Federal Reserve Bank of Chicago

Global Inflation

Matteo Ciccarelli and Benoît Mojon

WP 2008-05

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Matteo Ciccarelli†
European Central Bank

Benoît Mojon
European Central Bank
Federal Reserve Bank of Chicago

First draft: March 2005; This draft: April 2008

Abstract

This paper shows that inflation in industrialized countries is largely a global phenomenon. First, the inflation rates of 22 OECD countries have a common factor that alone accounts for nearly 70 percent of their variance. This large variance share that is associated with Global Inflation is not only due to the trend components of inflation (up from 1960 to 1980 and down thereafter) but also to fluctuations at business cycle frequencies. Second, we show that, in conformity to the prediction of New Keynesian open economy models, there is little spillover of inflationay shocks across countries. The comovement of inflation comes largely from common shocks. Global Inflation is a function of real developments at short horizons and monetary developments at longer horizons. Third, there is a robust "error correction mechanism" that brings national inflation rates back to Global Inflation. A simple model that accounts for this feature consistently beats the previous benchmarks used to forecast inflation 4 to 8 quarters ahead across samples and countries.

Key Words: Global Inflation, common factor, international business cycle, OECD countries

JEL: E31, E37, F42

*We would like to thank Julio Rotemberg (the editor) and an anonymous referee whose comments helped us improve the paper substantially. We are also indebted to Michel Aglietta, Filippo Altissimo, Micheal Bordo, Gabriel Fagan, Domenico Giannone, Ronald McKinnon, Jeffrey Frankel, Anil Kashyap, Nobu Kiyotaki, Simone Manganeli, Cyril Monnet, Philippe Moutot, Lucrezia Reichlin, Frank Smets, Mike Wickens, Micheal Woodford and seminar participants at the ECB, the OECD, the IMF, the Bank of Canada and the NBER Summer Institute 2006 for useful comments on several versions of this paper. Finally, we are very grateful to Daniel Levy for detailed and constructive comments on the draft, and to Sandrine Corvoisier for excellent research assistance. The views expressed are those of the authors and do not necessarily reflect the views of the European Central Bank, or the Federal Reserve System. Remaining errors are our own.

†Corresponding author: European Central Bank, DG Research, Kaiserstrasse 29, D-60311, Frankfurt am Main. E-mail: matteo.ciccarelli@ecb.int.

1 Introduction

This paper provides a formal analysis of the international comovement of inflation. We document that the international comovement of inflation has been strikingly high. We then investigate the origin of this comovement before we show one of its potential applications, i.e. that it can improve the forecasting of national inflation rates.

The idea that macroeconomic developments depend on international conditions is not new. Measures of this depencence, however, were developed only recently. For instance, Kose, Otrok and Whiteman (2003) (KOW thereafter) find that the world's common component to expenditure time series of 60 countries explains between one fourth and one half of the variance of these series in OECD countries.[1] By definition, the main risk of ignoring international developments is to overrate the importance of domestic ones. And these include domestic macroeconomic policies. As KOW put it:

> " Understanding the sources of international economic fluctuations is important both for developing business cycle models and making policy".

Surprisingly, the studies of global macroeconomic developments had, initially, mostly focused on the real business cycle. However, the fluctuations of inflation have been strikingly similar around the world. All OECD countries have experienced long-term swings in the level of inflation. Inflation has progressively risen in the 1960s and 1970s before it declined in the 1980's. Inflation has further declined in the early to mid-1990's and has since then remained low and stable. A more recent perspective shows that inflation rates are accelerating in most countries in 2007 and early 2008.

Prominent economists have recently pointed to the common disinflation trend around the world (Rogoff, 2003) or at least OECD countries (Levin and Piger, 2004, and many others). These studies may overlook two important aspects of the international comovement of inflation. First, they restrict their analyses to the post-1980 disinflation, hence disregarding the possibility that the previous phase, i.e. the acceleration of inflation between 1960 and 1980, was also very much a shared experience of most countries of the world (a point described early on by McKinnon, 1982 and Darby and Lothian, 1983, among others). Second, they focus strictly on the downward trend or on downward breaks of the inflation process, while, as we show in this paper, there is more than sufficient evidence of comovements of inflation at the business cycle frequencies as well.

[1] See also Forni and Reichlin (2001), Canova, Ciccarelli and Ortega (2007) and references therein.

We proceed in three sequential steps. We first document the fact with a simple common factor analysis. We extract the common component to the quarterly inflation series of 22 OECD countries from 1960 to 2007,[2] and quantify the extent to which this measure of "Global Inflation" helps explain national inflations. Subsequently, we test alternative explanations for the international comovement of inflation. Then we study the empirical implications of our stylised fact for the dynamics and the predictability of national inflation rates and check whether it is possible to exploit Global Inflation to improve inflation forecasts.

Our main results can be summarized as follows. First the intuition that inflation has been a global phenomenon is decidedly confirmed by the data. We indeed show that a simple average of 22 OECD countries inflation, which we call "Global Inflation," accounts for 70 percent of the variance of inflation in these countries between 1960 and 2006. The qualitative result is not only robust to different sample periods, but is also valid at low and at business cycle frequencies, where the variance explained by Global Inflation is about 37 percent on average, and much larger in numerous countries.

Second, consistently with the conclusions of several versions of New Keynesian open economy models, we reject that inflationary shocks spill over across countries have been important. Hence, the international comovement in inflation seem to come from the high correlation of inflation determinants in the OECD. At short horizons, inflation has responded to commodity prices and the international business cycle. At longer horizons, changes in the level of inflation reflect either major changes in the monetary policy regime that have been coincident across countries or at least changes in the mean level of inflation tolerated by central banks. These results are important because they support the notion that inflation can be analyzed directly at the global level, and it confirms that the 70 percent of inflation variance that is global depends on both real and monetary developments.

Third, Global Inflation is an attractor of national inflation, i.e. national deviations from their projection on this attractor are reverted. The evidence is again uniform and robust across sample periods and countries. We also document differences in the long run impact of Global Inflation. Countries that have experienced stronger commitment to price stability (e.g. Germany) are less affected than those with weaker inflation discipline (e.g. Italy). However, this kind of "Error Correction Mechanism" helps predict national inflation of most OECD countries at various horizons and over several samples. As a result, our forecasting model of inflation augmented with the Global Inflation consistently outperforms standard $AR(p)$ and

[2] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, New Zeland, Norway, the Netherland, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Random Walk models of inflation, as well as augmented Phillips curve models à la Gerlach (2003). This seems to be true also in the recent period where unpredictability of inflation has been documented in the recent literature.[3] We argue that existing forecasting models of inflation do not appropriately account for an international perspective which can improve predictability upon a simple Random Walk benchmark. These results could lead the Global Inflation model to become a new standard for forecasting inflation in OECD countries.

Several papers on the international comovement of inflation have appeared since the first circulation of this paper. Mumtaz and Surico (2008) and Monacelli and Sala (2007) use factor models to decompose sectoral national inflation rates into world and national components. Wang and Wen (2007) try to replicate the empirical fact that comovement in inflation rates is higher than the one in output growth in a variety of calibrated New Keynesian two-country models. Cecchetti et al. (2007) investigate the reasons why most G7 countries went through the Great Inflation in the seventies and provide evidence in favour of similar changes in monetary regimes. The main conclusions of these papers do usually not contradict our own.

Our work relates only marginally to the literature on "Globalization and inflation" that analyzes whether the integration of the world economy has changed inflation dynamics.[4] We find that inflation has been dominated by common shocks ever since the sixties and this has not changed over time. Arguably, globalization implies similar terms of trade shocks for OECD countries, an hypothesis that is fully compatible with our model of inflation but one that we do not analyze in this paper.

As a final remark, we shall note that the economic and econometric arguments we use in this paper do not claim to cover all the reasons for why inflation could be driven by global outcomes, nor does it pretend to be exhaustive on the empirical investigation of our findings. We are confident, however, that our results may provide a good starting point for exploring the hypothesis that inflation should –to some extent– be modelled as a global rather than a local phenomenon.

2 Inflation as a global phenomenon

In this section we document the empirical fact that inflation has largely been a global phenomenon over the last 45 years. We first describe our data and their necessary transformations. Then, we estimate the Global Inflation using simple alternative measures. Finally, we provide

[3]See Atkenson and Ohanian (2004), Stock and Watson (2007) and d'Agostino, Giannone and Surico (2006).

[4]See the IMF Spring 2006 World Econmic Outlook, Chen, Imbs and Scott (2004) and the debate on the global slack which opposes Borio and Filardo (2007) to Ball (2006), Rogoff (2006), Woodford (2007) and Ihrig et al. (2007).

some descriptive statistics over different subsamples and different subgroups of countries.

2.1 Data

Sources and transformations of all data are described in more detail in the appendix.

The data used in this section are values of the CPI indices available quarterly from the OECD main economic indicators database from 1960 onward. Our analysis mainly focuses on quarterly year-on-year (y-o-y) inflation rates, which, by construction, have no seasonal pattern. To analyze the fluctuations over the business cycle frequency, we consider a transformation of the data that filter out the lowest and the highest frequencies. We do this using a band-pass filtered CPI inflation rates with a pass band that removes all frequencies but the periods of 6 to 32 quarters.

2.2 Estimating Global Inflation

In what follows, we briefly describe and compare results for three alternative measures of Global Inflation, namely:

1. A cross-country average;
2. The aggregate OECD inflation, published by the OECD; and,
3. A measure based on static factor analysis.[5]

Results reported in subsequent sections are mainly based on the simplest and most intuitive measure, the cross-country average.

The "average" measure is the simple average of the year on year inflation rates of the 22 countries that have been members of the OECD for most of the sample period 1961:2–2006:4.[6] The aggregate OECD inflation is a weighted average of all OECD countries' inflation, where the weights are proportional to GDP. Regarding the common factor analysis, we opted for a parsimonious approximate factor representation (see e.g. Forni et al., 2000; Stock and Watson, 2002) which decomposes inflation rates for the pool of countries as

$$\underset{n\times 1}{\Pi_t} = \underset{n\times 1}{\Lambda} \underset{1\times 1}{f_t} + \underset{n\times 1}{\varepsilon_t} \tag{1}$$

where the first term captures the effect of a common factor (f_t), to which each country responds differently through Λ, whereas the last term refers to the idiosyncratic dynamics which captures

[5] Results are almost identical when using a dynamic factor model as introduced, e.g., by Forni et al. (2000).

[6] The 8 OECD countries that we do not include in our sample are Mexico, Korea, Turkey, the Czech Republic, Hungary, Poland, the Slovak Republic and Iceland.

the components generated by shocks whose effects remain local. We assume orthogonality between f_t and ε_t, and normality of the error term, with $\varepsilon_t \sim N(0, R)$.

An estimation of the factor is obtained using static principal component methods described in Stock and Watson (2002). Data have been previously demeaned and standardized to have unit variance before estimating f_t.

