ME
7/10/06
3:10 pm

Global Inflation*

Matteo Ciccarelli†
European Central Bank

Benoît Mojon
European Central Bank
and Université de la Méditerranée

This draft: February 2006

Abstract

This paper shows that inflation in industrialized countries is largely a global phenomenon. First, inflations of (22) OECD countries have a common factor that alone accounts for nearly 70% of their variance. This large variance share that is associated to 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, Global Inflation is, consistently with standard models of inflation, a function of real developments at short horizons and monetary developments at longer horizons. Third, there is a very robust "error correction mechanism" that brings national inflation rates back to Global Inflation. This model consistently beats the previous benchmarks used to forecast inflation 1 to 8 quarters ahead across samples and countries.

Key Words: Inflation, common factor, international business cycle, OECD countries
JEL: E31, E37, F42

*We would like to thank Sandrine Corvoisier for excellent research assistance and an anonimous referee, 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 and the Bank of Canada for useful comments on this research project. We are very grateful to Daniel Levy for detailed and constructive comments on the draft. The views expressed are those of the authors and do not necessarily reflect the views of the ECB, or ECB policy. Remaining errors are of the authors.

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

"We are [. . .] very much dependent on the global evolution. We have an idea of the global evolution, but there are risks at the global level that we have to take into account."

(Jean-Claude Trichet, 2 December 2004 press conference, Frankfurt)

1 Introduction

The idea that national macroeconomic developments depend on international conditions is not new. Only recently however we are starting to get measures of this dependence. For instance, Forni and Reichlin (2001) show that the share of the European common component in the variance decomposition of European regional output is larger than the national component. Kose, Otrok and Whiteman (2003), KOW thereafter, find that the world common component to expenditure time series of 60 countries explains between one fourth and one third of the variance of these series in OECD countries. As KOW put it:

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

A similar result is obtained in Canova et al. (2004), who demonstrate the presence of a significant world cycle using G7 data and show that country specific indicators play a much smaller role while no evidence of the existence of a Euro specific cycle nor of its emergence in the late 1990s is found.

By definition, the main risk of ignoring international developments is to overrate the importance of domestic developments. And these include domestic macroeconomic policies.

Surprisingly, the studies of global macroeconomic developments have 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.

One formal representation of these long term shifts in inflation focuses on the occurrence of breaks in the mean of inflation. State of the art break tests indicate that inflation series admit two or three breaks in their means since 1960 in every OECD countries. What is remarkable is that breaks in the mean of inflation cluster within three relatively short periods: between 1968 and 1972, between 1982 and 1984 and between 1991 and 1993 (Table 1 of Corvoisier and Mojon, 2004). The coincidence of these sharp changes to the inflation process suggests that they may have common causes.

Levin and Piger (2004) note that the breaks in mean inflation of the early 1990s coincide with changes in the monetary policy regimes, with the widespread adoption of inflation targeting. Rogoff (2003) also acknowledges the merits of central banks tighter focus on price stability in the effectiveness of disinflation. He however wonders whether there could be some other common causes underlying disinflation, indicating the respective role of improved monetary policy, sounder fiscal policies, acceleration of productivity, deregulation and globalization as possible causes. His main conclusion is that no factor alone seems to fully explain the progress that the world has made in containing inflation.

In our opinion most previous studies on the topic suffer from at least two drawbacks. 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 (McKinnon, 1982). 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 co-movements of inflation at the business cycle frequencies as well.

The paper aims at checking the hypothesis that inflation is a global phenomenon, and understanding the common economic forces which have been driving inflation in OECD countries. We proceed in four sequential steps. We start by estimating a measure of Global Inflation using the quarterly inflation series of 22 OECD countries (Section 2). Subsequently, we discuss the possible determinants of the estimated Global inflation (Section 3). Then we study the joint dynamics of national and Global Inflation by: (i) assuming that the common factor representation captures a long run relationship between national and global inflations, and (ii) estimating an Error Correction type model for national inflations. Finally we check whether it is possible to exploit the commonality across inflation processes to improve the inflation forecast upon existing benchmarks (Section 4).

Our main results can be summarized as follows.

First the intuition that inflation is global is decidedly confirmed by the data. We indeed show that a simple average of 22 OECD countries inflation accounts for 70 percent of the variance of inflation in these countries between 1960 and 2003. The qualitative result is not only robust to different sample periods, but is also independent of whether the analysis is performed at the low frequencies or a the business cycle frequencies, where the variance explained is about 36 percent on average, indicating that a common Global factor is an important source of variability for inflation also at higher frequencies.

Second, we document how global inflation can be described as a function of essentially (global) real developments at short horizons and (global) monetary developments at longer horizons, thus confirming the validity of a Global augmented Phillips curve à la Gerlach (2003). This result is important because it provides support for analyzing inflation directly at the global level and because it confirms that the 70% of inflation variance that is global depends on both real and monetary developments.

Third, Global Inflation is an attractor of national inflation, in that national deviations from the common factor are reverted. The evidence is again uniform and robust across different sample periods and different countries. We also document differences in the impact of Global Inflation across countries and find, for instance, that countries that have experienced stronger commitment to price stability (e.g. Germany) are less affected than those with weaker inflation discipline (e.g. Italy). Interestingly and perhaps more importantly, this kind of "Error Correction Mechanism" helps in predicting national inflation of nearly all OECD countries at various horizons and over several samples. As a result, our forecasting model of inflation consistently outperforms $AR(p)$, standard Factor $AR(p)$ and Random Walk models of inflation as well as augmented Phillips curve models à la Gerlach (2003). To the best of our knowledge[1], these results designate our Global Inflation model as a potential new standard for forecasting

[1] For recent systematic comparisons of forecasting models of inflation see Stock and Watson (1999, 2003), Banerjee et al (2003) and Banerjee and Marcellino (2002).

inflation in OECD countries.

As a final remark, we shall note that the economic and econometric arguments we use in this paper do not claim to drain all the reasons why inflation could be driven by Global outcomes, nor 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 an integrated world economy, inflationary and deflationary shocks do not spread across countries thanks to exchange rate adjustments. The nominal exchange rate should compensate for accumulated inflation differentials. Analyses of exchange rates have however showed that fundamentals explain at best a small fraction of the exchange rate fluctuations (Flood and Rose, 1995). Recently, Reinhart and Rogoff (2003) challenged the common wisdom that exchange rates have been flexible since the break up of Bretton Woods. They show that since 1971, effective floating exchange rates have been the exception rather than the rule. Only 4% of their country-year observations correspond to effective floating exchange rates. They relate this low number to some sort of broad "fear of floating" among policy makers (Calvo and Reinhart, 1998). Actually, McKinnon (1982) already made the point that the US loose monetary policy of the 1970's may have spread to other countries because their monetary authorities could only partially sterilize the increase in the central banks' foreign exchange reserves that resulted from their attempts to limit the depreciation of the dollar.

