices, the recent global downturn in activity will also put downward pressure on inflation. Taking a longer term perspective, episodes of global downturns have been traditionally associated with a substantial deceleration in consumer prices. Defining global downturns as episodes when the annual change in world real GDP falls below 2.5%, five episodes can be identified since 1980: early 1980s, early 1990s, 1998, 2001-2003 and the current downturn. During each of these episodes, global consumer price inflation also declined (Chart 4).

Chart 4: World growth and inflation
(YoY % change; quarterly data)



Source: GVAR database, IMF.

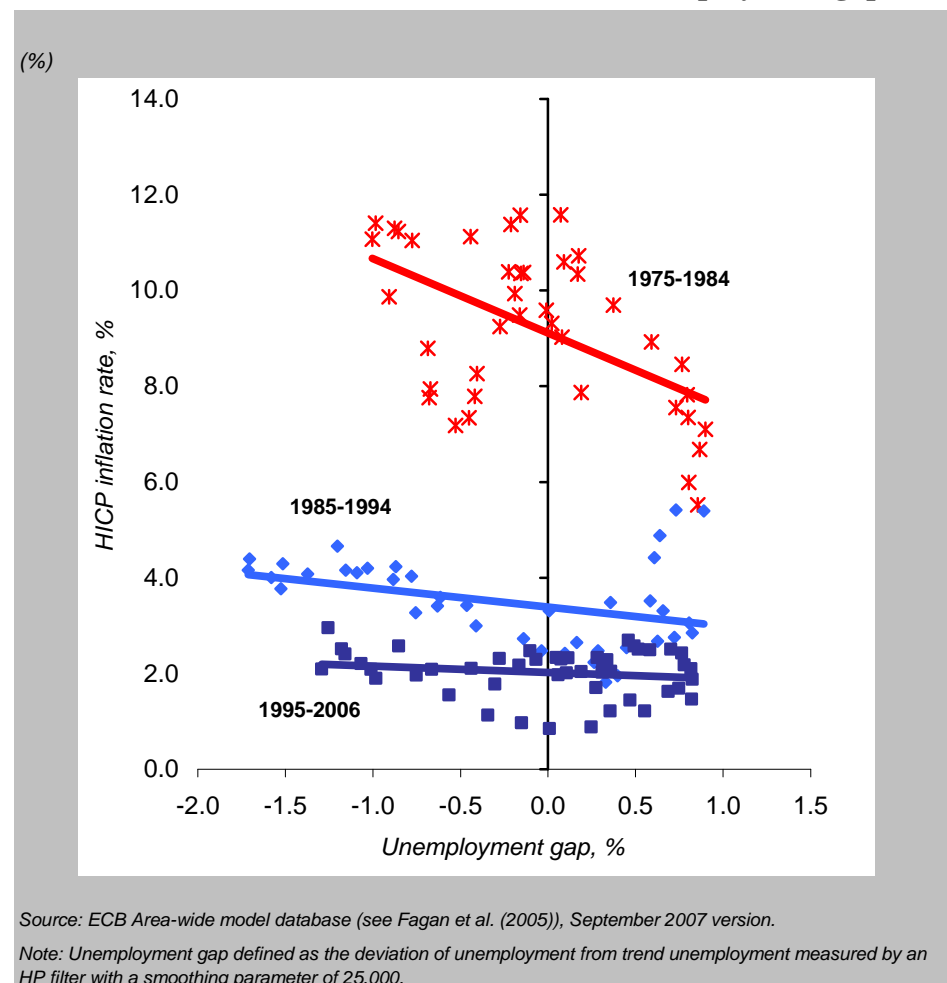
Note: Last observation refers to 2008 Q4. Projections up to 2009 Q4.

However, a downturn in Global GDP may not have such strong downward impacts on global inflation in comparison to previous recessions as there seems to be an observed flattening of Phillips Curves over the last decades. In the euro area, a flattening in the inflation-unemployment gap of the Phillips Curve has been evident over the last decades (see Chart 5).⁴ Nevertheless, it is not clear whether this reflects a growing influence of global or foreign measures of economic slack in domestic inflation (eg,

⁴ This flattening is consistent with developments in other advanced economies – see, for instance, Bean (2007) for a discussion of the UK inflation-unemployment relationship. Also see, for example, Pain et al (2006) and Chapter 3 of IMF (2006).

Borio and Filardo, 2007), or whether it is due to the more efficient conduct of monetary policy, “good luck” (fewer negative macroeconomic or other shocks), or structural reforms. This contrasts with theoretical arguments in favour of 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, for instance, Rogoff, 2006 or Ball, 2006).

Chart 5: Euro area HICP inflation and the “unemployment gap”

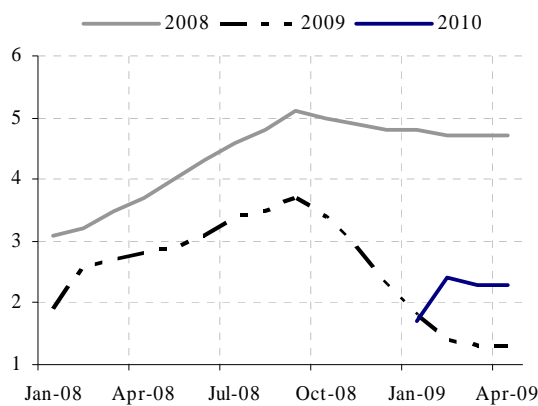


2.3 The consensus outlook

Consensus forecasts for global inflation and real GDP provide a good starting point for understanding how expectations have changed and evolved during the current global downturn (Charts 6 and 7). Consensus forecasts for global GDP growth for

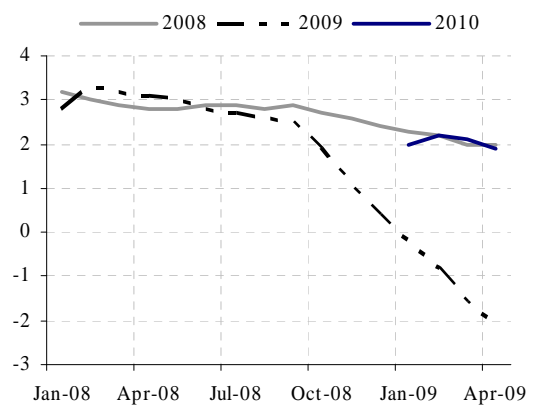
2009 were revised downwards as 2008 progressed, whereas downward changes to the Consensus inflation forecast did not appear until the October 2008 release. Since then global inflation expectations have been heavily revised downwards for 2009 to just above 1%, while global output is expected to sharply decline by about 2% in 2009. Turning to the outlook for next year, global inflation is expected to rise again in 2010 by about a percentage point to just above 2%, and global GDP growth to recover to positive growth of approximately 2% in 2010.

Chart 6: Global CPI inflation
(YoY % change)



Source: Consensus economics
Note: Last observation refers to May 2009.

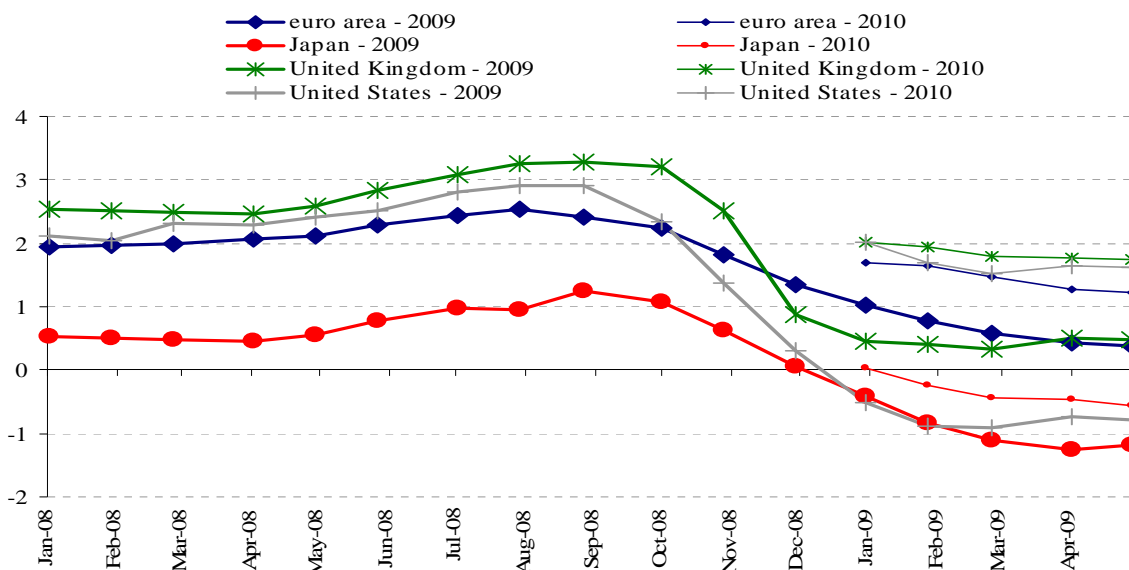
Chart 7: Global real GDP growth
(YoY % change)



Source: Consensus economics
Note: Last observation refers to May 2009.