Figure 1 reports the three measures of Global Inflation.[7] Two observations are in order. First, the "average" and the factor model measures are almost identical, while the OECD aggregate deviates from the other 2 series, especially in the second half of the eighties, presumably because of the different sample of countries. Second, the fluctuations and trends in the Global Inflation reflect the major events of the last 45 years. All measures are characterized by two trends, up from 1960 until the late-seventies (associated with the two oil shocks and the decline in OECD productivity) and down thereafter (reflecting tight monetary policies and the debt crisis), and, five or six cycles along the way. Given that both the seventies Great Inflation and the subsequent tight monetary policy have been observed in most countries, the trend components of Global Inflation perhaps should not come as a surprise. As a matter of fact, Corvoiser and Mojon (2005) show that breaks in the mean of inflation largely coincide through out the OECD: around 1970, around 1982 and, to a lesser extent, around 1992. Cecchetti et al (2007) show that the great inflation of the seventies coincide with prolonged periods of overly accomodative monetary policy, a point we discuss further in section 3.

To gauge the extent to which the inflation in individual countries are related to Global Inflation, Figure 2 reports the inflation series of the G7 and of the euro area with their projections on the common factor. Visual inspection reveals not only that the trend is captured accurately, but also that the most relevant cyclical movements are indeed common.

2.3 Descriptive statistics

Table 1 reports the share of the variance of national inflation series that is explained Global Inflation for each of the three measures introduced in the previous section: the simple cross-country average, the OECD aggregate inflation, and the first static common factor.[8] In each case, the national idiosyncratic variance is the complement to one of the figures reported in the table. The last column also shows the share of the variance explained by the second static factor. The table also reports the variance decomposition exercise for the euro area inflation rate.

[7] The OECD aggregate and the "average" have been de-meaned and standardized for the figure.

[8] This share is defined as $\lambda_i^2 var(f_t)/var(\pi_{it})$. It is equivalent to the R-square of a regression of the national inflation rate on Global Inflation and a constant.

First, all measures of Global inflation explain more than two thirds of national inflation rates fluctuations on average. The comovement of inflation is decidedly large. By way of comparison, we find that the global business cycle accounts on average "only" for about one third of the variance of industrial production growth in OECD countries.[9] It is also clear that the second common factor of the inflation series explains only a very limited share of the variance of national inflation series, on average. We consider this fraction small enough that we can model national inflation rates with one common factor only. We also note that the OECD aggregate inflation under performs the other three measures. We conjecture that this is because this aggregate includes countries that are not in our sample. Moreover, within our sample of countries, we also found that averages that are weighted by country size under perform the factors and the simple unweighted average (not reported).

Table 1 ranks (the column 'average' being the reference) the countries by increasing share of the inflation variance that is explained by the common factor. Only five countries have less than 60 percent of this variance explained by Global Inflation. Four of these five countries, Greece being the exception, are usually seen as low inflation economies. We also note that the ranking of the countries has little to do with geography nor the nature of the exchange rate regime.

The fact that non-European countries are spread through out the distribution casts doubt on the argument that Global Inflation among OECD countries is just a reflection that a majority of these countries are located in Europe. We actually estimated another measure of Global Inflation using a sample of six countries evenly split across time zones: Canada, US, UK, the euro area, Japan and Australia. We obtain a even higher median (0.75 instead of 0.73) and mean (0.74 instead of 0.71) share of inflation variance that is explaned by Global Inflation (see the top panel of Table 2). This result reinforces our conjecture that the comovement of national inflation rates does not necessarily reflect only European economic developments.

Moreover, the high degree of comovement in inflation may be seen as trivial because (European) countries in our sample have participated to a monetary union since 1999 after they had pegged their currency to the Deutsche Mark in one way or another since the late seventies. For these countries, most of our sample period, from 1960 to 1973 and then from 1979 to 2007, would be closer to a fixed exchange rate regime than to a one of floating exchange rate. For the other countries in the sample, the high degree of comovement could also come from the long periods of the last 45 years when exchange rate were fixed, mainly up to the

[9] A similar proportion has been found by KOW and used to document the importance of a common world real factor.

mid seventies or under some form of pegs.[10] However, the degree of comovement of inflation remains strikingly high if one looks at countries that did not pursue any sort of fixed exchange rate policies. This can be seen from the second and third panels of Table 2 where we consider the same sub-set of six countries as in the previous paragraph, though, this time, on the post 1974, as well as on the post 1983 sample. We obtain again a high degree of comovement of inflation among countries whose exchange rates were not formally tied together.[11]

Another somewhat easy explanation of the magnitude of inflation comovement is that it simply reflects common trends in the inflation series. This is why we now explore how much of the business cycle fluctuations in inflation are correlated across countries. In Table 3 we report (again ranked taking the column 'average' as reference) estimates of the share of de-trended inflation that is associated to a common factor. The national inflation series were detrended using Baxter and King (1999) band pass filter, which extracts cycles of length comprised between 6 and 32 quarters long with a truncation of 12 lags. These cyclical components of inflation are then used for extracting the common factor at business cycle frequencies (Figure 3). Again, the share of national inflation variance that is common is very large by any standard with mean and median on the order of 37 percent.[12,13]

The comovement of inflation is not only due to the trend component associated with the seventies great inflation and the coincidence of the countries's inflations gradual acceleration up to 1980 and the gradual disinflation that followed. Global Inflation actually explains a large share of the inflation variance also in countries like Switzerland and Germany, that is countries where the seventies inflation have been much smaller than in the average of OECD countries. A comparison of the ranking of countries in Tables 1 and 3 indicates that, in relative terms, Global Inflation seems to matter more at business cycle frequencies for low inflation countries, where the share of variance explained by Global Inflation is among the lowest when we don't remove the trend (Table 1), and just below the average when we do remove it (Table 3). This should be contrasted with the experience of countries such as Sweden and Portugal where the common factor of detrended inflation has less explanatory power for local inflation developments than the non-detrended measure. These results are a first indication that the

[10] For instance, the US and Japan were de facto pegging their currencies between February 1973 and February 1978; Australia had its exchange rate to the US Dollar fluctuate within a narrow horizontal band form October 1974 until November 1982, and the UK were shadowing the ECU in the late 1980's (Reinhart and Rogoff, 2002).

[11] One notable exception is Germany for the post 1983 sample. The divergence of German inflation from the world evolution around the reunification explain this low degree of co-movement.

[12] These results hold for other detrending methods such as the HP fitler or the first difference filter of inflation.

[13] An alternative approach, which consists of comparing the coherence of the cross spectra of Global Inflation and national inflation rates at each frequencies, provides very similar results. For most countries, this coherence is positive and typically superior to 0.5 at both low and business cycle frequencies. The results (not reported) are available upon request to the authors.

low frequency comovement of inflation is likely due to monetary policy, a point we come back to in section 3.

Finally, we have computed the cross-correlation of Global Inflation with national inflation series at several leads and lags. This exercise is useful to figuring out whether inflation tends to lag or lead Global Inflation in some of the countries. Results (not reported, but available upon request) show that almost no country is markedly leading or lagging global developments. This is a first indication against the possibility that inflation in a particular country (e.g. the U.S.) has been systematically spilling over to the rest of the OECD countries and that our focus on Global Inflation mistakenly picks up that one country sets the OECD inflation trend.

3 Why has inflation been a global phenomenon?

Given the finding that Global Inflation explains a substantial proportion of national inflations' variance, this section analyzes the likely causes of such commonality, provides quantitative estimates of the sources of the commonality, and investigates the determinants of the global factor. We make two important steps in the analysis of international inflation comovement. First, we reject that this comovement is due to spillovers of country specific shocks, thereby bringing support to the conclusions of New Keynesian models of monetary policy in open economies. Second, we describe the nature of the common shocks that explain the comovement of inflation across countries. At a short horizon, the variance of global inflation is largely explained by commodity price shocks and the world business cycle. At a longer horizon, global inflation echoes major changes in the monetary policy regime that have taken place simultaneously across OECD countries.

3.1 Some theoretical considerations

The comovement of OECD inflation rates can stem from two general sources:

- common shocks that spread evenly or at least simultaneously across countries;
- country specific inflationary shocks that spill over from one or a subset of countries.

The first possibility is somewhat uncontroversial. Commodity price shocks, internationally correlated productivity shocks, cost push shocks or changes in the stance of monetary policy could have analogous impacts on OECD inflation rates and therefore induce comovement in inflation rates. The common shocks should induce more comovement in inflation if they have a strong permanent component, or account for a larger share of the variance of inflation determinants, and if the responses of national inflation rates to these shocks are similar across countries.

The possibility of synchronization stemming from spillovers is more challenging. For instance, in the context of a stylized two country New Keynesian model, such as the one derived by Clarida et al. (2002), there is no spillover of inflation across countries when the central banks implement optimal policy independently from one another – a situation that is more likely to characterize the floating exchange rate regime that prevailed since 1975. In fact, in absence of cooperation, domestic inflation and output depend only on domestic cost push shocks.[14] In the case of policy cooperation, cost push shocks in one country can spill over abroad. Effectively, the domestic central bank would set its output gap as a function of both home and foreign inflation. But its policy would depend on the sign of the effects of foreign output on domectic marginal costs. Clarida et al. (2002) stress that this sign is indeterminate.[15] Hence, cross-country inflationary spillovers need not be positive. And negative spillovers would hardly explain the international comovement of inflation.[16]

The case against positive spillovers is reinforced by Wang and Wei (2007) and by Woodford (2007). Wang and Wei (2007) explore calibrated New Keynesian models with either sticky information or sticky prices in order to assess whether monetary shocks could generate the high degree of international inflation comovement that we see in the data. They show that, unless the monetary shocks are themselves correlated, there is little international comovement in the inflation. Woodford (2007) shows that in the context of sticky price two country models, central banks keep the control of domestic inflation. For instance, stimulative foreign monetary policy does not affect domestic inflation directly, and its indirect effects through the foreign output gap occurs through depressing the domestic output gap.

These modeling exercises have two important limitations. First, they tend to focus on one specific shocks (cost push for Clarida et al. and monetary for Wang and Wei). We cannot rule out though that, in the data, a particular combination of shocks could boost the comovement in inflation rates that would be due to spillover.[17] One such spillover channels put forth by

[14]Note, however, that this solution is compatible with a high correlation between different country inflations also if similar and independent cost-push shocks hit the two economies at the same time. Such coincidence would be observationally equivalent to common shocks.

[15]In the more likely case of intertemporal elasticities of substitution ($1/\sigma$ in Clarida et al's notations) inferior to one, the elasticity of domestic marginal cost with respect to foreign output is positive and the spillover of a foreign cost push shock on domestic inflation is negative.

[16]Even in the case of a monetary union, the ultimate degree of monetary cooperation, it is difficult to rule out that negative inflation spill-overs could be important. In particular, as long as the central bank loss function depends on the average inflation in the two countries, a shock to inflation in one country would lead to a higher interest rate for both countries and, potentially, a negative response of inflation in the other country.

[17]The simulations reported in Wang and Wei (2007) also show that the degree of inflation comovement obtained in calibrated two-country models can be very sensitive to modeling assumptions. Some of these, such as opting

McKinnon (1983) result from the resistance of central banks to see the dollar either depreciate too much or appreciate too much. He argues in particular that large scale interventions on Forex market could have led to over issuance of money when the dollar depreciated in the seventies and under issuance in the early eighties. For these consideration, in section 3.2 we assess systematically whether spillovers have been important in the data.