Now, if the key adjustment mechanism which can isolate an economy from foreign shocks to prices is not functioning, then inflation might be determined, at least to some extent, at an international level.[2] Moreover, even if exchange rates partially adjust for accumulated inflation differentials, there are other reasons for co-movement of inflation across countries, some of them

[2] Along the same line of argument, the Gold Standard is usually associated to a more uniform inflation performance than the current era in part because of the generalized peg to gold (e.g. Bordo et al. 2003 and references cited therein).

being relevant for the trend component of inflation, others for inflation fluctuations at business cycle or higher frequencies.

The trend component of inflation might reflect the objective of the central bank and this objective is not defined in vacuum. There could be some international pressures among or on top of monetary authorities. These "peer pressures" can arise through several channels. For example, the continuous exchange of views among Central Banks through official meetings, conferences and publications can lead to such a peer pressure. Hence, the dominant approach on the best monetary policy practise, being it good or bad, may be reflected in the level of inflation throughout the world. Another channel could potentially be identified with the endogenous equilibrium mechanisms that make a community of central banks (or of groups of central bank watchers) converge to relative rather than absolute benchmarks of success. Typically, performing badly on the inflation record is more tolerable when others perform badly as well. Empirical studies on fiscal policy have shown, for instance, that the fiscal discipline of US's states tend to be correlated with the one of neighboring states, about which, arguably, the electorate are better informed (Besley and Case, 1995).

Beyond the trend of inflation, it is a fact that countries are also subject to common shocks. Many scholars associate the 1970's great inflation to the two oil shocks of 1973 and 1979 and several also consider that the mid-1980's disinflation is linked to the 1986 counter oil shock. In the short run, the changes in the price of commodities, which are traded worldwide, have a systematic effect on the price of raw materials and energy that make up a significant share of consumer price indices. Finally, the findings of KOW and others on the co-movement in national business cycles should imply, through Phillips curve effects, co-movement of national inflation rates as well.

2.1 Estimating Global Inflation

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

1. a cross-country average,

2. the aggregate OECD inflation, published by the OECD,

3. a measure based on static factor analysis, and

4. a measure based on dynamic factor analysis.

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 1961:2–2004:4.[3] 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 the components generated by shocks whose effects remain local. Our specification in the dynamic case assumes the common factor to be an AR(1) process, e.g.

$$f_t = af_{t-1} + u_t. \tag{2}$$

We assume orthogonality between f_t and ε_t, and normality of the error terms, with $\varepsilon_t \sim N(0, R)$, and $u_t \sim N(0, Q)$.[4]

Estimation of (1)-(2) is obtained using the Expectation Maximization (EM) algorithm (Doz, Giannone and Reichlin, 2004). Data have been previously demeaned and standardized to have unit variance before estimating f_t.[5] The raw data are the CPI indices that are available quarterly from the OECD main economic indicators database from 1960 onward. Our

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

[4] We have also tried alternative lag order for the AR specification for the common factor. Results are unchanged.

[5] MATLAB codes developed by D. Giannone have been adapted and used here.

analysis focuses on quarterly year-on-year (y-o-y) inflation rates, which, by construction, have no seasonal pattern.

Figure 1 reports the four measures of Global Inflation.[6] Three observations are in order. First, the "average" and the factor model measures are almost identical, while the OECD aggregate deviates from the other 3 series, especially in the second half of the 1980's. 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-1970s (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 1970's 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.

To gauge the extent to which the inflation in individual countries are related to Global Inflation, Figure 2 report 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.

2.2 Descriptive statistics

Table 1 reports the share of the variance of national inflation series that is explained Global inflation[7] for each of the four measures introduced in the previous section : the simple cross-country average, the OECD aggregate inflation, the first static common factor and the first dynamic common factor. 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 dynamic factor. Finally, the table also reports the variance decomposition exercise for the euro area inflation rate.

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

[7] 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 co-movement of inflation is decidedly large. By way of comparison, we find that the global business cycle accounts "only" for about one third of the variance of industrial production growth in OECD countries.[8] 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 % 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.

Non-European countries are spread through out the distribution cast 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 0.72) and mean (0.72 instead of 0.69) 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

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

1970's. For these countries, most of our sample period, from 1960 to 1973 and then from 1979 to 2004, 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 mid 1970's or under some form of pegs.[9] 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 were we consider the same sub-set of 6 countries as in the previous paragraph, though, this time, on the post 1974, as well as on the post 1983 sample. We obtain again as high a degree of comovement of inflation among countries whose exchange rates were not formally tied together[10].

Another somewhat trivial 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 cycles frequencies. Again, the share of national inflation variance that is common is very large by any standard with mean and median of the order of 36 percent.[11,12]

The co-movement of inflation is not only due to the trend component associated with the 1970's 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

[9]For instance, the US and Japan were de facto pegging theri currency 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).

[10]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.

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

[12]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.

share of the inflation variance also in countries like Switzerland and Germany, that is countries where the 1970's 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 de-trended inflation has much less explanatory power for local inflation developments than the non de-trended measure. This may indicate that the monetary policy of these countries has been, in average over the last 45 years, very accomodative of shocks to the trend of inflation world wide.

To complete our description of Global Inflation, we have computed its cross-correlation with national inflation series at several leads and lags. This exercise is useful in 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 allows us to discard the possibility that one particular country has been systematically leading the rest of the OECD countries and that, if this country had been large enough, our focus on Global Inflation mistakenly would have picked up the leadership of the country in terms of inflation dynamics.

3 What is driving Global Inflation?

Given the finding that Global Inflation explains a substantial proportion of the local inflation variance, this section tackles the sources of global inflation. It is indeed crucial to understand what causes this process and to gain some insights into what the global factor is really capturing. To determine whether, when and by how much Global Inflation may be linked to oil, 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.

In what follows, therefore, we first explain the methodology used to select the best predictors for Global Inflation and then present the results.