Meanwhile, the Consensus outlook at the country-level shows that GDP growth is forecast to fall sharply in the four major economies, while annual inflation is expected to turn negative in both the US and Japan during 2009, but euro area inflation is forecast to remain positive for the year as a whole (Charts 8 and 9). During 2010, all four major economies are expected to register a recovery to positive GDP growth, which partly explains the expected return to positive territory for US inflation, while Japanese inflation is forecast to remain negative despite the expected boost to activity.

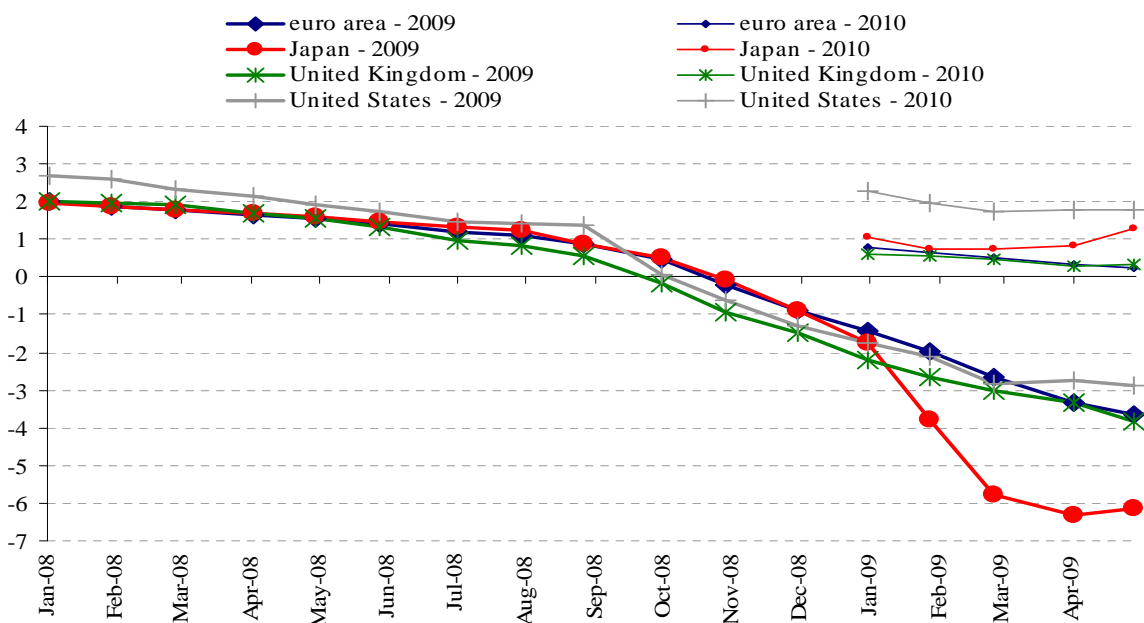
Chart 8: Global CPI inflation
(YoY % change)



Source: Consensus economics

Note: Last observation refers to May 2009.

Chart 9: Global real GDP growth
(YoY % change)



Source: Consensus economics

Note: Last observation refers to May 2009.

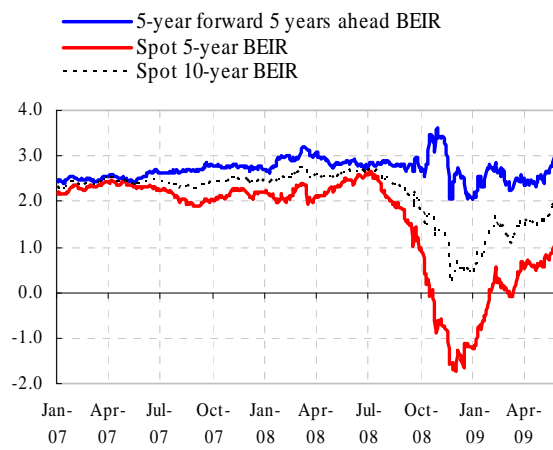
2.4 Financial market expectations of inflation

Looking at the BEIRs for the major four economies (Charts 10), inflation expectations now seem to be at levels consistent with positive inflation and price stability, while longer-term inflation in Japan is expected to remain negative.

Chart 10: Break-even Inflation Rates for US, euro area, UK and Japan

Zero coupon break-even inflation rates US

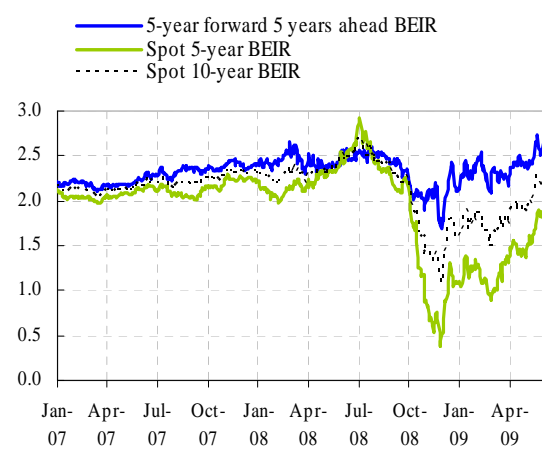
(daily data)



Source: Bloomberg and ECB calculations

Zero coupon break-even inflation rates EA

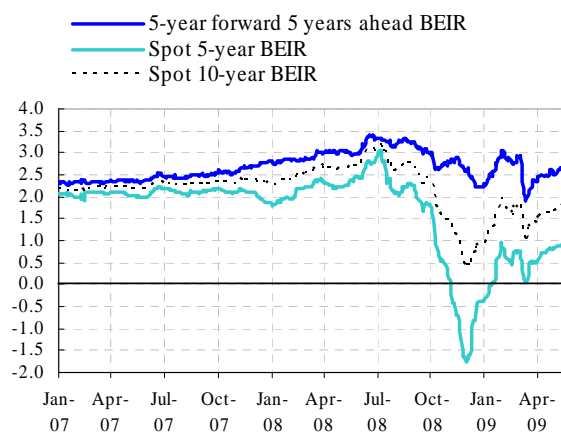
(daily data)



Source: Bloomberg and ECB calculations

Zero coupon break-even inflation rates UK

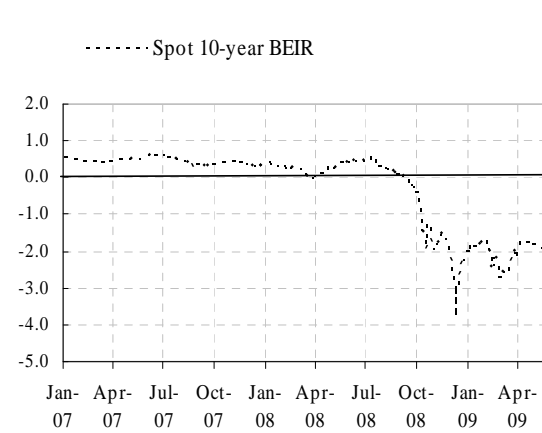
(daily data)



Source: Bloomberg and ECB calculations

Zero coupon break-even inflation rates Japan

(daily data)



Source: Bloomberg and ECB calculations

Amid the heightened volatility from September 2008 to the start of this year, it seemed that inflation expectations had turned negative even over a 5 year horizon for the United States, but the BEIR indicators had been somewhat distorted by the financial turmoil. Now, we see that it is only Japan which exhibits negative inflation expectations over the longer-term horizon, while the BEIRs for the other major economies reinforce the idea that inflation expectations are well anchored.⁵

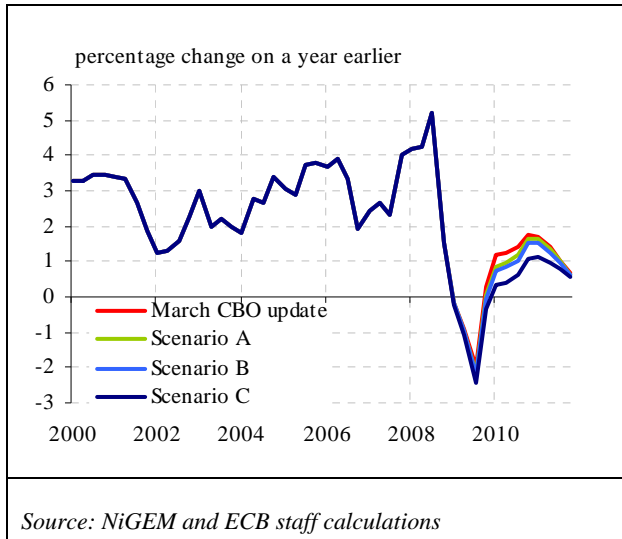
3 Risks of deflation in the US

Given that the US is currently experiencing negative inflation, and is also a major source of global shocks which are transmitted across the world, it seems useful to assess the risks of deflation in the US. In this section, we assess the risks of deflation in the US by using two techniques: first, we ask how large are the shocks required to produce deflation in the US;⁶ second, we use a structural VAR model of the US economy estimated with Bayesian techniques to gauge deflationary risks.