Second, these models describe inflation fluctuations around constant steady state inflation rates. Hence, they may not be the best tool to analyze the trend evolution of inflation and the observed international comovements at low frequencies. Both theoretical and narrative evidence strongly point to monetary policy as the single determinant of trend inflation. Ball (2006) argues that even in small open economies, central banks retain the ability to stabilize inflation at the level of their choice. Moreover, the narrative evidence on shifts in the practise of monetary policies is compelling. We know for instance that major changes in monetary policies clustered in two periods of a few years in a majority of OECD countries. First, the early eighties saw both the US disinflation and the European Monetary System based disinflation in Europe. Ten years later, most OECD countries were either embarking on the low inflation single currency planned by the Maastrischt treaty or adopting inflation targeting at lower inflation rates than the one that prevailed in the eighties. Turning to the United States, Goodfriend (2007) argues that a common understanding that core inflation should be kept near 2 percent arose in the Federal Open Market Committee in 1995. Hence, the nineties have witnessed all countries of our sample setting up monetary policy regimes with an inflation objective graviting around 2 percent, and the central banks adopting an explicit or implicit commitment to keep it there. Ex post, notwithstanding the acceleration of world inflation in 2007 and 2008, inflation has remained remarkably close to the quantified inflation objective or target of the central banks.[18]

Hence, the common trend in inflation since the late seventies is easily related to the evolution of monetary policies. What about then inflation acceleration in the sixties and seventies? Cecchetti et al (2007) show that the Great Inflation of the seventies relates to continued periods of loose monetary policies in several G7 countries. The main exception is Germany, where the low tolerance of the independent Deutsche Bundesbank for inflation in that period is a widely acknowledged fact. It is precisely the anti-inflation credibility of the German central bank that led other European countries to anchor domestic inflation expectations through a peg of their currency to the Deutsche mark from 1979 on within the European Monetary System.

for "cash in advance" rather than "money in the utility function", are however difficult to relate to the evolution of OECD countries since 1960.

[18] Diron and Mojon (2008) show for instance that at one and two-year horizons, inflation targets have been predictors of inflation.

Altogether, theory and narrative evidence suggest that trend inflation have been dominated by changes in the mean level of inflation chosen by monetary authorities. This conclusion shifts the problem to understanding why major changes in monetary policies with comparable impacts on trend inflation have coincided across OECD countries. Potential explanations include "peer pressure" between central banks,[19] changes in the dominant paradigm in monetary economics,[20] and common changes in preferences due to common demographic trends such as the baby boom. It however goes beyond the scope of this paper to test these alternative explanations.

Fluctations of inflation around its trend also have a fair amount of commonality as we showed in section 2. These fluctuations might reasonably have less to do with shifts in monetary regimes and more with responses to non permanent common shocks.[21] The most likely suspects are shocks to the price of commodities as well as common shocks to output gaps that reflect the international business cycle (KOW, 2003). In section 3.3, we test these hypotheses by reporting the ability of various common inflation drivers, be they monetary or real, to forecast global inflation either in the short run or over a longer horizon.

3.2 Common shocks versus international spillovers

Here we check whether spillovers have been important in the data. Following Stock and Watson (2005) we extend the specification in (1) with an autoregressive component and decompose the shocks to inflation of G8 countries (G7 and Australia)[22] into three sources: common, cross-country spillovers and domestic shocks.

Using the same notation as before and denoting by Π_t the vector of year-on-year inflation rates, the reduced form VAR is

$$\Pi_t = A(L)\,\Pi_{t-1} + \nu_t$$

where the error terms have a factor structure

$$\nu_t = \Lambda f_t + \eta_t$$

[19] See for instance Besley and Case (1995) for a model of endogenous influences of public policies across geogrpahic areas. It is also stricking that breaks in the mean of inflation in the OECD have clustered around a few years, a result that reinforce the view that central banks have implemented good and bad monetary policies together (Corvoisier and Mojon 2005).

[20] One could consider (and eventually check) that the Cogley and Sargent (2005) explanation of the Great Inflation is also valid in other countries.

[21] The existence of comonalities in the evolution of monetary policy help explain the commonalities in the trend or long run dynamics of inflation, but could in fact reduce the importance of the global component in inflation at the business cycle frequencies if, for instance, all central banks following the same reaction function were perfectly offseting inflation movements due to global forces. We thank the referee for pointing out this important issue to us.

[22] Australia helps rebalance this subset of countries across time zones.

As before, f_t is the vector of (possibly k) common international factors and, as in Stock and Watson (2005), we assume the following

$$\begin{aligned} E\left(f_t f_t'\right) &= diag\left(\sigma_{f_1}^2, ..., \sigma_{f_k}^2\right) \\ E\left(\eta_t \eta_t'\right) &= diag\left(\sigma_{\eta_1}^2, ..., \sigma_{\eta_n}^2\right) \end{aligned}$$

The common factors are identified as those factors that affect domestic inflation in all countries contemporaneously. This is the same specification as in (1) with a VAR structure of the endogenous variable which now, given the assumptions, allows us to decompose the h-step ahead forecast error variance for inflation into the sum of three sources: common shocks, idiosyncratic shocks, and spillovers of domestic shocks from the other countries.

In Table 4 we report the variance decomposition at 1, 4 and 16 quarters ahead for three sub-periods.[23] Note first that given the identification assumption, at one-quarter horizon spillovers do not account for any explained variance. At longer horizon they might account for a variance between 4 percent and 24 percent for particular countries, and between 9 percent and 15 percent on average across countries. As expected, most of the variance is explained by the international factors. Summing up column (1) and (2) the percentage of the variance explained by the common factors is roughly the one that we have found in Section 2, both at short and long horizons. Overall, then, these findings qualify those that have been discussed before, and show that among the common sources, spillovers – though not entirely ruled out – account only for a small portion of the common inflation variability.[24]

3.3 The determinants of global inflation

To determine whether, when and by how much Global Inflation may be linked to commodity prices, real or monetary shock or a combination of these and perhaps other shocks, we evaluate the predictive power of a set of standard inflation determinants. We proceed with a Bayesian model selection analysis which is particularly suited to select relevant regressors among a wide pool of candidate explanatory variables. A detailed description of the methodology is available in Ciccareli and Mojon (2005).

[23] Estimation is done using Maximum Likelihood methods and a factor model approach a la Forni et al (2000) where the k common factors are generated by q shocks, where $q < k$. Note that the system is overidentified. Likelihood tests for overidentification restrictions reject the null of up to 2 international factors and one shock against the unrestricted alternative of Σ_ν having full rank. Results of this part are therefore based on a specification with three international factors generated by one common shock.

[24] Because spillovers could in principle depend on the degree of monetary cooperation between countries (Clarida et al 2002) we tested in cross section whether the bilateral spill overs were correlatated with the variance of bilateral exchange rates. This correlation is based on 42 observations of bilateral spill overs and exchange rate variability among the G7 countries for either the full sample, 1961 to 1984 and 1985 to 2007. These correlations are very close to zero.

We limit our analysis to a number of variables widely argued to either affect or help forecast inflation. Among these, we include two indices of commodity prices, variables that should be correlated with marginal costs, i.e. real GDP growth, unit labor costs and wages and asset prices. We also consider the possibility that the U.S. macroeconomic policies trigger inflationary pressures both at home and abroad. We measure the U.S. fiscal stance by the fiscal deficit. This allow us to test in particular the view that the increase in public decifit associated to the Vietnam war is correlated with the take off of Global Inflation in the first part of the sample. The potential spillovers of U.S. monetary policies on Global Inflation, i.e. the McKinnon (1982) hypothesis, is also tested through testing by including the effective exchange rate among the explanatory variables.

Finally, we consider the stance of monetary policy. Because there is no consensus on how one should measure this concept, we investigate two possibilities. For the first one, we compute a Taylor rule residual as follows:

$$\text{Taylor residual}_t = 1.5\pi_t - 0.5(y_t - y_t^*) - i_t$$

where i_t is a short-term interest rate, π_t is inflation and $y_t - y_t^*$ is the HP filter based output gap. For the second measure, we use the growth rate of a monetary aggregate (M3).

For each variable, we extract a common factor in a similar way as we had done for inflation, i.e. taking unweighted averages of the variables of interest. However, because some of the variables are not available at quarterly frequencies early in the sample, indicators are obtained by averaging across national variables from the G7 and Australia. These averages explain usually between 1/3 (e.g. for real GDP growth) and 1/2 (e.g. for monetary aggregates) of the variance of national time series on average across countries.[25] This extraction is not performed for U.S. fiscal deficit, the dollar exchange rate and the inflation of commoditiy prices for obvious reasons.

We focus the analysis on the 1970-2006 sample because many of our variables were not available beforehand or since 2007. Within this 35 years sample we further check the stability of the results across the 1970-1990 sample and 1991-2006 sample. This latter sample should be particularly interesting with respect to the causality between monetary policies and Global Inflation. In that period, central banks have aimed at stabilizing inflation around a constant explicit or implicit inflation target. As the common approach to monetary policy has become to anchor inflation expectations at a constant level, and constants cannot be correlated, indicators

[25]Results using the dynamic factor or the existing OECD aggregates to compute the "Global" explanatory variables of inflation are quite similar to the ones reported here. The exact figures are available from the authors upon request.

of the stance of monetary policies should not help forecast Global Inflation in that period.

The results of the Bayesian selection algorithm are shown in Table 5. The *prob* column gives the probability that the variable is significant, i.e., the probabilty that the variable is included in the searched model, b gives the elasticity of global inflation vis-à-vis the variable and the last column gives the standard error of b. Several findings are worth emphasizing.

Looking first at the 1970-2006 sample, only a few variables contain forecasting power with regards to Global Inflation. Cost variables, including commodity prices and real GDP have a positive impact on Global inflation within 4 quarters. At 8 quarters horizon, stock prices, the dollar and indicators of the world stance of monetary help forecast inflation. In particluar, fast growth of M3 and smaller interest rates than the Taylor rule norm tend to be followed by higher inflation. This result strongly support the narrative evidence reported above and the conclusions of Cecchetti et al (2007) that the trend evolution of inflation in the OECD has been dominated by commonality in the stance of monetary policy and, possibly, by changes in the preferences of monetary authorities. We should also stress that the predictive power of the Dollar, though only over the full sample, comforms to the prediction of McKinnon (1983) that changes in the stance of monetary policies across countries might have been partially induced by spillovers of low frequency changes in stance of U.S. monetary policy. A weaker dollar has been followed, 8 quarters later, by a rise in Global Inflation.

The sub-sample results are also quite interesting. In particular, the information contents of M3 growth and the Taylor rule residuals are much less relevant for Global Inflation eight quarters ahead, as one would expect given the success of central banks in stabilizing inflation. We even notice that a weaker stance of monetary policies, as defined by more positive or less negative Taylor rule residual help forecast a decline in inflation at horizon 4 and 8 quarters. This may indicate that such deviations from the Taylor rule are much less persistent and more likely to be reverted in the recent subsample.