3.1 Methodology

Under the Bayesian model selection procedure, we search over several possible model specifications according to the explanatory variables used (e.g. George and McCulloch, 1993 and Koop, 2003). Generally speaking, the problem in building a multiple linear regression model is the selection of predictors to include. The basic model considered here is of the form

$$\pi_{t+h} = a\left(L\right)\pi_t + b\left(L\right)x_t + \varepsilon_{t+h} \tag{3}$$

where, π_t is our measure of global inflation and x_t represents a set of K possible predictors over three horizons $h = 1, 4, 8$. Thus we are searching for those explanatory variables which have the highest predictive power at different prediction horizons, while considering all possible combination of covariates in the model.

Given that we dispose of a set of K potential explanatory variables (predictors), the problem is to find the *best* model which only include a subset of selected covariates. Therefore, the comparison must be done among 2^K models. When K is a relatively high number the computational requirements for usual procedures (e.g. AIC or BIC) are also high. In our case, as discussed below, K is greater than 11, giving at least 2048 models to evaluate. We use a Bayesian Model averaging approach as discussed in Koop (2003) and Fernandez et al. (2001), where the "promising" subset of predictors is identified as those with the highest posterior probability. The latter is the frequency with which these variables appear in the search procedure of the algorithm used. The algorithm is the Markov Chain Monte Carlo Model Composition (MC^3) (Madigan and York, 1995), which draws samples from the posterior distribution of the 2^K models.

The concept of Bayesian Model averaging can be simply described using the rules of probability. Denote with M_k, $(k = 1, ..., K)$, our K different models, each characterized by a prior for the parameter vector $p\left(\theta_k \mid M_k\right)$, the likelihood $p\left(y \mid \theta_k, M_k\right)$ and the posterior

$p(\theta_k \mid y, M_k)$. Using Bayes theorem, the posterior model probabilities, $p(M_k \mid y)$, can be obtained and used to assess the degree of support for model M_k.[13] From the comparison of all the models a ranking of the best predictors can be obtained. In our case, the likelihood, the prior and the posterior of parameters, as well as the search algorithm are the same as in Koop (2003, pp.265-278).

Using the procedure outlined above, we calculate and report the posterior probability of the variable, calculated as the proportion of models drawn by the MC^3 algorithm which contain the corresponding predictor, the average estimate of their effect (b) as well as of their posterior standard deviation. The posterior probability of the variable can be used as a diagnostic to determine whether a given predictor plays an important role in explaining global inflation developments. It is comparable to a Granger causality test in a multivariate setting, where variables are simultaneously included and optimally chosen.

In the final step, we use a selection of the most frequent predictors of inflation as obtained from the previous Bayesian procedure to estimate a VAR model where the endogenous variables are the Global inflation and its selected determinants. The main purpose of this exercise is to decompose the variance of Global Inflation as explained by each determinant.

3.2 Results

We limit our analysis to a number of variables commonly argued to affect inflation. Among these, a first group of explanatory variables are defined and computed as "common factors" across the sample of countries for real GDP, Labor Costs, Short-Term Interest Rates, Long-term Interest Rates, the Yield Curve and Asset Prices as well as Money and the Fiscal Deficit. Although not exhaustive, these variables include the most likely determinants of inflation. Money and the short-term interest rate are associated with monetary policy, either as instruments or as operating targets. The long-term interest rate is particularly interesting given that it re-

[13] In formulae, it is

$$p(M_k \mid y) = \frac{p(y \mid M_k)\, p(M_k)}{p(y)}$$

where $p(M_k)$ is the prior model probability, i.e. our prior subjective support for the model, and $p(y \mid M_k)$ is the marginal likelihood, i.e. what the data should look like under model M_k before seeing the data iteself. The previous formula is just the Bayes theorem applied to the model.

flects long run inflation expectations. Likewise, asset prices either on stocks or the housing stocks may reflect the market participants views regarding future inflation. The cost of labor is a central link in propagating inflation shocks into persistent changes. Finally, real GDP is included to evaluate a potential Phillips curve.

For each variable, we extract a common factor in a similar way as we had done for inflation. We therefore build measures of the world GDP growth rate (W_GDP), the world nominal wages inflation (W_Wage) or, preferably, the world unit labour cost (W_ULC), the world asset prices inflation (W_Stocks and W_Houses), the world monetary aggregate growth rate (W_M3), the world money market and yield curve levels (W_STI and W_YC). The results that we report below correspond to the definition of these global indicators as simple cross-country averages. These averages of the variables explain usually between 1/3 (e.g. for real GDP growth) and 1/2 (e.g. for interest rates) of the variance of national time series on average across countries.[14] We also check whether global inflation depends on genuine world shocks such as commodity prices and the US fiscal deficit [15].

We focus the analysis on the post 1970 sample because many of our variables were not available beforehand. Within this 35 years sample we further check the stability of the results across the 1976-1990 sample and 1991-2004 sample. The choice of the sample is partially dictated by the availability of the data (e.g. the unit labor cost series start from 1976) and the interest in the post 1991 period where inflation has been remarkably stable (Rogoff, 2003).

The results of the Bayesian selection algorithm are shown in Table 4. 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 1971-2004 sample, only a few variables contain forecasting power with regards to global inflation. Cost variables, including commodity prices, wages and real GDP have a positive (although the sign of these effects is not always significant) impact on

[14]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.

[15]Unfortunately we do not have quarterly measures of fiscal policy for other countries.

Global inflation within 4 quarters. At 8 quarters horizon, monetary (policy) developments are the only ones that help in forecasting inflation. In this sense, Global Inflation would be fully in line with a monetarist model of inflation, i.e. its evolution over the medium run can best be foreseen by monitoring the developments of monetary aggregates, or its price, the short term interest rate. However, at shorter horizons, Phillips curve inflation drivers are more relevant.

The sub-sample results shows a somewhat different picture. Basically, the Phillips curve seems to have been more relevant since the early 1990's, while the information content of M3 growth or the negative impact of short-term interest rates was effective in the first sub-sample. This division of the information relevant for inflation over time is not necessarily surprising. As a matter of facts, if the relation between money growth and inflation lies in the low frequencies, money should not contain information content on inflation in times when there is little variance in the trend of these two variables, as it has been the case since 1991. On the contrary, the 1976-1991 sample (but also for the 1960-2004 or the 1981-2004 samples, as reported in Ciccarelli and Mojon, 2005) when there has been large variations in the trend of inflation and money, we observe that M3 growth helps in forecasting inflation.