Chart 11: US CPI inflation

⁵ Other evidence supporting the assertion that inflation expectations are well anchored is provided by ECB (2009a) which reports that various measures of longer-term inflation expectations for both the US and euro area fluctuate in a fairly narrow band consistent with monetary policy objectives and price stability. Meanwhile, ECB (2009b) looks at the recent sharp fall in inflation in the euro area and compares with various measures of underlying inflation, focussing on the movements of individual categories/products prices within the euro area HICP. The findings are that the observed distribution of euro area prices towards the current lower inflation outcome mostly reflects the reversal of the direct impact of past commodity price increases as well as the gradual fading out of related indirect effects of commodity prices.

⁶ For this simulation exercise, deflation is defined as negative inflation for four consecutive quarters (as such a period of negative inflation may begin to influence expectations and change consumer purchasing behaviour, etc, consistent with deflation).



In this section, we use the March 2009 CBO US forecast for inflation as a baseline and then impose negative shocks to consumption, the degree of fiscal stimulus, and external demand. We then ask whether we would expect deflation to occur in the event of some plausible combination of these risks materialising. Possible impacts on

CPI inflation are quantified using the National Institute's global economic model (NiGEM). Scenarios which include an episode of deflation involve both combinations of very large shocks and inflation expectations becoming unanchored. That is, in order to expect deflation, one would seem to require a much different view of the US recovery than embodied in the March CBO forecast.

Our first scenario (Scenario A) is a more severe retrenchment by US consumers. Specifically, we put a negative residual on US consumption which increases the personal savings rate in by an average of 1 percentage point (pp) over 2009Q1-2011Q4.⁷ Even such a severe shock does not come close to producing a period of deflation, having a maximum impact on quarterly CPI inflation of -0.1pp in 2009Q3 (Chart 11). It is possible that such a sharp retrenchment could also be associated with inflation expectations becoming unanchored to the downside. In Scenarios B and C, inflation expectations are therefore reduced by 1pp and 2pp for 2 years respectively. But while Scenario C brings down the forecast for inflation to a lower level compared to Scenario A, it does not lead to negative inflation during 2010. Therefore, a deep but plausible retrenchment in consumption does not seem likely to produce deflation, even if expectations become temporarily unanchored.⁸

The second set of scenarios is concerned with alternative treatments of the US fiscal package. For example, 50% reductions in both government consumption and

⁷ Specifically, on advice from NIESR, consumption is shocked by -1% on the level for 8 quarters (but left endogenous) and the savings rate itself is shocked by 0.1% for 8 quarters.

⁸ Admittedly this methodology does not account for the possibility of a more protracted reduction in expectations and a deflationary spiral, but expectations becoming unanchored for 2 years is still a significant departure from market expectations.

investment spending relative to the CBO figures incorporated into the March MPE generate lower inflation compared to the baseline, but projected inflation still remains positive during 2010.⁹

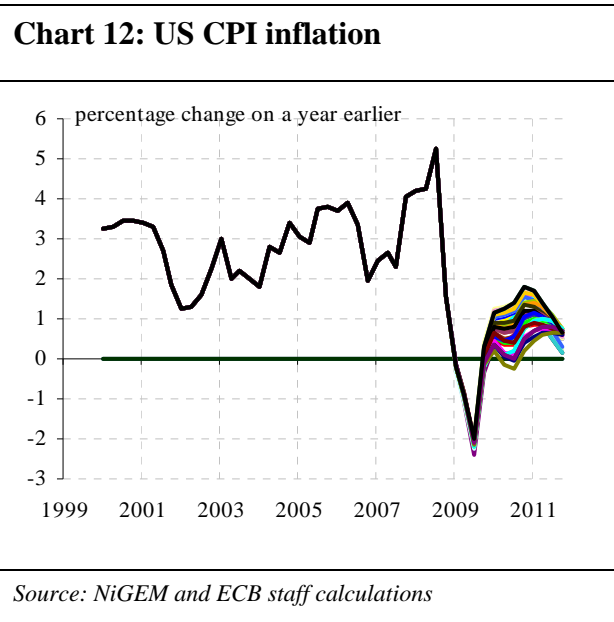


Chart 12 shows the swathe of US CPI profiles produced by applying different combinations of the domestic risks discussed above. However, it is not possible to generate episodes of deflation – defined here as four consecutive quarters of negative quarterly inflation over 2010Q1-2010Q4 – even if you assume the full combination of a more severe consumer retrenchment, a halving of

the fiscal stimulus, and that inflation expectations become unanchored for a prolonged period. Given that these shocks are individually large this suggests first that US deflation is unlikely, and second that deflation risks correspond to very different paths for the US recovery than that embodied in the March CBO and Consensus forecasts.

An alternative way of gauging deflationary risk is to employ a structural VAR model estimated with Bayesian techniques. The advantage of a Bayesian estimation in the current setting is that it allows straightforward computation of probabilities of deflation, again approximately defined for our illustrative purposes as a period of declining prices lasting for longer than one year.^{10,11}

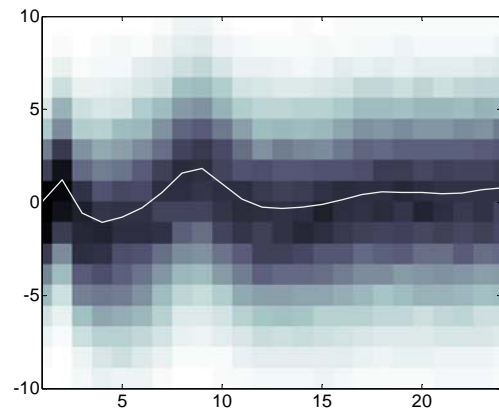
⁹ A third set of scenarios considers alternative profiles for the recovery of US external demand. In the first the trough in the quarterly growth rate from the March MPE – in 2008Q4 – is assumed to persist into 2009Q1, before recovering to the same trend and at the same rate as in the MPE thereafter. In the second, external demand reverts to its March MPE trend rate, but half as quickly as in that forecast. The third, is actually an upside scenario in which external demand recovers at its March MPE rate, but to a trend set to its average over 1980-2008Q3. All three simulations are run with both forward and backward looking consumers, and with and without US monetary policy responses. Neither of the downside scenarios even approach deflation.

¹⁰ This definition is based on the assumption that a period of four consecutive quarters of negative inflation is the minimum required to influence expectations and behaviour consistent with deflation.

¹¹ We remark that, using frequentist techniques, one can construct confidence intervals for the path of inflation, but it is quite cumbersome and involved to attach a proper probability measure to a composite event of prices falling for several subsequent periods.

To this end, we have estimated a VAR for the US economy akin to that presented in Zha and Waggoner (1999). The VAR is estimated at monthly frequency, with data ranging from January 1983 up to March 2009, and features a global index of commodity prices, M2, Federal funds rate, industrial production, CPI inflation and the unemployment rate. We compute conditional forecasts by fixing the commodity price index to their actual value for April and May 2009 (see Chart 13 for a fan chart of annualized month-on-month CPI inflation)¹², and then we calculate the

Chart 13: US CPI inflation possibilities
(in %, month-on-month annualized rate)



Source: ECB staff calculations

Note: First observation refers to April 2009.

probability of deflation as the ratio of the number of trajectories implying deflation (i.e. those for which negative CPI inflation, which first appeared in October 2008, will last seven additional months, accounting therefore for a year of declining prices) over the total number of Monte Carlo replications.

It is interesting to observe that the model foresees two waves of inflationary pressures: the first, at the beginning of the forecasting horizon, is directly linked to the evolution of commodity prices; the second one, foreseen by the model around the end of 2009, is instead a lagged consequence of the past rise in M2. As a consequence, deflationary risks are rather subdued with the probability of deflation being slightly below 4%. It is also interesting to remark that the limited risk of deflation is partly due to commodity price developments: if one employs an unconditional forecast (i.e. does not take into account the commodity price surge of the last two months), the probability of deflation rises to 21%.

¹² In a Bayesian framework, forecasting accounts for computing the complete probability distribution of the variables of interest across the forecasting horizon. This is accomplished by Monte Carlo numerical methods, so the relevant probability distribution is visualized as a series of histograms, constructed on the basis of a sufficiently large number of forecasting trajectories.