The relevance of wages and house prices since 1990 also is worth underlining. A major shock that could have affected wages similarly across countries in the last two decades is the emergence of China. However assessing whether this major labor supply shock has affected the impact of OECD wages on inflation would require further research that goes beyond the scope of this paper. Turning to house prices, we know that there has been a worldwide acceleration of house prices since 1995 in most OECD countries (Germany and Japan being the notable exceptions). Our results suggest that central banks should monitor house prices, not only because they may relate to credit fed asset bubble cycles that put banking systems in danger, but also because they carry relevant information for future inflation.[26] Finally, both wages and house prices might surely play a valuable role to overcome the recently noticed unpredictability inpredictibility (Atkenson and Ohanian, 2001; Stock and Watson, 2007 and d'Agostino, Giannone and Surico, 2006).

Overall, the findings reported in this section reveal a robust sensitiveness of Global Inflation to real and monetary determinants when measured at the global level. This reinforces the view that, possibly, economists working on inflation may need to reconsider the relevance of closed economy models of inflation.[27] As a matter of fact, in a majority of OECD countries, reduced form models of the type we estimated for Global Inflation are unable to obtain significant coefficients for any variables beyond the own lags of inflation itself (Corvoisier and Mojon, 2005). From this perspective, our results for Global Inflation are good news because they show that there exist one level of aggregation at which leading indicators of inflation indeed contain exploitable information about future inflation. Finally, the response of Global Inflation to both real determinants –at short horizons– and monetary determinants –at longer horizon– invite central banks to monitor both categories of inflation determinants. This surveillance, however, should be done not only at the level of countries, but also more globally to account for informational content of common international evolutions of inflation.

4 Predictive implications of Global Inflation

In this section, we describe the impact of Global Inflation on national inflation rates. We show that Global Inflation behaves as an attractor of the national inflation rates. This mechanism is important both to guide our understanding of the inflation process and to pursue practical policy purposes such as forecasting.

4.1 Global Inflation is persistent and "attractive"

Using the simple framework of the factor representation of section 2, it is easy to show that domestic inflation reverts to the global component – which acts as an "attractor" – and is characterised by stationary fluctuations around the latter. In the factor representation, an estimate of national inflation is simply given by

$$\begin{aligned}\hat{\varepsilon}_{i,t} &= \pi_{i,t} - \hat{\lambda}_i \hat{f}_t \\ \hat{\varepsilon}_{i,t} &= \rho_i \hat{\varepsilon}_{i,t-1} + \upsilon_{i,t}\end{aligned}$$

[26]See the discussion in Borio and Lowe (2002).
[27]This point is also made by Borio and Filardo (2007) though for different reasons.

where $\hat{\lambda}_i$ is an estimate of the country-specific loading and $\hat{f}_t$ is our preferred measure of global inflation.

To check whether domestic inflation reverts to the global component it suffices to check the stationarity of $\hat{\varepsilon}_{i,t}$. Table 6 reports the estimates of ρ_i the first autoregressive coefficients in an AR(1) representation for $\hat{\varepsilon}_{i,t}$, while Table 7 reports the $\hat{\lambda}_i$.[28] Estimates of ρ_i are on average not higher than 0.5, which implies that, in the available sample of countries, a temporary shock to inflation is on average absorbed in five to seven quarters at most. However, the same estimate for the global inflation is on average much higher than those of countries' inflations, both on the whole sample and on single subsamples.

On the whole sample, therefore, the global component captures the most persistent and possibly non-stationary part of inflation.[29] This result is in line with the finding that estimated global factor would capture the non-stationarity of the data used to estimate the factor (see e.g. Bai and Ng 2002). In this case, then, the global inflation behaves as an attractor and domestic inflation fluctuates around its projection on this attractor.

Incidentally, the importance of the global component of inflation leads us to reconsider the debate on inflation persistence. Two main conclusions emerge from the recent studies on inflation persistence. First, empirical estimates of inflation persistence fall when statistically significant shifts or breaks in the mean of inflation are accounted for.[30] Second, the question of what drives the break in the mean has not received a clear answer yet.[31] Both evidence on the importance of the mean of inflation and of common patterns in possible breaks in the mean are consistent with the view that inflation is a global phenomenon. Therefore, consistently with our findings and considering our measure of global inflation as a common long run mean, we can conclude also that inflation of 22 OECD countries exhibit lower persistence once we control for the dependence of the national inflation processes on Global Inflation. In a previous version of this work, we have also shown that inflation persistence might have not been stable over time.[32] The question of stability is relevant from an econometric point of view, as any measure of persistence of a time-varying structure is biased if time variation is not accounted for. Results here broadly confirm the time-varying ones, where the global factor captures the

[28]For this exercise we use annualised quarter-on-quarter trasformations of seasonally adjusted inflation series, i.e. $\pi_{i,t} = 400\,(P_{i,t}/P_{i,t-1} - 1)$.

[29]With a year-on-year transformation, the AR(1) coefficient of the global component is not different from one, whereas the average coefficient of country inflations is not higher than 0.85.

[30]Robalo Marques (2004), among others, has recently argued that the mean of inflation plays a crucial role in the definition of persistence and that any estimate of persistence should be seen conditional on a given assumption for the mean of inflation.

[31]See for instance the discussion by Rogoff (2003).

[32]See Ciccarelli and Mojon (2005) and Mumtaz and Surico (2008).

persistent component of inflation on the whole sample, and its persistence declines ove the last 10-15 years.[33]

It is also worth noting that the estimates of the loadings of inflation rates on Global Inflation are evenly distributed, across countries, around one (see Table 7). These loadings summarizes the "echo" of Global Inflation changes on national inflation rates, on average, since 1960. Countries that have historically been considered as high inflation countries, have, not surpringly a loading higher than one. Germany, on the contrary, has the lowest loading among G7 countries. The sub-sample results, with notable exceptions, would also indicate some sort of convergence to more similar values.

4.2 A new benchmark for forecasting inflation?

A well documented result in the forecasting literature is that reliable leading indicators of inflation are scarce. For example, Stock and Watson (1999, 2003), Banerjee et al (2003) and Banerjee and Marcellino (2002) all conclude that, while some leading indicators of inflation outperform the forecasts based on simple AR(p) models of inflation in some countries and for some sample periods, none has yet emerged that systematically beat the AR(p) (typically AR(1) or AR(2) of level inflation), or even the Random walk (RW). It has been also argued therefore that – especially over the last 10-15 years – inflation has become harder to forecast, in the sense that *it has become much more difficult for an inflation forecaster to provide value added beyond a univariate model* (Stock and Watson, 2005). This finding had already been documented by Atkeson and Ohanian (2001) – who found that backwards-looking Phillips curve forecasts were inferior to a RW forecast– and more recently by D'Agostino et al.(2005) – who show that the ability to predict several measures of inflation and real activity declined remarkably, relative to naïve forecasts, since the mid-1980s.

All this literature, however, only focuses on the U.S. economy. To the best of our knowledge, a systematic comparison of similar features for the other industrialised economies has not been carried out yet. The issue is also partially related to the debate on the Great Moderation, which has also not attained an international momentum. Both topics are on our current research agenda. For our purposes here, however, the previous discussion can help shed new light on the issue of predictability of inflation, particularly by taking into account the international commonalities of inflation. The question is: Can the international environment help predict national inflation?

In this section, we sketch an answer by considering a parsimonious specification simply

[33] For a similar result with disaggregate data see also Angeloni et al. (2006).

augmented with the global component of inflation.

Consistently with previous sections, we start from the usual common h-step ahead specification (Stock and Watson, 2002)

$$\pi_{i,t+h}^{h} = \alpha_{i,0}^{h} + \alpha_{i,1}^{h}(L)\,\pi_{i,t} + \alpha_{i,2}^{h}(L)\,\hat{f}_t + u_{i,t+h} \tag{2}$$

where the factor $\hat{f}_t$, instead of summarising hundreds of series, is simply the common component of the 22 national inflation series:

$$\pi_{i,t} = \lambda_i f_t + \varepsilon_{i,t}$$

estimated with the average or the static principal component approach.

Notation and strategy are similar to the ones employed by Stock and Watson (2002). In particular, the multistep forecasts is linear in $\hat{f}_t$ and π_t (and lags), and an h-step-ahead projection is used to construct the forecasts directly. Therefore, after estimating all unknown up to time T, we use (2) and forecast $\pi_{i,T+h}^{h}$ from $\hat{\alpha}_{i,0}^{h} + \hat{\alpha}_{i,1}^{h}(L)\,\pi_{i,T} + \hat{\alpha}_{i,2}^{h}(L)\,\hat{f}_T$ for each unit i and step h. The dependent variable is defined as $\pi_{i,t}^{h} = (400/h)\ln(P_t/P_{t-h})$ – the h-period annualized inflation in the price level P_t – whereas $\pi_{i,t} = \pi_{i,t}^{1}$ is the quarter-on-quarter quarterly inflation rate.

As said, this specification is a well known factor-augmented econometric relationship. Here we simply argue that a very parsimonious search of the factor f_t, only based on an average of inflation series, can outperform or be as competitive as the usual benchmarks, without the need to choose an optimal number of factors from hundreds of variables. The important issue, however, is the appropriate consideration of an international ingredient summarised in f_t, which, as noted previously, works as an attractor for national inflations.

Because we want to keep the discussion limited to the scope of the paper, we check the forecasting performance of our model only against three natural competitors. The first one is an AR(p) of the form

$$\pi_{i,t+h}^{h} = \alpha_{i,0} + \alpha_{i,1}(L)\,\pi_{i,t} + \varepsilon_{i,t+h} \tag{3}$$

where the lag length p is imposed equal to 1 or optimally chosen with a standard BIC.

The second model is a Random Walk (RW)

$$\pi_{i,t+h}^{h} = \pi_{i,t} + \varepsilon_{it+h} \tag{4}$$

We pay particular attention to this naive specification – especially on recent samples – to check the issue of the unpredictability raised e.g. by D'Agostino, Giannone and Surico (2005) and Stock and Watson (2007).

A third benchmark can be considered along the lines of Stock and Watson (1999), Nicoletti-Altimari (2000) and Gerlach (2003) by setting an augmented Phillips curve model where the first difference of inflation depends on its own lags and on the lags of the growth rates of industrial production, oil price and M3. Specifically, it is:

$$\begin{aligned}\pi_{i,t+h}^{h} &= \alpha_{i,0} + \alpha_{i,1}(L)\,\pi_{i,t} + \alpha_{i,2}(L)\,\Delta IP_{it} \\ &\quad + \alpha_{i,3}(L)\,\Delta M3_{it} + \alpha_{i,4}(L)\,\Delta Oil_{t} + \varepsilon_{i,t+h}\end{aligned}$$

The experiment is conducted in a "pseudo real-time" framework with all models re-estimated at each step using only information up to time t. We choose the lag length to be one or two for the AR component of each model, while fixing to four the number of lags of f_t. The evaluation and comparison are made over three forecasting periods, 1980-2004, 1980-95 and post 1995, and for eight forecasting horizons (quarters). We report results only for the last subsample at the one-year ahead horizon. The choice of the subsamples is motivated by the issue of unpreditability over the last 15-20 years, and the choice of the horizon by the policy relevance.[34]

Tables 8 report the RMSE of our preferred specification (2) relative to the RMSE of the four competing models. Clearly, our specification is preferred in a forecasting sense if the reported statistic is lower than one. A rough comparison across the three benchmarks can also be made: the bigger the reported statitics for a model the better its performance with respect to the others. So, for instance, if the reported statistics for RW is greater than the one for AR, then the former is preferred. The significance of these ratios is checked with a simple test on the difference between two competing Mean Squared Forecast Errors, adjusting the statistic when models are nested (Clark and West 2007). Bold entries in the table denote 10 percent significance.