The relevance of Phillips curve effects at the Global level over the last 15 years is worth underlining. First, this may reflect the increasing importance of Globalisation for macroeconomic adjustments. If confirmed, this tendency can become of primary importance for the analysis of the business cycle as, precisely, Phillips curves estimated on national data have lost accuracy over the recent years. Atkenson and Ohanian (2001) show that Phillips Curves have, for the US, under performed Random Walk in forecasting inflation.[16] The BIS annual report for 2005 indicated that the effects of real activity on inflation has become insignificant in the post 1990 sample for other G7 countries.

Turning now to asset prices, we find little evidence of forecasting power either for stock or for house prices. Only the yield curve help in forecasting Global Inflation with a changing sign from positive at 4 quarters to negative at 8 quarters horizon in the recent sample. **One possible interpretation is that an increasing gap between long and short interest rates first**

[16] See also the discussion in D'Agostino et al. and Stock and Watson (2005).

reflects an increase in expected inflation. However, the expected tightening in the stance of monetary policy eventually affects inflation downward. Finally, we note that indicators of the US fiscal (lack of) discipline are not very successful in forecasting Global Inflation. The evidence for oil and commodity price is mixed as it tends to vary across forecast horizons and sub-samples. Moreover, their sign is not always positive nor significant.

To conclude our description of the determinants of Global Inflation, we report measures of the share of Global Inflation explained by the different variables within a multi-variate VAR. We include in the VAR the variables that are most often significant in predicting inflation as was shown in Table 4. These variables are W_GDP, Com. price, W_wages/ULC, W_M3, W_YC,W_STI.

Table 5 reports the share of Global Inflation variance that is explained by each of these variables after controlling for the other variables in the list. The estimation results are again suggesting that M3 growth help forecast inflation when there is some action in the trend of inflation, i.e. for the longest sample when the VAR is estimated. We also observe that Phillips curve inflation drivers, such as GDP and the unit labor costs have been explaining a fair share of Global Inflation developments in the last 15 years.

Overall, the findings reported in this section demonstrate 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. 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 the determinants of inflation dictated by theory are indeed significant. 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 the spillover of these determinants across countries.

4 The Dynamics of National and 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 for practical purposes and to guide our understanding of the inflation process.

4.1 Global Inflation is "attractive"

If we take Eq. (1) as a long run relationship between national inflations and the common factor, then it is almost natural to set up an "Error Correction Mechanism" to specify the behavior of the short run inflation dynamics.

Algebraically, it is possible to think of the following assumptions to derive a simple ECM representation:

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \gamma x_t + \eta_t \tag{4}$$

where for the x variables a factor representation holds:

$$x_t = \lambda_0 f_t + \lambda_1 f_{t-1} + \omega_t$$

If we assume that the factor representation captures a long run relationship, then a simple algebra conveniently derives the short-run dynamics for the first difference of inflation as a function of the "cointegration relation". Specifically, if we subtract π_{t-1} from both side of (4), then add and subtract $\gamma\lambda_0 f_{t-1}$ on the right-hand side and finally add and subtract $\gamma(\lambda_0 + \lambda_1) f_{t-1}$ again on the right-hand side we obtain

$$\Delta\pi_t = \alpha_0 + \alpha_2 (\pi_{t-1} - k f_{t-1}) + \alpha_3 \Delta f_t + \varepsilon_t$$

where the new parameters are combination of the old ones and $k = \gamma(\lambda_0 + \lambda_1) / (1 - \beta_1)$ is the long run multiplier of π_t with respect to x_t.

A more general representation can be shown to hold. For our purposes, and restricting the analysis to a parsimonious specification with only one lag for the Error correction term, we will be analyzing the following specification (now for each country i):

$$\Delta\pi_{i,t} = \alpha_{i,0} + \alpha_{i,1}(L)\,\Delta\pi_{i,t-1} + \alpha_{i,2}(\pi_{i,t-1} - \lambda_i f_{t-1}) + \alpha_{i,3}(L)\,\Delta f_t + \varepsilon_{i,t} \tag{5}$$

where Δ is the first difference operator, $\alpha_{i,j}(L)$ are polynomial in the lag operator L, $\pi_{i,t}$ is national inflation, f_t is the common factor and λ_i is the factor loading of country i, which provides the extent of the adjustment to a deviation from the common "equilibrium" of national inflations.

Equation (5) has been estimated for every country over the sample 1961:2-2004:4 with 4 lags for both $\Delta\pi_{i,t-1}$ and Δf_t. In practical terms, (5) is estimated in two steps, by first performing the standard common factor analysis and then plugging in (5) the idiosyncratic term $(\pi_{i,t-1} - \lambda_i f_{t-1})$ and the first difference of the factor Δf_t.

The estimation results are reported in Table 6. In the first column we show the estimates of λ_i, which is both the loading and the average long term response of national inflation to Global Inflation. As expected, this response to Global Inflation is lower in countries with a tight commitment to price stability, like Switzerland (CH) and Germany (DE), and higher in countries that experienced the largest inflation fluctuations over the sample period (Portugal, Italy, Spain among others).

The estimates of α_2 and their t-statistics are shown in the other columns of Table 6. Consistently with our intuition, it is clear that for all countries and, with exception of a few countries, for all sample periods, there is a mechanism that pull back inflation towards Global Inflation. As national inflations exceeds Global Inflation today, they will be forced to decrease at some point in future.

We find that the robustness of this mechanism across countries and sample periods is astonishing. This is why, in the next section, we further test the relevance of our Global Inflation Error correction model by evaluating its performance in forecasting inflation.

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(2) of level inflation).

Given the results of the previous subsection, a forecast version of (5) can be obtained using a specification similar to Stock and Watson (1999):

$$\pi^h_{i,t+h} - \pi_{i,t} = \alpha_{i,0} + \alpha_{i,1}(L)\,\Delta\pi_{i,t} + \alpha_{i,2}(\pi_{i,t} - \lambda_i f_t) + \alpha_{i,3}(L)\,\Delta f_t + \varepsilon_{i,t+h} \tag{6}$$

where $\pi^h_{i,t} = (400/h)\ln(P_t/P_{t-h})$ is the h-period annualized inflation in the price level P_t and $\pi_{i,t} = (100)\ln(P_t/P_{t-4})$ is the y-o-y quarterly inflation rate.[17] As before, the estimation here must be performed in two steps, but at each time we compute the common factor and the idiosyncratic terms using the information up to t and then forecast h periods ahead.