4. Structural aspects of global inflation

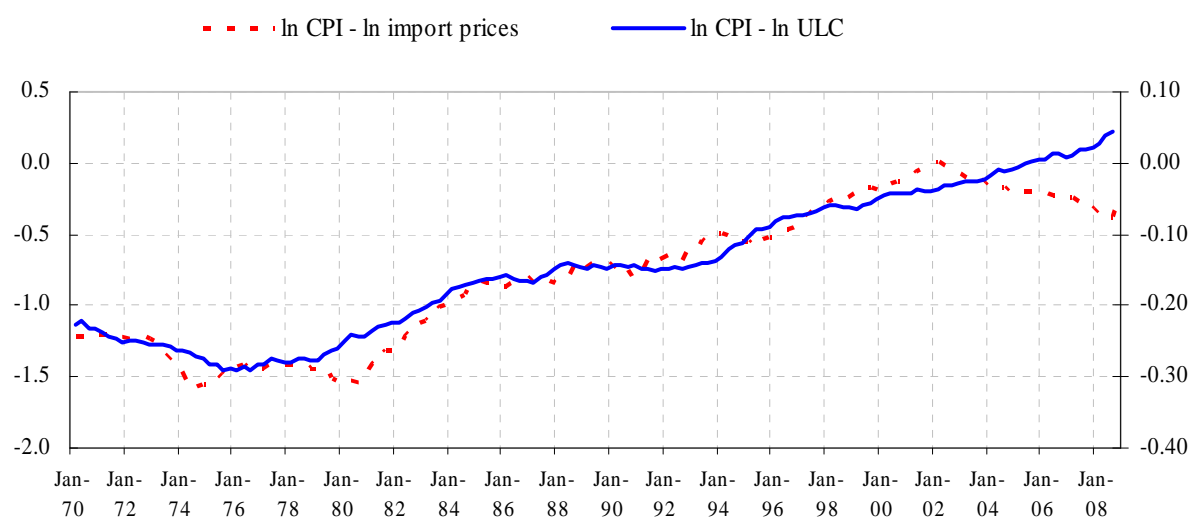
4.1 global relative price shocks

We now turn to look in more detail at structural factors influencing global inflation. For example, there seem to be a number of relative price shocks at the global level which seem to be related to globalisation. On the import price side, there are two opposing effects: on the one hand, rising imports from low-cost countries are putting downward pressure on manufacturing import prices; on the other hand, strong growth in the non-OECD economies in recent years seems to at least partly explain the significant rise in the prices of oil and non-energy commodities since 1999 up to the first half of 2008. 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, may have reduced the bargaining power of workers in more advanced economies.

In particular, we focus on the possible impacts of longer-term relative price adjustments taking place in the global economy. A broad indication of these possible relative price shocks comes from the simple observation that in OECD countries, two mark-ups - a mark-up of consumer prices over import prices ($\ln \text{CPI} - \ln \text{import prices}$) and that wage costs (ie, $\ln \text{CPI} - \ln \text{ULC}$) - have widened significantly in the past decades (see Chart 14 which shows these mark-ups for the OECD aggregate). These adjustments in relative prices, which are possibly associated with globalisation, appear to be strongly correlated with past developments in the inflation rate (Chart 1). In particular, the rise in the mark-ups for the OECD aggregate that started in the early 1980s (or alternatively the declines in real import prices and real unit labour costs) corresponds with the pronounced trend decline of inflation for the OECD aggregate. One can theoretically link these relative price adjustments and the levels of inflation by a mark-up model, whereby the mark-ups have a negative impact on inflation. For example, Sekine (2009) adopts such a model and finds that the widening of these two mark-ups account for more than 1.5 percentage points of the 5 percentage points decline in the inflation rate of a sample of major OECD countries between 1970-1989

to 1990-2006, while another 1 percentage point decline is due to a monetary policy shock. Another interpretation is that the two mark-ups simply reflect inflationary pressures and are frequently included in structural New Keynesian Phillips curves where inflation depends on real marginal costs which can also include the real price of imports (see Batini, Jackson and Nickell, 2005), or can simply be included in Phillips curves specifications as in Eickmeier (2008).

Chart 14: Two mark-ups: OECD aggregate import prices and unit labour costs



Source: OECD MEI and ECB calculations.

Notes: OECD CPI all items; ULC are OECD total economy unit labour costs; OECD imports of goods and services deflator.

Accordingly, in the following sections we look at some of these key variables in more detail, in particular: issues affecting the outlook for oil prices; how oil price shocks affect headline and core inflation; and structural pressures on inflation and wages related to globalisation.

4.1 The outlook for oil prices

Although there are some similarities between current oil market developments and those during the 1980s, the recent decline in prices in the second half of 2008 may not lead to a stabilisation in oil prices as was the case from the mid-1980s to 2000.¹³ Structural changes in oil demand have made it less likely that high prices will permanently dampen oil demand, as it happened after past oil shocks, by causing a substitution of oil by coal and natural gas in the industrial and power-generating sectors. Nowadays these sectors account for a relatively small share of oil demand, while a higher proportion of demand for oil is now accounted for by the transportation and non-energy sectors, where substitution is more difficult for technical reasons. In addition, oil demand will probably grow significantly in line with expected strong economic growth in non-OECD countries, such as Asia and particularly China (Chart 15). Meanwhile, the depletion of oil resources reduces the ability of higher oil prices to encourage an increase in oil supply. Oil prices fell between 1970s/80s and the 1990s partly due to increases in non-OPEC oil production, but the latter has slowed and since 2004 has actually declined as oil resources become depleted. Hence, increases in supply in newly opened areas (like Caspian Sea) will only partially offset declining rates of production in other geologically mature non-OPEC oil regions (such as United States and North Sea). One might also expect slow growth in OPEC capacity as simulations suggest that significant increases in OPEC capacity reduce OPEC revenues by lowering prices by more than the gain in sales due to lower prices (Chart 16).¹⁴ There seem few incentives for OPEC to substantially increase its capacity, which will probably have structural impacts on oil prices in the future. These limits to supply might be compounded by the fact that many capital investment and infrastructure projects in the oil industry were postponed during the current downturn and the associated sharp fall in oil prices in second half of 2008. On the other hand, expenditure on large-scale investment projects that have been underway for some time will probably result in rising capacity during the downturn.¹⁵ All in all, the above factors seem to imply further increases in oil prices in the future which may well result in oil prices continuing to exceed the range of USD 70 to USD 90 per

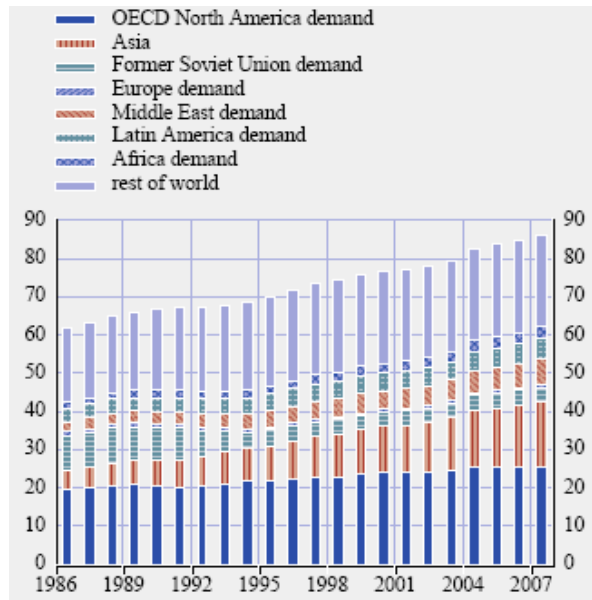
¹³ See Kaufmann, Karadeloglou and di Mauro (2008) for a more detailed analysis.

¹⁴ Describe mechanisms of chart on why increase in OPEC capacity reduces OPEC revenues

¹⁵ For example, see April 2009 IMF World Economic Outlook Box 1.5 “Will commodity prices rise again when the global economy recovers”.

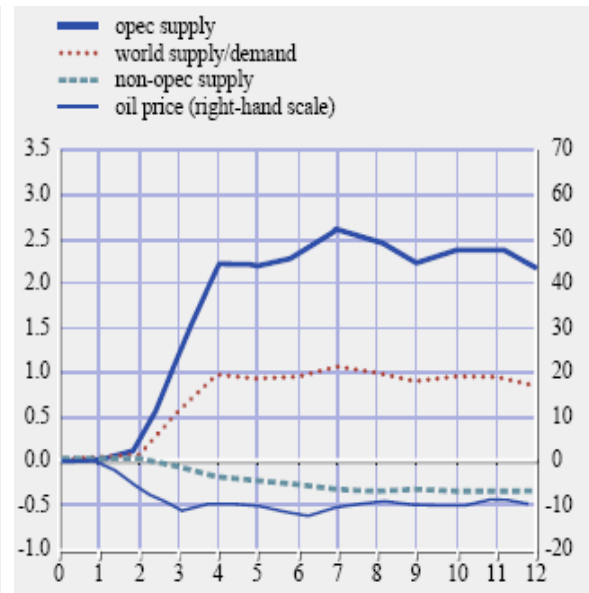
barrel over the longer-term. This is indeed in line with current oil futures prices of around \$73 per barrel by end 2011.

Chart 15: World Oil Demand by Region
(Million Barrels per day)



Source: International Energy Agency
Note: Last observation refers to 2007.