Overall results show that our model can outperform the competing models in forecasting inflation on average, across forecast horizon and over evaluation periods, and for most countries. Improvements are of the order of up to 16 percent with respect to the augmented Phillips curve specification, 15 percent with respect to the RW and 20 percent with respect to the standard AR. Our model seems to perform particularly well on the 4-quarter-ahed horizon, which is the most relevant one for policymaking, and over the last 10 years, where the unpredictability related to the Great Moderation should be more evident.

These conclusions are consistent both with the fact that the Global Inflation works as an anchor for national inflations and with a somewhat expected greater commonality among

[34]Results for other subsamples and horizons are not reported because qualitatively very similar. A version of them are available in Ciccarelli and Mojon (2005).

inflations from the nineties (e.g. Rogoff, 2003). Our interpretation of the results is that the unpredictability of inflation is related to the use of "local" vs. "global" models, and might not necessarily be true for all industrialized countries. Our findings are remarkable, and have the potential features of a new benchmark for forecasting inflation, based on the incorporation of global information in the standard models.

Note finally that over the evaluation sample 1995-2004 there is indeed an issue of unpredictability for the average (or median) country, in that the reported statistics for RW are greater than the one for AR and Phillips curve. However this ratio is lower than 1 (and significantly so for many countries), meaning that our preferred specification is able to beat on average the random walk.

Our preliminary conclusion, then, is that a simple parsimonious extension of a standard AR model, where we consider the attraction role of the Global Inflation, outperform robust predictors of inflation. The results confirm also the importance of exploiting the international links and commonalities as advocated by the recent empirical Factor-Model literature. What makes our contribution particularly valuable is the search of the factors in a global rather than a domestic information set, and the interpretation of the common factor as an attractor of national inflation. Our parsimonious specification, where the global factor is a simple average of 22 national inflation series, seems to forecast well future developments of national inflation. The latter result, which holds across countries, samples periods and forecasting horizons, is obviously one of the main contributions of our current research that deserves further investigation.

5 Conclusions

In this paper, we have shown that the inflation of the OECD countries have moved together over the last 45 years. This comovement accounts for 70 percent of the variability of country inflation, on average. Moreover, there is a powerful and robust "error correction mechanism" that brings national inflation rates back toward the level of their long term projection on Global Inflation. As a first practical application of the idea of Global Inflation, we present a fairly parsimonious model of inflation forecast. The preliminary findings suggest that the new specification beats standard competitors.

The main open question is to assess whether these results reflect some sort of statistical "return to the mean" phenomenon or whether some deeper endogenous economic adjustments are at work. For example, some determinants of inflation are global: the price of commodities is the same for all countries; KOW have shown that there is a global business cycle; last but not least, it seems that monetary policy concepts are effectively spreading among central banks. In some periods, bad monetary policy strategies are dominating for a majority of countries. At other times, good strategies appear dominant.

We show that Global Inflation does not result from countries spillovers but rather from common shocks. It responds to commodity prices, the global business cycle and the global trends of liquidity. We further qualify that real developments are more relevant at short horizons and monetary developments matter at longer horizons.

Our paper has two important policy implications. First, given the importance of Global Inflation for local inflation, the nature of Global Inflation brings support to the monetary policy strategies that give importance both to real and monetary developments in their assessment of inflationary pressures. Second, there may be a useful informational content in the average of foreign inflation records, even for countries that, like Switzerland, were on average less affected by common developments in inflation.

Future research to which the authors will contribute should follow mainly three directions. The first one is to extend the sample of countries and regions to emerging markets, and assess the importance of global, regional and domestic mechanisms that help explain inflation developments. The second one is to explore more systematically the forecasting performance of the Global Inflation Model, and compare it with the performance of other univariate and multivariate specifications, across other samples and cross sections of countries. Finally, we should try to gain insights on the nature of the shocks that drive Global Inflation and their transmission to country inflations. Our belief is that to a large extent the results reported in this paper may reflect the importance for central bankers of exchanging views and cooperating in the design of their monetary policy concepts. Hence, paraphrasing the conclusion of the 1848 Communist Manifesto we would like to invite:

"*central bankers of all countries: unite!*"

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APPENDIX. Data source and transformation

Definition	Source	Transformation
Consummer price indices	OECD Main Economic Indicators	y-o-y growth rates
Hourly earnings	OECD Main Economic Indicators	y-o-y growth rates
Industrial production	IMF International Financial Statistics	y-o-y growth rates
Short-term interest rate (3-month)	OECD Economic outlook	level
Long-term interest rate (10-year)	OECD Economic outlook	level
GDP	Eurostat and OECD Economic outlook	y-o-y growth rates
Commodity prices	Bridge/Commodity Research Bureau; Spot market price index: All commodities; www.freelunch.com	y-o-y growth rates
Oil price	Fed St Louis Oil price: Domestic West Texas Intermediate	y-o-y growth rates
US government fiscal deficit	Net lending or net borrowing (-); Table 3.2. Federal Government Current Receipts and Expenditures; Bureau of economic analysis	level
Stock prices	BIS unpublished data base, Borio and Lowe (2002).	y-o-y growth rates
Real estate prices, housing indices	BIS unpublished data base, Borio and Lowe (2002).	y-o-y growth rates
Broad money (M3)	euro area countries (Eurostat Balance sheet items); Canada, Denmark, Sweden and United Kingddom (OECD MEI); Australia, Japan, New Zeland, Norway Switzerland and United States (OECD Economic Outlook); for Austria, Belgium, Finland, France, Germany, Ireland	y-o-y growth rates

Table 1. Share of inflation variance explained by alternative measures of Global Inflation

	Average	OECD	Static factor	
			first	second
Greece	0.41	0.65	0.37	0.16
Switzerland	0.46	0.24	0.41	0.16
Japan	0.55	0.29	0.52	0.15
Netherlands	0.58	0.25	0.57	0.20
Germany	0.60	0.33	0.57	0.16
New Zeland	0.63	0.61	0.61	0.14
Portugal	0.65	0.65	0.63	0.09
United States	0.69	0.72	0.67	0.02
Norway	0.70	0.57	0.68	0.03
Australia	0.73	0.70	0.71	0.06
Denmark	0.73	0.53	0.71	0.00
Austria	0.74	0.40	0.72	0.12
Spain	0.75	0.58	0.74	0.03
Sweden	0.76	0.63	0.71	0.02
Luxembourg	0.76	0.48	0.77	0.02
United Kindom	0.82	0.66	0.80	0.00
Finland	0.83	0.58	0.81	0.01
Canada	0.83	0.75	0.81	0.04
Belgium	0.84	0.56	0.84	0.03
Ireland	0.85	0.61	0.86	0.00
Italy	0.86	0.81	0.86	0.03
France	0.89	0.73	0.89	0.00
mean	0.71	0.56	0.69	0.07
median	0.73	0.59	0.71	0.03
euro area	0.95	0.76	0.95	0.00

Note: 1961:1-2007:2. The euro area aggregate inflation is not included in the pool of 22 countries used to estimate Global Inflation.

Table 2: Share of inflation variance explained by average inflation for a selection of six countries

	1961-2007	1975-2007	1984-2007
Australia	0.71	0.70	0.37
Canada	0.83	0.86	0.69
Germany	0.63	0.63	0.26
UK	0.88	0.91	0.83
Japan	0.61	0.83	0.66
US	0.78	0.81	0.67
mean	0.74	0.79	0.58
median	0.75	0.82	0.67

Note: Global inflation is here defined as in column 1 of Table 1, i.e. as the unweighted average of the inflation rates of the six countries of this table.

Table 3. Share of detrended inflation variance explained by alternative measures of Global Inflation

	Average	OECD	Static factor
Portugal	0.03	0.01	0.02
Spain	0.10	0.00	0.03
New Zeland	0.10	0.01	0.05
Norway	0.15	0.02	0.09
Greece	0.27	0.29	0.19
Sweden	0.28	0.08	0.17
Netherlands	0.29	0.08	0.29
Denmark	0.30	0.21	0.21
Germany	0.32	0.08	0.26
Australia	0.35	0.20	0.26
Canada	0.36	0.20	0.29
Finland	0.39	0.15	0.34
Luxembourg	0.40	0.05	0.40
United Kingdom	0.40	0.24	0.35
United States	0.43	0.57	0.42
Switzerland	0.44	0.22	0.33
Austria	0.47	0.12	0.43
Japan	0.54	0.49	0.46
Ireland	0.57	0.20	0.57
France	0.61	0.49	0.64
Italy	0.61	0.41	0.60
Belgium	0.63	0.24	0.64
mean	0.37	0.20	0.32
median	0.37	0.20	0.31
Euro area	0.83	0.34	0.84

Note: 1961:1-2007:2. The inflation series are detrended by applying the band pass filter of Baxter and King (1999). The euro area aggregate inflation is not included in the pool of 22 countries used to estimate Global Inflation.

Table 4: Decomposition of inflation dynamics into common shocks, international spill overs and countries own shocks