At least four natural competitors arise to assess the forecasting performance of (6). The first is an augmented AR with the common factor (FAR):

$$\pi^h_{i,t+h} - \pi_{i,t} = \alpha_{i,0} + \alpha_{i,1}(L)\,\Delta\pi_{i,t} + \alpha_{i,3}(L)\,\Delta f_t + \varepsilon_{i,t+h} \tag{7}$$

The second is an AR of the form

$$\pi^h_{i,t+h} - \pi_{i,t} = \alpha_{i,0} + \alpha_{i,1}(L)\,\Delta\pi_{i,t} + \varepsilon_{i,t+h} \tag{8}$$

The third is a Random Walk (RW)

$$\pi^h_{i,t+h} - \pi_{i,t} = \varepsilon_{it+h} \tag{9}$$

A fourth benchmark can be considered along the lines of Stock and Watson (1999), Nicoletti-Altimari (2000) and Gerlach (2003) by simply 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.[18]

[17] For a detailed discussion of this specification, see Stock and Watson (1999).

[18] A more systematic analysis of the forecasting performance of the Global Inflation model is underway in a separate paper.

Specifically, it is

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

Tables 7a-7c report the RMSE of our preferred specification (6) relative to the RMSE of the four competing models. The experiment is conducted in a "real time" framework with all models reestimated at each step using only information up to time t and by optimally choosing the lag length. The evaluation and comparison are made over three forecasting periods, 1965-2003, 1985-95 and post 1995, and for eight forecasting horizons (quarters). We report results at three horizon (1, 4 and 8 quarters). Clearly, our specification is preferred in a forecasting sense if the reported statistic is lower than one.

Results show that our model outperforms the competing models in forecasting inflation on average, across forecast horizon, over evaluation periods, and for the majority of the countries. Improvements are of the order of up to 25% with respect to the augmented Phillips curve specification, 14% percent with respect to the RW and up to 10% with respect to the standard AR or factor augmented AR. Our specification seems to perform particularly better on forecast horizons greater than 1 and over the last 10-20 years of observations. Hence, while the information pooling associated to a standard FAR or by an AR (possibly augmented with Phillips curve arguments) is useful in short-term predictions, it is the information contained in the error correction mechanism that helps the most in forecasting medium and long run. Moreover, 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 inflations from the 1990's (e.g. Rogoff (2003)).

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 the AR(p) model, which has been considered so far as the most robust predictor 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 interpretation of the factor representation as a long-run relationship that parsimoniously allows for the use of an Error Correction Mechanism which, in turn, seems to help in forecasting future developments of national inflation. The latter result, which holds across countries, samples periods and forecasting horizons, is obliviously one of the main contributions of our current research. Irrespective of whether we can formulate a "convincing" structural model of the pull-back of national inflation toward Global Inflation, our simple model has the potential features of a new benchmark for forecasting inflation.

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 % 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, monetary and financial conditions may spill-over across countries. Such spill overs are, in theory, less likely when exchange rates are floating. However, Reinhart and Rogoff (2002) have shown that, in spite of the break up of Bretton Woods, very few pure floating exchange rates regimes have been observed. Moreover, while it is hard to show in the data, our experience as central bankers convince us 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 indeed responds to commodity prices, the global business cycle and the growth of the global liquidity. We further qualify that real developments are more relevant at short horizons and monetary developments matter at longer horizons.

The paper has got 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 powerful externality between country inflation records. Even if some countries were clearly less affected by Global Inflation than others, none, not even Switzerland, can claim to have been completely immune from Global Inflation shocks.

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 local mechanisms which help explaining inflation developments. The second one is to explore more systematically the forecasting performance of the Global Inflation Error Correction 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. To this respect, our general supposition 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. Paraphrasing the conclusion of the 1848 Communist Manifesto we would like to invite

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

References

[1] D'Agostino, A. D. Giannone and P. Surico (2005), (Un)predictability and Macroeconomic Stability, Mimeo, ECARES.

[2] Andrews, D. and W.K. Chen (1994), Approximately median-unbiased estimation of autoregresive models, *Journal of Business and Economic Statistics 12*:187-204.

[3] Atkenson, A. and L. Ohanian (2001), Are Phillips Curves Useful for forecasting inflation?, *Federal Reserve Bank of Mineapolis Quarterly Review 25*, 2-11.

[4] Bai, J. (2003), Inferential theory for factor models of large dimensions, *Econometrica 71*:135-171.

[5] Ball L. and N. Sheridan (2003), Does inflation targeting matter?, NBER Working Paper No. 9577.

[6] Banerjee A., M. Marcellino and I. Masten (2003), Leading indicators of euro area inflation and GDP growth, CEPR WP 3893.

[7] Banerjee A. and M. Marcellino (2003), Are there any reliable leading indicators for the US inflation and GDP growth?, IGIER WP 236.

[8] BIS (2005), Annual Report 2005, Bank of International Settlements, www.bis.org.

[9] Besley T. and A. Case (1995), Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Compe, *American Economic Review 85*: 25-45.

[10] Bilke L. (2004), Break in the mean and persistence of inflation: a sectorial analysis of French CPI, mimeo, ECB.

[11] Bordo M. D. , R. D. Dittmar and W. T. Gavin (2003), Gold, Fiat Money, and Price Stability, NBER WP 10171.

[12] Borio, C. and P. Lowe (2002), Asset prices, financial and monetary stability: exploring the nexus, BIS Working Papers No. 114.

[13] Canova F., M. Ciccarelli and E. Ortega (2004), Similarities and convergence in G7 cycles, ECB WPS no. 263.

[14] Calvo G. and C. Reihnart (2002), Fear of Floating, *Quaterly Journal of Economics, 117*: 379-408.

[15] Ciccarelli M. and B. Mojon (2005), Global Inflation, ECB WPS no 537.

[16] Cristadoro R., M. Forni, L. Reichlin and G. Veronese (2004): A core inflation indicator for the euro area, mimeo, Banca d'Italia.

[17] Corvoisier S. and B. Mojon (2005), Breaks in the mean of inflation: How they happen and what to do with them, ECB Working Paper No. 451.

[18] Doz, C. D. Giannone and L. Reichlin (2004), A Maximum Likelihood Approach for Large Approximate Dynamic Factor Models, mimeo, Université Cergy-Pontoise and Université Libre de Bruxelles.

[19] Fernandez, C., E. Ley and M. Steel (2001), Benchmark priors for Bayesian model averaging, *Journal of Econometrics 100*: 381-427.

[20] Flood, R. and Andrew Rose, (1995), Fixing Exchange Rates: A Virtual Quest for Fundamentals, *Journal of Monetary Economics 36*: 3-37.