Chart 16: The Effect of a 5% Increase in OPEC Capacity
(%)



Source: Dees at al 2007

4.2 Impacts of oil price shocks using a GVAR

In this section, we construct a GVAR to examine impacts of oil price shocks on output and inflation, showing separate results for headline and core inflation. This will give us a greater understanding of the contribution to inflation of rising oil prices over most of the 2000s as well as the likely downward impacts on inflation of the sharp fall in oil prices during the second half of 2008. In summary, our results for the euro and US show that oil price impacts on inflation seem to be weaker than in the past and do not tend to feed into core inflation. This seems to be the partly the result of anti-inflationary monetary policy which has kept inflation expectations well anchored. As a result, it seems highly unlikely that deflation could result from the recent sharp fall in oil prices. Nevertheless, this assumes both linear and symmetric responses regardless of the magnitude and sign of oil price shocks, which may not be the case.

4.2.1 The GVAR Model¹⁶

A Global Vector Autoregression (GVAR) model is estimated based on the specification of Pesaran, Schuermann and Weiner (2004) which was further developed by Dees, di Mauro, Pesaran and Smith (2007). The GVAR consists of a number of economies each modelled individually as a VAR with each country model comprising domestic and foreign variables, with the latter constructed as a weighted average of the other countries' variables (based on bilateral international trade weights).¹⁷ In addition, global variables representing international factors - such as oil prices – are included in each country model.

Each country model is individually estimated by assuming weak exogeneity for both domestic and foreign variables, which is implicitly assuming the small open economy hypothesis for each country (while the weak exogeneity assumption allows the individual estimation of each country model thereby avoiding the unfeasible full-estimation of the whole GVAR).

The set of country-specific variables in the GVAR includes: core inflation (calculated as annualized monthly CPI inflation excluding energy and food); headline inflation – more specifically, the annualized monthly CPI inflation; real industrial production; the nominal effective exchange rate; and the nominal short-term interest rate. There are also two global variables, namely: the price of food; and the price of oil.

The estimated GVAR model covers 33 economies, including both developed and developing countries.¹⁸ The data on which the estimates are based are of monthly frequency for the sample period January 1999 – December 2007.

¹⁶ The GVAR model as well as the reported empirical results are based on Galesi and Lombardi (2009). See Appendix 1 for further details of the GVAR model.

¹⁷ The weights are fixed over time, and computed in the usual way for GVAR models as averages of exports and imports bilateral relationships for the period 1999-2007. However, given the key role of imports in transmitting inflationary pressures, we also estimated the GVAR model using imports-based weights. However, as there was no significant change in the results, we simply report the results using the weights based on the averages of exports and imports.

¹⁸ These are either individual countries, such as the USA or UK, 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, Netherlands, Portugal, Slovenia and Spain.

After estimating the country-models, their corresponding estimates 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 Generalized Impulse Response Functions (GIRFs), proposed in Koop, Pesaran and Potter (1996) and further developed in Pesaran and Shin (1998).¹⁹

4.2.2 GVAR Generalised Impulse response functions of oil price shock

A positive standard error unit shock to nominal oil prices is simulated.²⁰ The following simulations focus on the euro area and USA, but the results for various regions of the world are documented in Galesi and Lombardi (2009) as well as simulations of food price shocks. The key issues to be addressed are: is there a significant pass-through of external shocks – particularly oil price shocks - to core inflation; and, to what extent are the inflationary effects persistent?

Each impulse response shows the dynamic response of each domestic variable to standard error unit shocks to oil prices up to a limit of 24 periods (e.g. 2 years). Confidence intervals are presented at the 90% significance level,²¹ although we anticipate that the vast majority of responses may not be statistically significant due to a number of causes, including the use of volatile monthly data.²²

¹⁹ In the Global VAR framework, the GIRFs are more appealing with respect to the traditional Sims' (1980) Orthogonalized Impulse Response Functions, being invariant to the ordering of the variables and of the countries. Given that in such a multi-country setting there is no clear economic *a priori* knowledge which can 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) Global VAR analysis is based on the investigation of the geographical transmission of country-specific or global shocks, thus this limitation is not considerably perceived

²⁰ 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.

²¹ Confidence intervals are calculated using the sieve bootstrap method with 1000 replications. See Kreiss (1992), Buhlmann (1997) and Bickel and Buhlmann (1999) for a detailed description of the sieve bootstrap technique.

²² we present the impulse responses aggregated at a regional level for synthesis purpose: the aggregation of country-specific GIRFs can lead to non-significant regional outcomes; the estimation of the GVAR model using monthly data necessarily implies the presence of high volatility in our estimates; the country-specific parameters estimates are derived from unrestricted estimations: in the context of a short-run analysis such the following we prefer not to impose economic-based restrictions in the cointegrating space of each country VECMX* model, which are likely to be rejected by the appropriate tests.

A positive standard error unit shock to nominal oil prices corresponds to an increase of about 6 percent of the oil price index in one month (Chart 17). The impact on other key commodities - such as food prices – is not significant, remaining close to the zero line.²³

The impulse responses for headline inflation indicates the direct inflationary effects due to oil price hikes. The GVAR results indicate a significant historical correlation between oil price shocks and inflationary accelerations for most of the developed regions under study, while non-statistically significant effects are observed for the less developed economies. The US headline inflation response is on impact equal to 1.1 percent (Chart 17), then it rapidly dies out, becoming statistically insignificant after three months. The euro area's headline inflation increases by about 0.6 percent at the time of the shock (Chart 17), then its impact declines and returns to the baseline after approximately two months. The observed effects on the euro area are roughly only half of the magnitude of the effects for the United States. This result seems partly due to the fact that the intensity of oil utilization in production is lower in the euro area compared to the USA.^{24,25}

The impacts of the oil price hike on core inflation are not statistically significant for the US (Chart 17). This is consistent with the findings in Hooker (2002). Similarly, no second-round effects are found for the euro area. Overall, these impacts on core inflation are in line with the policies of the US and the euro area's monetary authorities and their objectives to limit the nominal consequences of oil shocks, which seems to have resulted in the anchoring of inflation expectations in line with the price stability objectives of the ECB.

²³ As we expected to observe a significant positive dynamic correlation between oil and food prices, this counterintuitive finding could be due to endogeneizing the global variables in the GVAR model, so that the effect on food price of a oil price shock is dampened by all the variables' contributions in the system.

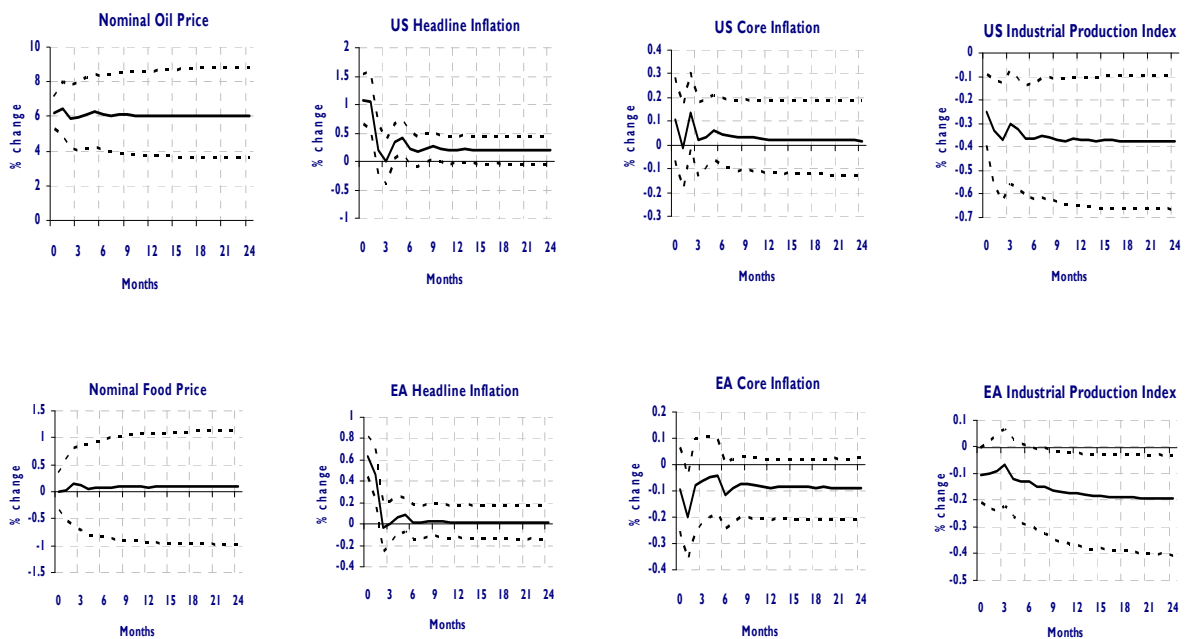
²⁴ See, for example, Anderton and di Mauro (2007) who show that the oil intensity of production in the euro area is about 75% of the USA (where the oil intensity of production is proxied by oil demand divided by GDP (in real terms).