		1961-2007				1961-1983				1984-2007			
		(1)	(2)	(3)=(1)+(2)	(4)	(1)	(2)	(3)=(1)+(2)	(4)	(1)	(2)	(3)=(1)+(2)	(4)
	horizon	**global shock**	**spillovers**	**common**	**own shock**	**global shock**	**spillovers**	**common**	**own shock**	**global shock**	**spillovers**	**common**	**own shock**
Canada	0	0.71	0.00	0.71	0.29	0.34	0.00	0.34	0.66	0.43	0.00	0.43	0.57
	4	0.69	0.14	0.83	0.17	0.51	0.09	0.60	0.40	0.47	0.12	0.59	0.41
	16	0.70	0.19	0.89	0.11	0.60	0.14	0.74	0.26	0.47	0.15	0.61	0.39
France	0	0.37	0.00	0.37	0.63	0.22	0.00	0.22	0.78	0.57	0.00	0.57	0.43
	4	0.57	0.07	0.64	0.37	0.51	0.07	0.58	0.42	0.47	0.16	0.63	0.37
	16	0.64	0.11	0.75	0.25	0.60	0.11	0.71	0.29	0.45	0.24	0.70	0.30
Germany	0	0.31	0.00	0.31	0.69	0.32	0.00	0.32	0.68	0.84	0.00	0.84	0.16
	4	0.41	0.04	0.45	0.55	0.38	0.04	0.42	0.58	0.66	0.22	0.88	0.12
	16	0.46	0.07	0.52	0.48	0.42	0.06	0.48	0.52	0.65	0.24	0.88	0.12
Italy	0	0.51	0.00	0.51	0.49	0.91	0.00	0.91	0.09	0.39	0.00	0.39	0.62
	4	0.62	0.11	0.74	0.26	0.80	0.14	0.95	0.05	0.42	0.05	0.47	0.53
	16	0.67	0.17	0.85	0.15	0.79	0.18	0.97	0.03	0.43	0.06	0.49	0.51
Japan	0	0.30	0.00	0.30	0.70	0.32	0.00	0.32	0.68	0.87	0.00	0.87	0.13
	4	0.39	0.06	0.46	0.54	0.34	0.10	0.44	0.56	0.78	0.14	0.92	0.08
	16	0.43	0.08	0.51	0.49	0.35	0.10	0.46	0.54	0.76	0.16	0.92	0.08
UK	0	0.87	0.00	0.87	0.13	0.96	0.00	0.96	0.04	0.23	0.00	0.23	0.77
	4	0.78	0.14	0.92	0.08	0.81	0.17	0.98	0.02	0.36	0.13	0.49	0.51
	16	0.76	0.18	0.95	0.05	0.79	0.19	0.98	0.02	0.37	0.16	0.54	0.46
US	0	0.42	0.00	0.42	0.58	0.67	0.00	0.67	0.33	0.61	0.00	0.61	0.39
	4	0.46	0.07	0.53	0.47	0.66	0.05	0.72	0.28	0.60	0.06	0.66	0.34
	16	0.54	0.11	0.64	0.36	0.69	0.07	0.76	0.24	0.60	0.06	0.66	0.34
Australia	0	0.09	0.00	0.09	0.91	0.10	0.00	0.10	0.90	0.16	0.00	0.16	0.84
	4	0.25	0.08	0.33	0.67	0.32	0.09	0.41	0.59	0.26	0.08	0.35	0.65
	16	0.39	0.13	0.52	0.48	0.45	0.13	0.58	0.42	0.27	0.11	0.37	0.63
average	*0*	*0.45*	*0.00*	*0.45*	*0.55*	*0.48*	*0.00*	*0.48*	*0.52*	*0.51*	*0.00*	*0.51*	*0.49*
	4	*0.52*	*0.09*	*0.61*	*0.39*	*0.54*	*0.09*	*0.64*	*0.36*	*0.50*	*0.12*	*0.62*	*0.38*
	16	*0.57*	*0.13*	*0.70*	*0.30*	*0.59*	*0.12*	*0.71*	*0.29*	*0.50*	*0.15*	*0.65*	*0.35*

Note: 1961:1-2007:2. Values in the table represent the fraction of forecast error variance due to each shock at the one-, four- and sixteen-quarter horizon. The results are based on a structural FAVAR model estimated with maximum likelihood methods and a factor model approach a la Stock and Watson (2005) and Forni et al (2000), where the k common factors are generated by q shocks, and q<k. Likelihood tests for overidentification restrictions reject the null of up to 2 international factors and one shock against the unrestricted alternative full rank. The results are therefore based on a specification with three international factors generated by one common shock.

Table 5: BMA Posterior probabilities and estimates, dependent variable is Global Inflation

1 step ahead	1970-2006			1970-1990			1990-2006		
lag of	prob.	b	std	prob.	b	std	prob.	b	std
own	**1.00**	**0.90**	**0.06**	**1.00**	**0.81**	**0.13**	**1.00**	**0.86**	**0.08**
comm. price	**0.98**	**0.03**	**0.01**	**0.95**	**0.04**	**0.02**	**0.51**	0.01	0.01
oil price	0.29	0.00	0.01	0.17	0.00	0.00	0.11	0.00	0.00
GDP	**0.90**	**0.13**	**0.07**	0.38	0.03	0.05	0.14	0.01	0.03
ULC	0.11	0.00	0.03	0.15	0.01	0.04	0.10	0.00	0.02
Wages	0.29	0.02	0.04	**0.47**	0.09	0.11	0.17	0.02	0.07
Stock prices	0.10	0.00	0.00	0.10	0.00	0.00	0.15	0.00	0.00
House prices	0.09	0.00	0.01	0.10	0.00	0.01	0.10	0.00	0.01
U.S. fiscal deficit	0.08	0.00	0.02	0.08	0.00	0.02	0.19	0.02	0.05
Dollar effective x rate	0.21	0.00	0.01	0.41	0.01	0.01	0.14	0.00	0.00
Taylor residual	0.08	0.00	0.01	0.13	0.00	0.02	0.16	-0.01	0.02
M3	0.42	0.02	0.03	0.40	0.02	0.04	0.08	0.00	0.01
4 steps ahead									
own	**1.00**	**0.61**	**0.09**	0.20	0.02	0.12	0.13	0.01	0.07
comm. price	0.23	0.01	0.01	0.32	0.02	0.03	0.19	0.00	0.01
oil price	**1.00**	**0.06**	**0.01**	0.39	0.01	0.01	0.12	0.00	0.00
GDP	**0.85**	0.23	0.13	**0.98**	**0.42**	**0.14**	0.14	-0.01	0.05
ULC	0.17	0.02	0.07	**0.98**	**0.56**	**0.16**	0.47	-0.10	0.13
Wages	0.10	0.01	0.04	**0.70**	0.23	0.19	**1.00**	**0.49**	**0.10**
Stock prices	0.09	0.00	0.00	0.10	0.00	0.00	0.26	0.00	0.00
House prices	0.13	0.00	0.02	0.18	-0.01	0.03	0.18	-0.01	0.02
U.S. fiscal deficit	0.08	0.00	0.04	0.16	-0.02	0.08	0.23	0.02	0.06
Dollar effective x rate	0.19	0.00	0.01	0.17	0.00	0.01	**0.98**	**-0.03**	**0.01**
Taylor residual	0.21	0.02	0.04	**0.76**	**0.13**	**0.10**	**0.97**	**-0.21**	**0.07**
M3	**1.00**	**0.26**	**0.05**	**0.50**	**0.08**	**0.09**	**0.56**	0.07	0.08
8 steps ahead									
own	0.21	-0.03	0.08	0.18	0.02	0.08	**0.98**	**0.58**	**0.26**
comm. price	0.36	0.02	0.03	**0.62**	**0.04**	**0.04**	0.26	0.01	0.02
oil price	0.20	0.00	0.01	0.10	0.00	0.01	0.11	0.00	0.00
GDP	0.17	0.02	0.07	0.15	0.02	0.08	**0.90**	-0.33	0.17
ULC	0.13	-0.01	0.04	0.18	0.02	0.08	**0.53**	-0.13	0.16
Wages	0.10	0.00	0.04	0.19	0.03	0.09	**0.48**	-0.15	0.19
Stock prices	**0.93**	**0.021**	**0.009**	**0.67**	0.01	0.01	0.25	0.00	0.00
House prices	0.22	-0.02	0.04	0.09	0.00	0.02	**0.92**	**0.16**	**0.07**
U.S. fiscal deficit	0.30	-0.08	0.14	0.09	-0.01	0.06	0.12	-0.01	0.04
Dollar effective x rate	**0.95**	**-0.06**	**0.02**	**0.82**	-0.04	0.03	0.24	0.00	0.01
Taylor residual	**1.00**	**0.41**	**0.06**	**1.00**	**0.39**	**0.08**	**0.92**	**-0.33**	**0.14**
M3	**1.00**	**0.58**	**0.06**	**1.00**	**0.43**	**0.08**	0.41	-0.06	0.09

Note: The three columns of numbers for each sample-panel report the probability that the corresponding variable help predict Global Inflation, the estimated coefficient and its standard deviation respectively. Probability higher than 0.5 and significant coefficients are in bold. The dependent variable is Global inflation. Potential explanatory variables enter with one lag. The estimation and search technique are explained in Ciccarelli and Mojon (2005).

Table 6: Persistence of the Global and the National Components of Inflation

	1960-2007		1960-1980		1980-1990		1990-2007	
	ρ	stderr	ρ	stderr	ρ	stderr	ρ	stderr
Euro area	0.48	0.06	0.23	0.11	0.36	0.14	0.55	0.10
G7								
United States	0.63	0.06	0.68	0.09	0.47	0.12	0.15	0.12
Canada	0.35	0.07	0.30	0.11	0.61	0.12	0.28	0.12
United Kingdom	0.45	0.07	0.34	0.11	0.52	0.11	0.17	0.12
Japan	0.54	0.06	0.37	0.11	0.33	0.14	0.03	0.12
Germany	0.54	0.06	0.47	0.10	0.40	0.14	0.42	0.11
France	0.55	0.06	0.50	0.10	0.24	0.15	0.19	0.12
Italy	0.44	0.07	0.43	0.10	0.03	0.15	0.52	0.11
median	*0.54*	*0.06*	*0.43*	*0.10*	*0.40*	*0.14*	*0.19*	*0.12*
mean	*0.50*	*0.06*	*0.44*	*0.10*	*0.37*	*0.13*	*0.25*	*0.12*
Other Euro/EU								
Austria	0.18	0.07	0.10	0.11	0.32	0.15	0.17	0.12
Belgium	0.42	0.07	0.42	0.10	0.52	0.13	-0.04	0.12
Denmark	0.10	0.07	-0.05	0.11	-0.03	0.16	0.30	0.11
Finland	0.44	0.07	0.42	0.10	0.37	0.15	0.37	0.11
Greece	0.73	0.05	0.41	0.10	0.39	0.14	0.44	0.11
Ireland	0.19	0.07	0.02	0.11	-0.34	0.14	0.61	0.10
Luxembourg	0.48	0.06	0.44	0.10	0.48	0.13	0.03	0.12
Portugal	0.05	0.07	-0.14	0.11	0.61	0.11	0.22	0.12
Spain	0.37	0.07	0.39	0.10	0.16	0.15	-0.13	0.12
Sweden	0.18	0.07	0.02	0.12	0.23	0.14	0.10	0.12
The Netherlands	0.41	0.07	0.16	0.11	0.07	0.16	0.42	0.11
median	*0.37*	*0.07*	*0.16*	*0.11*	*0.32*	*0.14*	*0.22*	*0.12*
mean	*0.32*	*0.07*	*0.20*	*0.11*	*0.25*	*0.14*	*0.23*	*0.11*
Others								
Australia	0.28	0.07	-0.09	0.11	0.32	0.15	0.20	0.12
New Zeland	0.59	0.06	0.57	0.09	0.51	0.13	0.45	0.11
Norway	0.17	0.07	0.09	0.11	0.44	0.14	-0.16	0.13
Switzerland	0.61	0.06	0.63	0.09	0.33	0.15	0.29	0.12
median	*0.43*	*0.07*	*0.33*	*0.11*	*0.38*	*0.14*	*0.24*	*0.12*
mean	*0.41*	*0.07*	*0.30*	*0.11*	*0.40*	*0.14*	*0.20*	*0.12*
Global Inflation	0.94	0.02	0.92	0.04	0.88	0.05	0.69	0.08

Note: The table reports the estimates of the first autoregressive coefficient of national inflations (defined as π_{it}-$\lambda_i f_t$) and their standard errors over four samples. An AR(1) is asssumed. Estimation technique is OLS. The factor is estimated with a simple average.