[21] Forni, M., M. Hallin, M. Lippi, and L. Reichlin (2000): The generalized factor model: identification and estimation,*The Review of Economics and Statistics* 82: 540-554.

[22] George E. I. and R. E. McCulloch (1993), Variable selection via Gibbs sampling, *Journal of the American Statistical Association 88*: 881-998.

[23] Gerlach S. (2004), The ECB's two pillars, CEPR Discussion paper No. 3689.

[24] Koop, G. (2003), Bayesian Econometrics, J. Wiley.

[25] Kose A,. C. Otrok and C. Whiteman (2003), International business cycles: World, region and country-specific factors, *The American Economic Review 93*, No 4, p 1216-39.

[26] Levin A.T. and J.M. Piger (2004), Is inflation persistence intrinsic in industrial economies?, ECB Working Paper No. 334.

[27] Madigan, D. and J. York (1995), Bayesian graphical models for discrete data, *International Statistical Review 63*: 215-232.

[28] McKinnon R. I. (1982), Currency substituion and in instability in the World Dollar Standard, *American Economic Review 72* : 320-333.

[29] Mojon B. (2004), New evidence on the response of US inflation to monetary policy shocks, mimeo, European Central Bank.

[30] Nicoletti-Altimari S. (2001), Does money lead inflation in the euro area?ECB Working Paper No. 63.

[31] Reinhart C. and K. Rogoff (2002), The Modern History of Exchange Rate Arrangements: A Reinterpretation , NBER wp8963.

[32] O'Reilly G. and K. Whelan (2004), Has euro area inflation persistence changed over time?, ECB WP n. 335.

[33] Robalo Marques C. (2004), Inflation persistence: facts or artefacts?, ECB Working Paper No. 371.

[34] Rogoff K. (2002), Global disinflation, unpublished mimeo.

[35] Stock J. and M. Watson (1999), Forecasting inflation, *Journal of Monetary Economics 44*: 293-335.

[36] Stock J. and M. Watson (2002), Macroeconomic Forecasting Using Diffusion Indexes, *Journal of Business and Economic Statistics* 20, 147-162.

[37] Stock J. and M. Watson (2005), Has inflation become harder to forecast?, Mimeo.

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, Netherlands, Portugal, Spain data where back dated before 1970, for Greece before 1980, for Canada before 1967, for New Zeland before 1965, for the United Kingdom before 1962 with y-o-y growth rates of "Claims on other resident sector" of the IMF IFS.	y-o-y growth rates

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

	Average	OECD	Static factor	Dynamic factors	
				first	second
Greece	0.39	0.60	0.37	0.37	0.27
Switzerland	0.43	0.15	0.35	0.34	0.18
Japan	0.53	0.20	0.48	0.47	0.25
Netherlands	0.56	0.20	0.54	0.54	0.30
Germany	0.59	0.27	0.53	0.52	0.14
New Zeland	0.60	0.59	0.62	0.62	0.12
Portugal	0.61	0.58	0.63	0.63	0.12
Norway	0.66	0.56	0.67	0.67	0.02
Austria	0.68	0.33	0.64	0.63	0.12
United States	0.68	0.67	0.69	0.69	0.01
Denmark	0.71	0.44	0.71	0.71	0.01
Spain	0.73	0.54	0.74	0.75	0.03
Australia	0.73	0.68	0.73	0.74	0.05
Sweden	0.73	0.62	0.71	0.71	0.03
United Kindom	0.77	0.62	0.77	0.77	0.00
Luxembourg	0.77	0.50	0.78	0.78	0.02
Finland	0.81	0.55	0.81	0.80	0.02
Canada	0.82	0.74	0.84	0.84	0.02
Belgium	0.83	0.55	0.83	0.82	0.03
Ireland	0.85	0.61	0.89	0.89	0.00
Italy	0.85	0.79	0.89	0.89	0.04
France	0.88	0.70	0.92	0.92	0.00
mean	0.69	0.52	0.69	0.69	0.08
median	0.72	0.57	0.71	0.71	0.03
euro area	0.95	0.75	0.96	0.96	0.01

Note: 1961:2-2004:4. 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

	1961-2004	1975-2004	1983-2004
Australia	0.74	0.74	0.55
Canada	0.81	0.84	0.75
Germany	0.54	0.53	0.10
UK	0.88	0.92	0.77
Japan	0.60	0.82	0.50
US	0.77	0.77	0.68
mean	0.72	0.77	0.56
median	0.75	0.80	0.61

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	Dynamic factor
Portugal	0.04	0.00	0.04	0.03
Norway	0.09	0.00	0.05	0.05
Sweden	0.11	0.00	0.04	0.04
New Zeland	0.12	0.09	0.09	0.09
Spain	0.26	0.14	0.18	0.18
Greece	0.26	0.09	0.20	0.21
Germany	0.31	0.10	0.29	0.29
Denmark	0.32	0.14	0.28	0.26
Netherlands	0.32	0.18	0.35	0.36
Austria	0.35	0.14	0.30	0.29
Canada	0.36	0.25	0.34	0.35
Finland	0.38	0.22	0.36	0.38
Switzerland	0.41	0.14	0.35	0.36
United Kindom	0.41	0.31	0.41	0.41
Luxembourg	0.42	0.13	0.47	0.49
Australia	0.42	0.17	0.43	0.43
United States	0.43	0.44	0.47	0.46
Japan	0.54	0.30	0.54	0.53
Ireland	0.57	0.27	0.62	0.63
France	0.61	0.50	0.74	0.73
Italy	0.63	0.37	0.70	0.68
Belgium	0.63	0.36	0.73	0.74
mean	0.36	0.20	0.36	0.36
median	0.37	0.16	0.35	0.36
euro area	0.83	0.39	0.84	0.83

Note: 1961:2-2004:4. 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: BMA Posterior probabilities and estimates, dependent variable is Global Inflation