²⁵ In addition, higher energy taxes in the euro area compared to the United States potentially also partly explain these differences, dampening the effect of oil price hikes in the euro area.

Turning to the real-side, US industrial production falls on impact by 0.25 percent in response to the rise in oil prices, then after two years its decline averages almost 0.4 percent (Chart 17). Meanwhile, 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 percent, which then stabilizes to 0.2 percent below the baseline. Again, the downward impacts on industrial production in the euro area may be smaller relative to the USA due to the lower oil-intensity of production in the euro area.

Overall, the impacts on inflation and output seem to be smaller in comparison to earlier oil price shocks. This is in line with Blanchard and Gali (2007) who find that oil price shocks now have smaller effects on prices and wages as well as output and employment, due to: a decrease in real wage rigidities; an increase in the credibility of monetary policy associated with smaller impacts of oil price shocks on expected inflation; and the decrease in the share of oil in consumption and production.

Chart 17: Generalised Impulse Responses of a Positive Unit (1 s.e.) Shock to Oil Prices



Source: Galesi and Lombardi (2009)

The GVAR model was also used to simulate a positive standard error unit shock to nominal food prices, but overall the results for the US and euro area were much the same in terms of mainly affecting headline rather than feeding into core inflation. However, the detailed results do show a small positive impact on US core inflation from the rise in food prices.

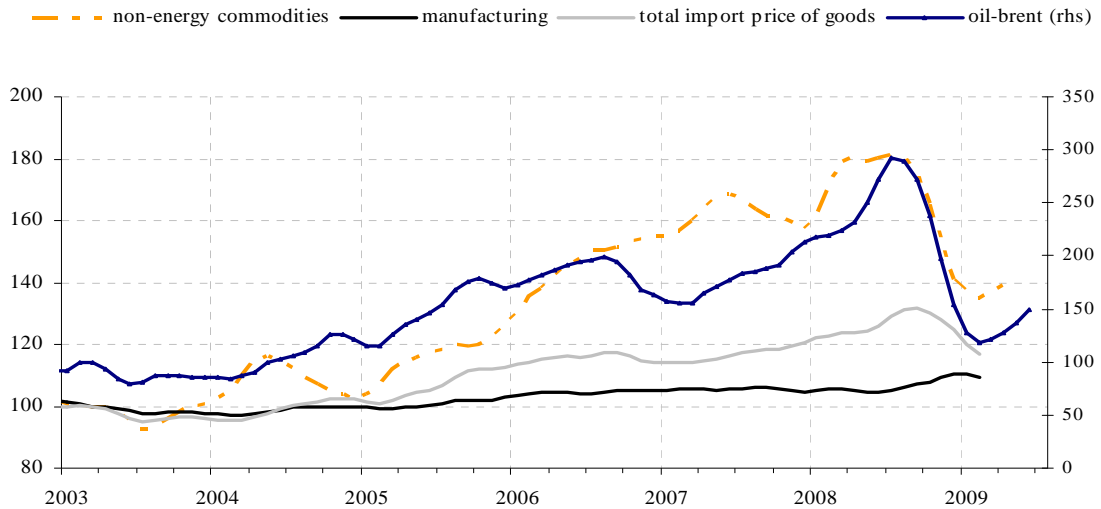
In summary, our results for the euro and US show that oil price impacts have temporarily affected headline inflation but the impacts seem to be weaker than in the past and do not tend to feed into core inflation. The latter seems to be the partly the result of anti-inflationary/price-stability monetary policy which has kept inflation expectations well anchored. As a result, it seems highly unlikely that deflation could result from the recent sharp fall in oil prices which are likely to bring down headline inflation with negligible effects on core inflation. However, this assumes both linear and asymmetric responses to increases and decreases in oil prices, which may not be the case. Nevertheless, these results correspond with the regression analysis of Cecchetti and Moessner (2008) on the impact of the rise in food and energy prices on inflation. They find that in recent years core inflation has not tended to revert headline inflation in response to oil and food price shocks, implying that commodity 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 the oil price, also commodity prices fail to predict core inflation.

4.3 Structural factors: global and euro area evidence on import prices and inflationary pressures.

There are various structural factors that continue to put some 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 has been the main reason why import prices for manufactures have been either stagnating or on a downward trend in recent years (Chart 18).

Chart 18: Extra-euro area import prices by commodity

(indices: Q1 2003 = 100; seasonally adjusted; 3-month moving average)



Source: ECB

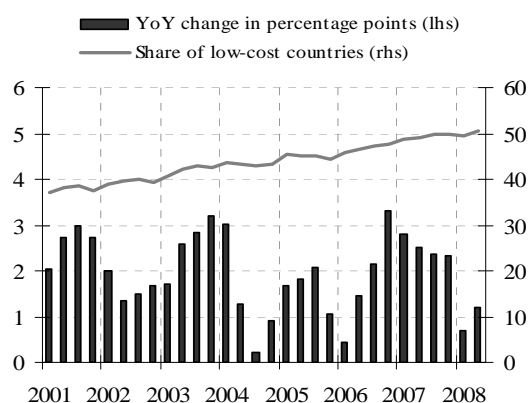
Notes: Last observation relates to February 2009, except for non-energy commodities (May 2009) and Oil- Brent (June 2009).

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 (see Chart 19) 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, which captures 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, while the “price effect” makes a much smaller contribution to these downward pressures (See Table 1).²⁶

²⁶ The methodology used in this analysis is described in detail in Appendix 2 and is similar to that of Kamin, Marazzi and Schindler (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, which is somewhat higher but slightly below the estimates for the euro area.

Chart 19: Share of extra-euro area manufacturing imports from low-cost countries

(LHS: YoY change in percentage points; RHS: in %; quarterly data)



Note: Last observation August 2008

Source: Eurostat and ECB calculations; Table 1: Taglioni and Vergote (2009)

Table 1: Decomposition of euro area import prices
(in %)

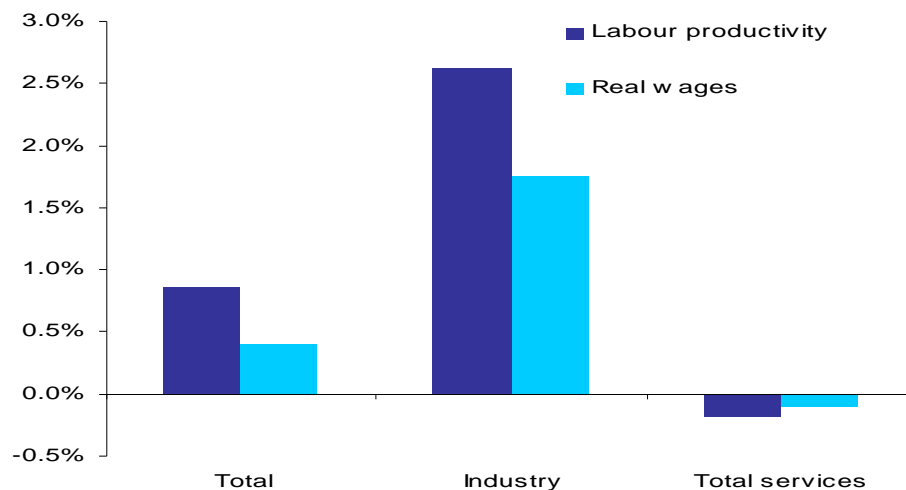
	1996-2007
Manufacturing import price inflation in % p.a.	0.09
High-cost countries effect	2.08
Low-cost countries effect	-1.99
China	-0.75
share effect	-0.81
price effect	0.06
New EU member states	-0.26
share effect	-0.66
price effect	0.40
Rest of low-cost	-0.99
share effect	-0.10
price effect	-0.89

Of course, as mentioned above, this is part of a *relative price effect* where inflation is simultaneously dampened from prices of imports of manufactured goods but accentuated by increases in other prices given global demand pressures (for example, Chart 18 above shows the strong rise in import prices of commodities related to strong emerging market economies' demand for energy and other commodities such as metals and food). As relative price movements are a natural part of economic functioning and therefore need not necessarily have any effect on aggregate inflation, such movements may only be expected to have short-term aggregate inflationary impacts. However, as the above chart on the mark-ups shows, import prices at the aggregate OECD level seem to have had a downward impact on inflation for a considerable period of time.