Table 7: Loadings of National Inflation Rates on Global Inflation

	1960-2007		1960-1980		1980-1990		1990-2007	
	λ	stderr	λ	stderr	λ	stderr	λ	stderr
Euro area	0.76	0.02	0.73	0.03	1.01	0.03	0.85	0.05
G7								
United States	0.71	0.04	0.85	0.07	0.90	0.13	0.80	0.10
Canada	0.84	0.04	0.84	0.07	1.00	0.08	0.91	0.16
United Kingdom	1.34	0.06	1.54	0.11	1.10	0.14	1.24	0.14
Japan	0.91	0.08	0.81	0.14	0.61	0.10	0.65	0.15
Germany	0.42	0.03	0.37	0.05	0.70	0.07	0.86	0.12
France	1.04	0.03	0.93	0.06	1.44	0.09	0.60	0.06
Italy	1.48	0.05	1.62	0.10	1.78	0.12	1.03	0.09
median	*0.91*	*0.04*	*0.85*	*0.07*	*1.00*	*0.10*	*0.86*	*0.12*
mean	*0.96*	*0.05*	*0.99*	*0.08*	*1.07*	*0.10*	*0.87*	*0.12*
Other Euro/EU								
Austria	0.54	0.04	0.49	0.08	0.67	0.08	0.67	0.09
Belgium	0.77	0.04	0.79	0.07	0.93	0.09	0.61	0.09
Denmark	0.91	0.07	0.74	0.14	0.98	0.14	0.15	0.08
Finland	1.12	0.06	1.04	0.11	0.92	0.10	0.92	0.11
Greece	1.53	0.14	1.99	0.18	0.87	0.23	3.68	0.32
Ireland	1.44	0.07	1.46	0.13	2.25	0.18	0.28	0.16
Luxembourg	0.70	0.04	0.70	0.06	1.03	0.13	0.62	0.10
Portugal	2.02	0.15	2.06	0.29	1.24	0.35	2.10	0.16
Spain	1.35	0.07	1.30	0.15	1.20	0.11	1.03	0.10
Sweden	0.96	0.06	0.83	0.10	0.86	0.15	2.09	0.20
The Netherlands	0.57	0.05	0.52	0.09	0.90	0.06	0.35	0.09
median	*0.96*	*0.07*	*0.83*	*0.13*	*0.93*	*0.15*	*0.67*	*0.16*
mean	*1.08*	*0.08*	*1.08*	*0.14*	*1.08*	*0.17*	*1.14*	*0.16*
Others								
Australia	1.04	0.06	1.24	0.08	0.39	0.15	0.87	0.21
New Zeland	1.26	0.08	1.22	0.10	0.88	0.33	0.59	0.15
Norway	0.83	0.06	0.67	0.11	0.81	0.14	0.80	0.18
Switzerland	0.47	0.05	0.26	0.09	0.52	0.12	1.29	0.08
median	*0.94*	*0.06*	*0.94*	*0.10*	*0.81*	*0.15*	*0.80*	*0.16*
mean	*0.90*	*0.07*	*0.85*	*0.10*	*0.65*	*0.18*	*0.89*	*0.15*

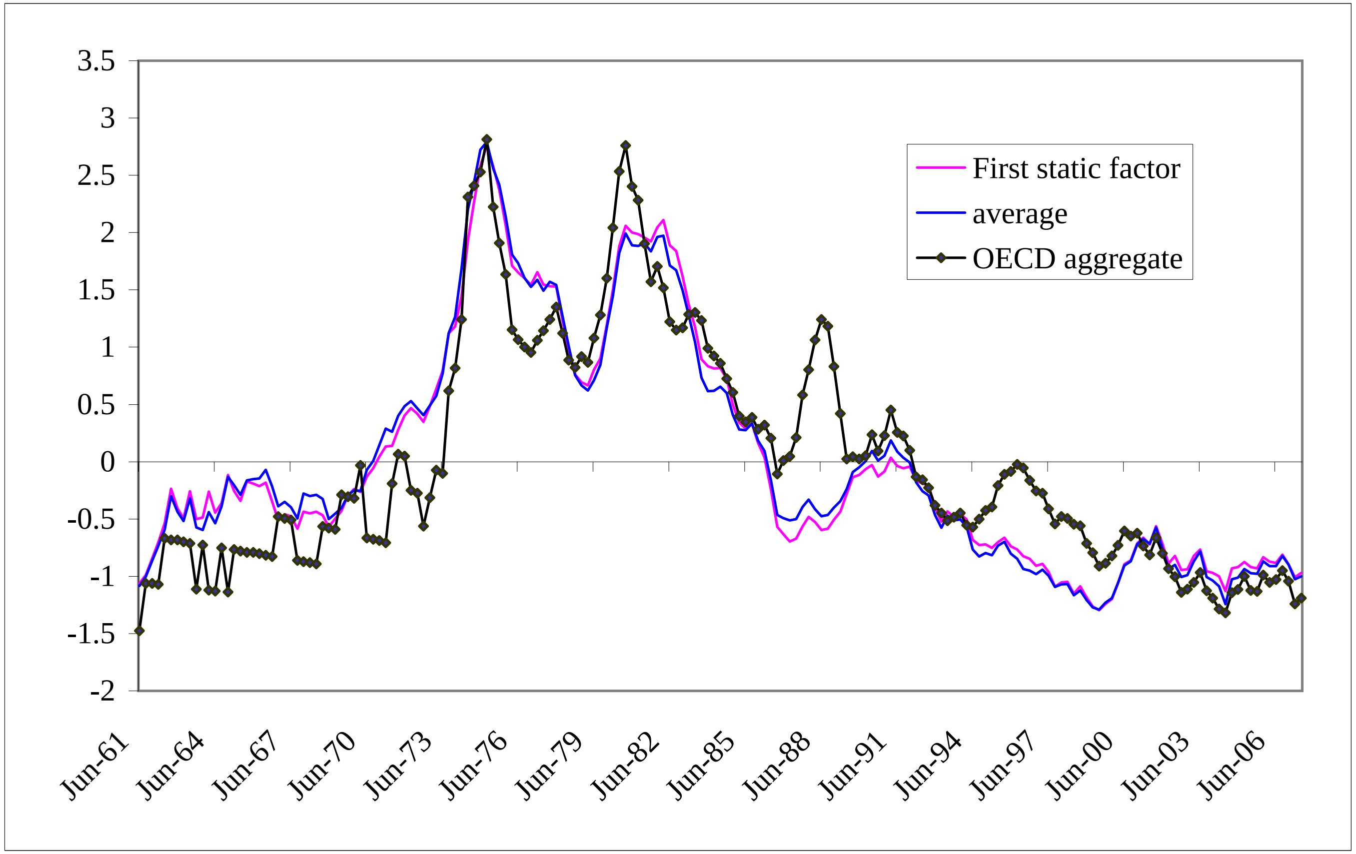
Note: The table reports the estimates of the factor loading in the equation $\pi_{it} = \lambda_i f_t + \varepsilon_{it}$ and its standard errors for all countries and over four samples. Estimation technique is OLS. The factor is estimated with a simple average.

Table 8: RMSE of the Global Inflation model relative to standard benchmarks (1995-2006)

	1-step ahead			4-step ahead			8-step ahead		
	RW	AR	PHIL	RW	AR	PHIL	RW	AR	PHIL
Euro area total	**0.77**	**0.76**	**0.76**	**0.87**	**0.83**	**0.84**	**0.86**	**0.79**	**0.78**
G7									
United States	**0.90**	0.96	0.93	**0.92**	0.97	0.96	**0.85**	**0.89**	0.91
Canada	**0.81**	**0.87**	**0.89**	**0.77**	**0.84**	**0.85**	**0.76**	**0.83**	**0.84**
United Kingdom	0.96	**0.76**	**0.81**	1.01	**0.65**	**0.69**	1.02	**0.58**	**0.61**
Japan	1.17	1.06	1.34	1.14	0.96	1.37	1.18	**0.89**	1.57
Germany	**0.78**	**0.84**	**0.84**	**0.81**	**0.86**	**0.87**	**0.82**	**0.87**	0.91
France	**0.86**	**0.86**	**0.87**	**0.86**	**0.81**	**0.85**	**0.80**	**0.75**	**0.82**
Italy	1.36	0.95	1.13	1.02	**0.64**	**0.75**	0.92	**0.52**	**0.59**
median	*0.90*	*0.87*	*0.89*	*0.92*	*0.84*	*0.85*	*0.85*	*0.83*	*0.84*
mean	*0.98*	*0.90*	*0.97*	*0.93*	*0.82*	*0.90*	*0.91*	*0.76*	*0.89*
Other Euro/EU									
Austria	0.88	**0.75**	**0.76**	**0.80**	**0.69**	**0.73**	**0.69**	**0.63**	**0.66**
Belgium	**0.69**	**0.75**	**0.74**	**0.77**	0.82	0.83	**0.64**	**0.69**	**0.68**
Denmark	1.35	**0.62**	**0.81**	1.36	**0.59**	**0.86**	1.12	**0.53**	**0.81**
Finland	0.97	**0.90**	**0.91**	0.94	**0.83**	**0.82**	0.96	**0.80**	0.82
Greece	1.06	0.95	1.02	1.03	**0.76**	**0.79**	0.98	**0.69**	**0.71**
Ireland	1.37	1.25	1.16	1.02	1.07	0.87	0.97	1.05	0.88
Luxembourg	**0.84**	0.90	0.91	**0.86**	0.92	0.91	**0.84**	0.93	0.92
Portugal	1.30	**0.39**	**0.44**	0.98	**0.39**	**0.41**	1.11	**0.36**	**0.39**
Spain	**0.76**	**0.66**	**0.68**	0.85	**0.66**	**0.70**	**0.82**	**0.59**	**0.65**
Sweden	1.03	**0.76**	**0.73**	0.96	**0.71**	**0.70**	1.05	**0.72**	**0.71**
The Netherlands	**0.87**	**0.81**	**0.82**	**0.78**	**0.73**	**0.78**	0.88	0.82	**0.83**
median	*0.97*	*0.76*	*0.81*	*0.94*	*0.73*	*0.79*	*0.96*	*0.69*	*0.71*
mean	*1.01*	*0.79*	*0.82*	*0.94*	*0.74*	*0.76*	*0.91*	*0.71*	*0.73*
Others									
Australia	0.79	0.85	**0.84**	0.83	0.88	0.89	**0.74**	0.81	0.80
New Zeland	**0.85**	**0.80**	**0.75**	**0.83**	**0.73**	**0.71**	**0.83**	**0.67**	**0.61**
Norway	**0.75**	**0.82**	**0.81**	**0.74**	**0.79**	**0.78**	0.74	**0.77**	**0.77**
Switzerland	1.06	**0.94**	**0.95**	1.25	1.01	**0.96**	1.31	0.98	0.99
median	*0.82*	*0.84*	*0.83*	*0.83*	*0.83*	*0.83*	*0.79*	*0.79*	*0.79*
mean	*0.86*	*0.85*	*0.84*	*0.91*	*0.85*	*0.83*	*0.91*	*0.81*	*0.79*
Overall median	*0.90*	*0.84*	*0.84*	*0.92*	*0.81*	*0.83*	*0.88*	*0.76*	*0.80*
Overall mean	*0.96*	*0.83*	*0.87*	*0.93*	*0.79*	*0.82*	*0.91*	*0.75*	*0.79*

Note: entries are the ratios of root mean squared errors of the Global inflation forecast model to the one obtained with a random walk (RW), an AR(1) (AR), and a Phillips Curve augmented with industrial production, commodity prices and money (PHIL). Evaluation period: 1995-2006.