	1971-2004			1976-1990			1991-2004		
1 step ahead	prob.	b	std of b	prob.	b	std of b	prob.	b	std of b
own	**1.00**	**0.90**	**0.07**	**1.00**	**0.95**	**0.09**	**1.00**	**0.70**	**0.18**
Com. Price	0.32	0.00	0.00	**0.96**	0.01	0.01	**0.46**	0.00	0.00
Oil price	0.14	0.00	0.00	**0.55**	-0.02	0.03	0.20	0.00	0.01
W_GDP	**1.00**	**0.19**	**0.05**	0.24	0.03	0.08	0.27	0.02	0.05
W_Wages	**0.74**	0.07	0.06						
W_ULC				0.26	0.03	0.09	0.29	-0.02	0.05
W_STI	0.14	0.00	0.02	0.29	-0.02	0.11	**0.69**	0.14	0.12
W_YC	**0.99**	**-0.20**	**0.08**	**0.51**	-0.13	0.19	0.38	0.06	0.10
W_M3	0.11	0.00	0.02	**0.67**	0.14	0.15	0.11	0.00	0.02
US deficit	0.09	0.00	0.03	0.08	0.00	0.04	0.09	0.00	0.03
W_Stocks	0.08	0.00	0.00	0.18	0.00	0.00	0.09	0.00	0.00
W_Houses	0.30	0.01	0.02	0.16	0.00	0.03	**0.54**	0.04	0.05
4 steps ahead	prob.	b	std of b	prob.	b	std of b	prob.	b	std of b
own	**1.00**	**0.55**	**0.16**	**1.00**	**0.78**	**0.12**	0.08	0.00	0.04
Com. Price	**0.62**	0.01	0.01	**1.00**	**0.05**	**0.01**	**1.00**	**-0.02**	**0.00**
Oil price	0.10	0.00	0.01	0.29	-0.02	0.03	0.19	0.00	0.01
W_GDP	**1.00**	**0.39**	**0.10**	0.10	0.00	0.06	**0.89**	**0.17**	**0.09**
W_Wages	**0.69**	0.17	0.14						
W_ULC				0.22	0.05	0.12	**0.93**	**0.13**	**0.07**
W_STI	0.41	-0.07	0.10	0.27	-0.08	0.19	**1.00**	**0.25**	**0.05**
W_YC	**0.78**	-0.30	0.22	0.18	-0.07	0.22	**1.00**	**0.32**	**0.10**
W_M3	**1.00**	**0.34**	**0.09**	**1.00**	**0.78**	**0.19**	**0.90**	**0.13**	**0.07**
US deficit	0.18	-0.03	0.09	0.08	0.00	0.06	0.09	0.00	0.03
W_Stocks	0.08	0.00	0.00	0.10	0.00	0.01	0.31	0.00	0.00
W_Houses	0.31	0.02	0.04	0.15	0.01	0.04	0.14	0.00	0.02
8 steps ahead	prob.	b	std of b	prob.	b	std of b	prob.	b	std of b
own	**0.72**	0.35	0.25	**0.96**	**0.59**	**0.24**	0.20	0.02	0.08
Com. Price	0.13	0.00	0.00	**0.99**	**0.04**	**0.01**	**0.83**	**-0.01**	**0.00**
Oil price	0.28	-0.01	0.02	0.14	-0.01	0.05	**0.89**	**-0.04**	**0.02**
W_GDP	0.15	0.02	0.07	0.16	-0.04	0.17	0.16	0.01	0.04
W_Wages	0.39	0.12	0.17						
W_ULC				**0.79**	0.52	0.36	0.21	0.02	0.05
W_STI	**0.72**	-0.19	0.14	**0.95**	**-0.92**	**0.47**	**0.46**	0.06	0.08
W_YC	0.11	0.00	0.08	0.24	-0.20	0.51	**0.90**	**-0.31**	**0.16**
W_M3	**1.00**	**0.65**	**0.10**	**0.65**	0.39	0.36	0.10	0.00	0.02
US deficit	0.22	-0.06	0.15	0.08	0.00	0.08	0.09	0.00	0.03
W_Stocks	0.08	0.00	0.00	0.12	0.00	0.01	0.13	0.00	0.00
W_Houses	0.25	0.02	0.05	0.31	-0.09	0.17	**0.49**	0.04	0.05

Note: the three columns report probability that the variable in column help predict Global Inflation, the coefficient of that variable and its standard deviation. Probabilities greater or equal than 0.5 are in bold. See the main text for the definitions of the explanatory variables listed in the first columns.

Table 5. Variance decomposition of Global Inflation

Horizon	Std Error	Own lags	W_GDP	COM P	W_Wage /ULC	W_M3	W_YC	W_STI
1971-2004 (4 lags)								
4	0.93	**74**	2	5	0	4	0	2
8	1.44	**44**	2	8	3	**19**	0	3
12	1.73	**31**	2	7	6	**32**	2	3
16	1.87	**26**	2	7	9	**35**	3	3
1976-1990 (2 lags)								
4	0.84	**62**	2	**20**	0	5	12	6
8	1.39	**31**	2	**35**	0	10	**15**	13
12	1.69	**21**	2	**34**	3	8	13	**15**
16	1.81	**18**	2	**30**	6	8	12	**15**
1991-2004 (2 lags)								
4	0.34	**64**	9	2	8	5	7	2
8	0.44	**41**	13	9	8	6	**17**	3
12	0.52	**32**	**22**	9	11	5	12	2
16	0.62	**27**	**26**	6	**16**	5	10	2

Notes: Entries are percentage of the variance of global inflation accounted for by variation in the column variable at horizons ranging from 4 to 16 quarters, when the variable is ordered last in the variance decomposition, except for own lags which are always ordered first. The VAR includes all seven variables.
Bold numbers are percentage of variance explained supperior to 15 %.