Apart from these direct relative price effects, globalisation may also put downward pressure on prices via increase competition in the labour and goods markets. Turning to recent euro area wage developments, globalisation may have been one contributing factor to an extended period of wage moderation within the euro area (for instance, if offshoring or the threat of offshoring reduces the wage demands of workers). As indicated in Chart 20, real wages have been weaker than productivity both on aggregate and also within the manufacturing and services. At the same time, there has been an ongoing weakening of the wage share for a longer period, which has been

more severe than the corresponding fall in the US since the mid-80s, bringing this measure in both regions to historical lows (Chart 21). While such a development might be taken to indicate that the bargaining power of workers may have declined in the context of globalisation, extreme caution should be made in drawing such conclusions given several caveats related to measurement issues²⁷ and the fact that much of this decline took place well before the recent phase of globalisation. As for globalisations impacts on prices, Pula and Skudelny (2009) use calculations based on several methodologies and find that a direct dampening effect of import openness on euro area producer price inflation of 0.1-1.0 percentage point for the euro area manufacturing sector over the period 1996 to 2004. The authors report a dampening impact on euro area consumer price inflation of 0.05-0.2 percentage point per year on average based on aggregate data over the same period. Pain et al. (2006) find a combined effect on consumer inflation from lower non-commodity import price inflation and higher commodity import price inflation of up to 0.3 percentage point per annum over the period 2000 to 2005. Using similar methodologies, Chen et al. (2007) and Helbling et al. (2006), and Glatzer et al. (2006) report findings of a similar magnitude for other countries and regional groupings.

Chart 20: “Real” wages and productivity in the euro area
(average annual change between 1996 and 2007)

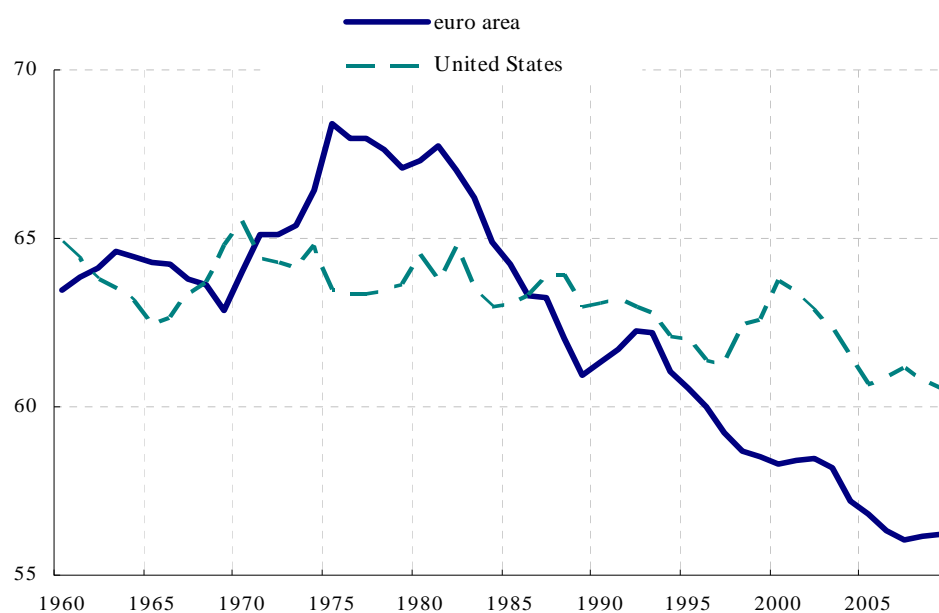


Source: Eurostat (ESA95).

Note: Real wages computed as nominal compensation per employee less the respective value added deflator. Services sum of (1) Trade, repairs, hotels, restaurants, transport and communications, (2) Financial, real estate, renting and business activities, and (3) Other service activities.

²⁷ It should be noted in this respect that several measurement problems limit the reliability of the wage share, including a growing importance of non-wage remuneration (particularly for the growing number of self employed), which imply that this measure cannot be interpreted reliably as the share of income accruing to capital or labour.

Chart 21: Long-term developments in labour shares
(in percentage of gross national income)



Source: AMECO database and ECB calculations.

Note: 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.

4.4 Global components of inflation

A related aspect to the above mechanisms is that the global component of inflation seems to have increased in size relative to domestic component (see Eickmeier, 2008; Neely and Rapach, 2009). There is limited evidence that domestic inflation has become more sensitive to measures of foreign slack in addition to the standard import price channel.²⁸ On the one hand, Borio and Filardo (2007) find a significant role for global economic slack measures in Phillips Curves of advanced economies (albeit with mixed results for the euro area). Specifically for the euro area, studies such as Paloviita (2007) 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 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 explained by macroeconomic factors attributable to "international" factors

²⁸ Globalisation may have weakened the link of domestic liquidity on domestic prices or, alternatively, implied a higher role for foreign liquidity in domestic prices; Rueffer and Stracca (2006) find that evidence of a significant spill-over of global liquidity to the euro area economy.

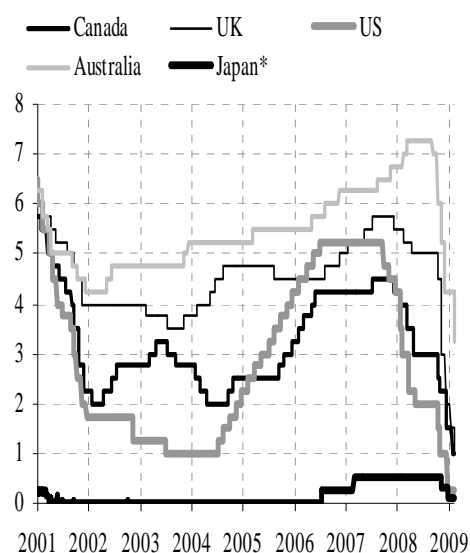
for both Germany and France, but that such factors are more relevant in the goods/manufacturing sector than in the service sector. For the UK, Batini et al (2005) find external competitive pressures also seem to affect U.K. inflation via their impact on the equilibrium price markup of domestic firms. On the other hand, many other studies have failed to identify a significant role for global economic slack measures 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 et al. (2007) find that a flattening of the slope of the euro area Phillips curve occurred mainly in the 1980s, before the current globalisation phase. Broadening the studies to those looking at other economic regions, Ball (2006), Woodford (2007), Ihrig et al. (2007) and Wynne and Kersting (2007) argue for a negligible role for measures of global economic slack on inflation dynamics, while Pain et al. (2006) relate a rise in the sensitivity to domestic inflation in OECD economies to foreign economic conditions to an import price channel alone. On the basis of a new Keynesian Phillips curve-based model, Sbordone (2008) finds it difficult to argue that an increase in trade would have generated a sufficiently large increase in U.S. market competition to reduce the slope of the inflation-marginal cost relation.

In summary, on the import prices side, globalisation forces seem to have had a dampening effect on OECD inflation until the mid-2000s associated with low prices of imports of manufactured goods through increased global supply from low-cost countries which, more recently, was more than offset by strong increases in the prices of commodities such as oil until the first half of 2008 resulting from heightened global demand pressures. During the second half of 2008, oil prices fell sharply but have since recovered strongly and our analysis suggests that oil prices will rise to higher levels in the future. These impacts will be partly offset by the ongoing downward price pressures on manufacturing imports from rising imports from low-cost countries. At the same time, international competitive pressures may have also contributed to reducing inflationary pressures in the OECD from wage moderation and falling real unit labour costs, but there is no guarantee that this will continue into the future. However, the GVAR simulations – based on past recent behaviour in the 2000s - suggest that the sharp declines in oil prices in the second half of 2008 may not have significant impacts on core inflation in the euro area and US (assuming responses are linear and symmetric regarding the magnitude and sign of oil price shocks), emphasising the role of well-anchored inflation expectations in containing inflationary pressures.

5. Policy responses and inflationary pressures

In this last section, we provide a brief analysis of some of the possible impacts of the recent global fiscal stimuli which is not meant to be a comprehensive analysis but simply to get some “ball-park” estimates of the likely impacts on global activity and inflation. In addition to the upward impacts on global activity arising for the decline in oil prices last year, policy-makers have also quickly reacted to the global economic downturn. Monetary authorities have swiftly and repeatedly lowered policy rates as the crisis intensified and the inflationary pressures apparent in the first half of 2008 started to vanish (Chart 22).²⁹

Chart 22: Monetary policy rates (in %)



Source: Bloomberg.

Note: Latest observation refers to 15 January 2009.

Table 2: Fiscal stimuli and fiscal position in selected economies (% of GDP)

	Fiscal Stimulus (% of GDP, relative to 2007 baseline)			Government surplus/Deficit		Govern- ment debt
	2008	2009	2010	2007	2008	2007
	US ¹	1.1	2.0	1.8	-2.9	-4.7
UK	0.2	1.4	-0.1	-2.6	-5.4	51
Japan ²	0.3	2.4	1.8	-2.5	-5.6	170
Australia	0.7	2.1	1.7	1.6	0.1	16
China	0.4	3.1	2.7	0.9	-0.3	20

Source: IMF

¹ Excludes cost of financial system support measures.

² Financial sector-related measures are not included.