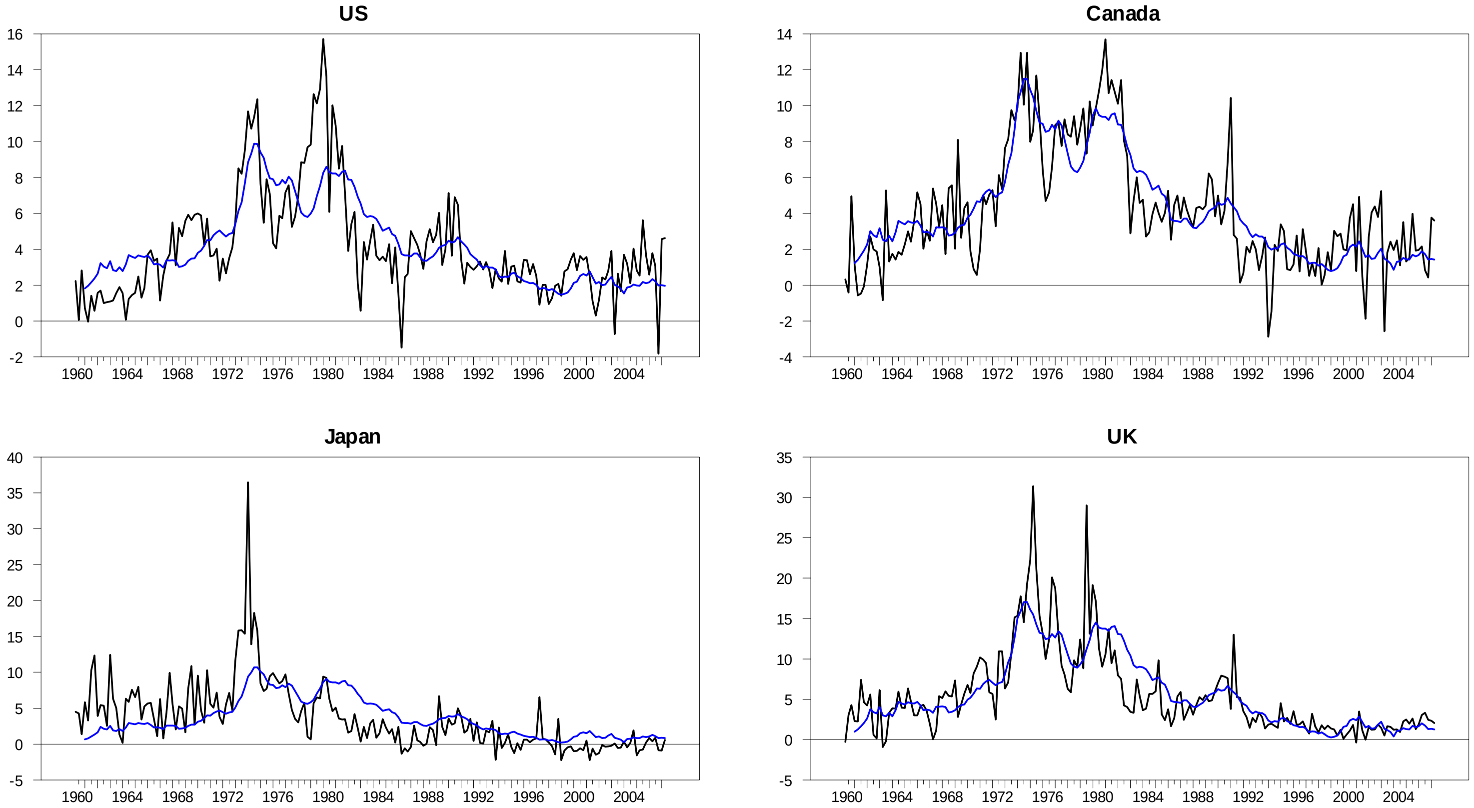
Figure 1: Measures of Global Inflation



Note: Three measure of Global Inflation: a simple cross-country average, the accregate OECD measure and a static factor.

Figure 2a : G7 and euro area inflation and their projection on Global Inflation

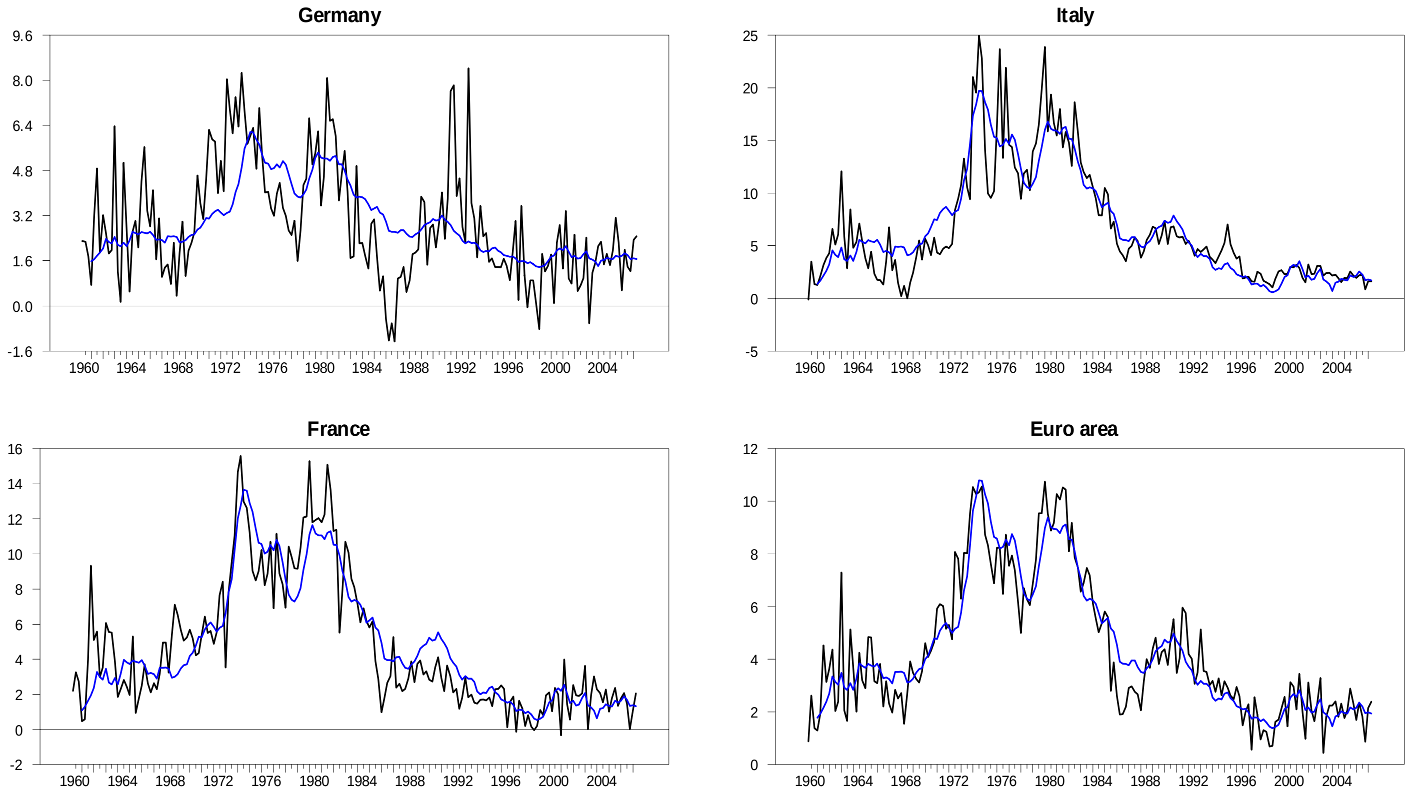
United States, Japan, Canada and United Kingdom (1961-2007)



Note: Domestic inflations and their projections on the Global Inflation (measured by simple average). Estimation technique: OLS. Dependent variable is a deseasonalized quarter-on-quarter inflation rate.

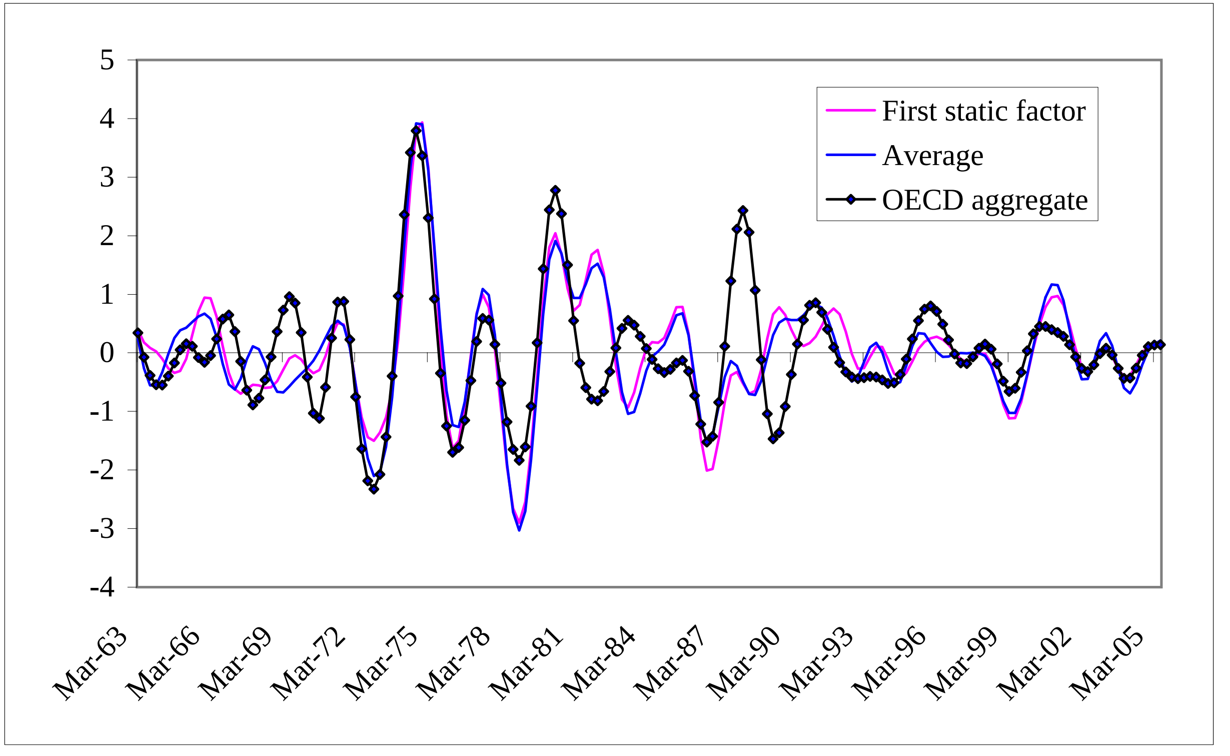
Figure 2b : G7 and euro area inflation and their projection on Global Inflation

United States, Japan, Canada and United Kingdom (1961-2007)



Note: Domestic inflations and their projections on the Global Inflation (measured by simple average). Estimation technique: OLS. Dependent variable is a deseasonalized quarter-on-quarter inflation rate.

Figure 3: Measures of Global de-trended Inflation



Note: Three measures of detrended Global Inflation. The inflation series are detrended with Baxter and King (1999).

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