Significant fiscal packages to sustain economic growth have also been announced by various countries (Table 2). This overall size of the US stimulus is approximately \$787 bn, consisting of tax cuts, government investments, government consumption and transfers to individuals and states. The magnitude of each of the components is as follows; tax cuts up to \$288.3bn of which \$232.4bn (36.6% of the package) are tax

²⁹ The strength and speed of the current monetary and fiscal policy response should be seen against the background of the past deflationary episode experienced by Japan as described in Appendix 1.

cuts for individuals. The rest of the tax cuts, \$55.9bn, are directed to firms and this partly consists of business related tax cuts (eg. speedier deductions on investments), however, a higher share of these are focused on infrastructure and (renewable) energy related incentives; approximately \$151bn are expected to be spent for infrastructure investments by both the federal and state governments; finally around \$228bn will be spent on government consumption. Table 2 shows the simulated marginal impacts of the combined fiscal packages³⁰ using the global model NiGEM on GDP and CPI. The impact on US GDP amounts to 1.28 and 1.0 percentage points in 2009 and 2010, while euro area GDP increases by 0.78% and 0.73%, respectively. As a caveat, it should be mentioned that simulations do not take into account the impact of the fiscal stimuli on confidence levels in the economy, which could play a crucial role in the current climate.

The positive effects of the fiscal packages on demand will also provide a stimulus to inflation and partly counteract some of the disinflationary pressures in the short-to-medium run (Table 3). However, such positive stimulus will probably be unable to avoid the likely few months of negative inflation for some countries, as a large part of the inflationary pressures following the rebound of economic activity will kick off only in 2010. It is also important to highlight that after the fiscal stimulus packages are finished they could potentially generate additional inflationary pressures due to their high impact on public debt, which authorities may be tempted to monetize.

Table 3: Marginal impact of fiscal stimuli on GDP and CPI (% change from baseline)

	2009	2010	2011
Country		GDP	
US	1.28	1.0	0.33
EA	0.78	0.73	0.38
World	0.62	0.52	0.22
Country		CPI	
US	0.27	1.7	0.84
EA	0.14	0.36	0.49

Source: ECB staff calculations.

³⁰The countries included are the US, UK, Japan, Australia, Canada and the euro area.

6. Conclusions

Against the background of large fluctuations in world commodity prices and global growth, combined with ongoing structural aspects of globalization exerting various pressures on global trade prices and unit labour costs, this paper assesses the key drivers of global inflation, also in the light of proposed and ongoing policy responses. The paper considers the various factors putting upward and downward pressures on global inflation, distinguishing between conjunctural and structural factors as well as risks. In particular, this paper examines:

- Recent developments as well as the outlook for global activity and inflation based on Consensus forecasts as well as financial market measures of inflation expectations and the outlook for oil prices;
- The risk of deflation in the US based on various techniques using traditional macroeconomic models and Bayesian VAR models;
- The quantitative impact and persistence of changes in oil and food prices on headline and core inflation for the euro area and US economies using a GVAR model of the world economy;
- The role of ongoing structural factors and relative price shocks in the global inflationary process. For example, globalisation has been accompanied in the euro area and other economies by a higher share of imports of manufactured goods from low-cost countries which has put downward pressure on both manufacturing import prices and inflation, while putting increased global demand particularly in the non-OECD countries has exerted upward pressures on commodity prices, particularly oil prices. At the same time, globalisation seems to have put downward pressure on real unit labour costs in the OECD economies.
- Finally, the paper investigates how recent proposed policy responses, most notably fiscal stimulus packages may affect global growth and inflation

Overall, some countries are experiencing temporary negative inflation while other economies may soon share this experience. However, this is largely driven by the

sharp fall in commodity prices in the second half of 2008 and does not imply a deflation: there are no elements yet indicating that the current price contraction at the global level will be prolonged or expectations-driven at the global level (as in previous deflation episodes). In addition, GVAR simulations – based on past recent behaviour in the 2000s - suggest that the sharp declines in oil prices in the second half of 2008 may not have significant impacts on core inflation in the euro area and US (assuming responses are linear and symmetric regarding the magnitude and sign of oil price shocks), emphasising the role of well-anchored inflation expectations in containing inflationary pressures. Meanwhile, headline global inflation rates will probably face upward pressures partly due to the recent rebound in oil prices, while simulations suggest that the planned fiscal packages will provide a positive boost to activity and inflation across the globe particularly in 2010. One key result of the analysis is that Consensus forecasts as well as expectations of financial markets suggest that longer-term inflationary expectations seem to be well anchored in most major economies across the globe despite the extreme recent volatility of the world economy.

Appendix 1: lessons to be learned from the past deflation episode in Japan

Overall, from a deflation perspective, hindsight suggests that there are lessons to be learned from Japan, particularly that expansionary monetary and fiscal policies at the early stages would have been helpful in preventing the Japanese deflation and slump of the 1990s.

The Japanese deflation started with a sharp decline in credit and a collapse in aggregate demand, which led producers to cut prices on an ongoing basis. This caused further recessionary effects, thus deepening and prolonging the initial slowdown in activity. Consumer prices followed the economy downward, falling below zero in 1995. In response, Japanese short-term interest rates were lowered nearly to zero by late 1995. However, with prices declining, real interest rates remained positive, restraining growth further.

Japan's deflation and protracted slump was the outcome of developments that date from the "bubble economy" of the late 1980s, when equity and land prices first boomed and then collapsed. This led to balance sheet problems for households and especially for firms. Investment demand fell sharply, especially in construction. At the same time, weak stock markets prevented investment financing via equity issuance and in parallel, declining stock and real estate prices undercut the value of collateral, thus financing via loans was also difficult. Leading to deterioration in loan performance, this also undermined the financial strength of the banking system. Japanese banks failed to resolve their non-performing loans problems and adequately recapitalize themselves. The continued fragility of the banking system, in turn, limited its ability to extend new loans and support economic recovery.

To what extent do the current developments in the United States and the euro area resemble the Japanese experience? Overall, although there are some similarities to the Japanese episode, the main differences relate to the way policymakers have so far reacted to the crisis. As the Japanese experience shows, the risk of a deflation in the United States and in the euro area, will especially depend on the ability of the banking sector to adequately recapitalize itself and deal with non-performing investments problems. In this regard, US and European banks have been quicker than those in Japan in the 1990s to disclose and write off losses, with policymakers quickly recognising the need to use taxpayers' money to plug the banking system. Both monetary and fiscal authorities have been acting in a coordinated manner to re-establish orderly conditions in financial markets, whereby central banks have also been using a wider set of tools than the Bank of Japan at the onset of the crisis.

One of the most important lessons of the Japanese deflation is that more expansionary monetary and fiscal policies in the earlier stages would have been helpful in

preventing deflation and a protracted slump in Japan (see, for instance, Ahearne et al., 2002). Acting quickly and actively, policymakers in the United States and in Europe seem to have learned from Japan's experience, leaving reason to believe that this will shorten the length of the economic downturn and limit the risks of deflation.

Appendix 2: Methodology used for calculating impacts of low-cost countries on the euro area's manufacturing import price.

In order to decompose the changes in the euro area manufacturing import unit value into the effects arising from a change in the geographical distribution of imports between high-cost and low-cost countries (and among them, CN, NMS and ROLC³¹), two factors have to be considered separately: a *share effect* (what would have been observed if only the share 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

As the euro area absolute import unit value is a weighted average of the import unit values from various countries of provenance, the percentage change in the euro area import unit value from period $t-n$ to period t can be deduced from equation (4), 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:

$$\frac{\Delta p_t}{p_{t-n}} = \sum_j \left[\frac{p_{j,t} - p_{HC,t}}{p_{t-n}} \Delta \alpha_{j,t} \right] + \sum_j \alpha_{j,t-n} \left[\frac{\Delta p_{j,t}}{p_{j,t-n}} \frac{p_{j,t-n}}{p_{t-n}} - \frac{\Delta p_{HC,t}}{p_{HC,t-n}} \frac{p_{HC,t-n}}{p_{t-n}} \right] + \frac{\Delta p_{HC,t}}{p_{HC,t-n}} \frac{p_{HC,t-n}}{p_{t-n}} \quad (1)$$

$j = \{CN, NMS, ROLC\}$

In equation (1), 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 import price inflation rates for country j and the reference country. If the import price from country j increases by more (decreases by less) than that of the reference country, then given the geographical composition of imports, the country will have a positive

³¹ CN stands for China; NMS for New EU Member States; ROLC for rest of low-cost countries.

(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.

The caveats of the methodology

The methodology employed in the note is subject to four main caveats:

- Firstly, 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 officially published one is based on Fischer index.
- Secondly, the results of the magnitude of the share and price effects depend on the grouping of the countries, and therefore on the reference country. As this note focuses on the effect of imports from the low-cost countries, the results are decomposed into China, the NMS and ROLC, whereas the high-cost countries remain aggregated and represent the reference point. 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. This is so because the difference between the import price level of China and that of the rest of the world would be lower than with that of high-cost countries. The price effect would also be affected, although it is not possible to know *a priori* in which direction.
- Thirdly, 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 the NMS or any other low-cost country or country group.
- Finally, import shares in value terms are used for the aggregation of the import unit value, thus in addition to structural developments also capturing valuation effects. The available alternative would be to use import share in volume terms. However, Eurostat Comext database reports volumes measured in weight units (multiples of kilograms) that are difficult to interpret at an aggregate level.

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