Table 6. ECM between national inflation and Global Inflation

	1960_2004		1960_2004		1960-1980		1981-2004		1990-2004	
	lambda	stderr	alpha 2	t-stat	alpha 2	t-stat	alpha 2	t-stat	alpha 2	t-stat
Australia	1.04	0.04	-0.14	-3.62	-0.22	-1.27	-0.16	-2.65	-0.42	-3.27
Austria	0.49	0.03	-0.35	-3.29	-0.44	-3.37	-0.13	-2.36	-0.27	-2.93
Belgium	0.75	0.03	-0.14	-3.17	-0.11	-1.79	-0.14	-2.46	-0.47	-2.63
Canada	0.84	0.03	-0.23	-4.34	-0.26	-2.91	-0.39	-5.23	-0.33	-3.07
Denmark	0.88	0.04	-0.31	-3.92	-0.51	-2.80	-0.14	-1.89	-0.46	-3.16
Finland	1.13	0.04	-0.17	-3.23	-0.26	-2.90	-0.18	-2.18	-0.24	-3.04
France	1.03	0.03	-0.16	-3.35	-0.20	-2.81	-0.11	-2.14	-0.11	-1.03
Germany	0.38	0.03	-0.14	-3.79	-0.30	-3.50	-0.07	-2.04	-0.31	-3.57
Greece	1.58	0.13	-0.08	-3.17	-0.20	-1.49	-0.07	-2.14	-0.19	-3.01
Ireland	1.48	0.05	-0.17	-4.34	-0.67	-4.79	-0.09	-1.56	-0.11	-2.86
Italy	1.53	0.04	-0.19	-4.10	-0.15	-2.54	-0.11	-2.46	-0.13	-2.05
Japan	0.87	0.07	-0.08	-2.40	-0.12	-1.34	-0.20	-3.68	-0.26	-3.10
Luxembourg	0.68	0.03	-0.17	-4.44	-0.21	-2.81	-0.09	-2.08	-0.28	-3.24
Netherlands	0.51	0.04	-0.11	-2.74	-0.21	-2.90	-0.07	-2.06	-0.21	-3.81
Norway	0.79	0.04	-0.19	-3.85	-0.36	-2.67	-0.18	-2.74	-0.27	-2.04
New Zeland	1.26	0.07	-0.11	-2.30	-0.19	-2.93	-0.11	-2.05	-0.34	-3.91
Portugal	2.06	0.11	-0.17	-2.74	-0.34	-2.93	-0.22	-4.38	-0.47	-3.97
Spain	0.91	0.04	-0.21	-2.84	-0.53	-3.41	-0.14	-1.62	-0.56	-2.74
Sweden	1.38	0.06	-0.18	-3.26	-0.25	-3.18	-0.47	-3.92	-0.32	-2.39
Switzerland	0.41	0.04	-0.12	-2.74	-0.15	-1.72	-0.09	-2.25	-0.42	-3.81
United Kindom	1.30	0.06	-0.16	-3.93	-0.48	-3.64	-0.16	-2.50	-0.32	-3.70
United States	0.70	0.04	-0.11	-3.07	-0.21	-4.22	-0.28	-3.63	-0.77	-4.27
Euro area	0.97	0.02	-0.18	-3.23	-0.27	-2.63	-0.09	-2.43	-0.14	-2.35

Note: lambda is the coefficient of projection of national inflation on global inflation. Alpha is the estimated coefficient of the error correction term. The dependant variable is the first difference of the national inflation rate.

Table7a. RMSE of the Global Inflation model (4) relative to standard benchmarks (1980-2004)

	1 step ahead forecast				4 steps ahead forecast				8 steps ahead forecast			
	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL
Euro area	0.81	1.03	0.99	n.a.	1.04	0.98	0.91	n.a.	0.86	0.89	0.87	n.a.
Australia	0.90	1.08	0.99	0.94	1.08	1.09	1.00	0.84	1.11	1.09	1.04	0.89
Austria	0.68	1.04	1.01	0.99	0.77	0.84	0.89	0.88	0.74	0.82	0.89	0.87
Belgium	0.68	0.99	0.98	0.88	0.65	0.75	0.72	0.55	0.65	0.75	0.76	0.46
Canada	0.82	0.97	0.98	0.93	0.89	0.83	0.87	0.81	0.88	0.82	0.84	0.83
Denmark	0.93	1.21	1.12	0.88	1.40	1.34	1.18	0.82	1.32	1.24	1.19	0.94
Finland	0.80	1.05	1.02	0.86	1.29	1.23	1.19	0.90	1.27	1.32	1.37	1.00
France	0.83	1.02	1.01	0.86	1.07	0.97	0.95	0.78	0.95	0.91	0.90	0.78
Germany	0.80	1.00	0.99	0.77	0.88	0.88	0.86	0.51	0.82	0.86	0.82	0.45
Greece	0.70	1.03	1.01	0.79	0.88	0.88	0.83	0.59	0.85	0.82	0.78	0.62
Ireland	0.92	1.14	1.12	1.04	0.98	1.02	1.02	0.89	0.96	1.01	1.04	0.97
Italy	0.90	1.00	0.97	0.85	0.94	0.79	0.75	0.56	0.74	0.69	0.70	0.58
Japan	0.84	1.10	1.01	0.92	1.31	1.41	1.16	0.80	1.58	1.88	1.61	1.10
Luxembourg	0.84	0.97	0.96	0.88	0.85	0.81	0.81	0.64	0.66	0.69	0.72	0.55
Netherlands	0.57	1.01	1.00	0.98	0.97	0.96	1.08	0.97	1.01	1.07	1.21	1.10
New Zeland	1.01	1.01	1.00	0.94	1.00	0.96	0.95	0.90	0.94	0.87	0.87	0.81
Norway	0.73	1.04	1.04	0.86	0.79	0.82	0.84	0.64	0.68	0.69	0.73	0.57
Portugal	0.78	0.99	0.94	0.83	0.81	0.75	0.69	0.62	0.57	0.53	0.51	0.45
Spain	0.65	1.02	1.01	0.91	0.93	1.06	1.08	0.89	1.06	1.19	1.30	1.16
Sweden	0.69	0.99	0.99	0.90	0.79	0.82	0.89	0.78	0.75	0.75	0.80	0.78
Switzerland	0.75	0.98	0.97	0.94	0.80	0.82	0.77	0.72	0.83	0.85	0.74	0.81
United Kingdom	0.91	1.19	1.16	1.04	1.63	1.54	1.48	1.36	1.70	1.69	1.61	1.58
United States	0.74	0.98	0.99	0.96	1.05	0.91	0.96	0.82	0.96	0.87	0.94	0.85
median	0.80	1.02	1.00	0.91	0.94	0.91	0.91	0.81	0.88	0.87	0.87	0.82
mean	0.80	1.04	1.01	0.91	0.99	0.98	0.95	0.78	0.95	0.97	0.97	0.82

Note: ratio of the root mean square error of the Global inflation model forecast to the one obtained with a random walk model (equation (9) in the main text), an AR(4) (equation (8) in the main text), a factor augmented AR(4) (equation (7) in the main text) and a Phillips augmented with commodity prices and money (equation (6) in the main text). Evaluation period: 1980-2004.

Table 7b. RMSE of the Global Inflation model (4) relative to standard benchmarks (1980-1995)

	1 step ahead forecast				4 steps ahead forecast				8 steps ahead forecast			
	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL
Euro area	0.82	1.03	0.99	n.a.	1.04	0.97	0.90	n.a.	0.87	0.89	0.87	n.a.
Australia	0.97	1.14	1.00	0.94	1.16	1.17	1.04	0.91	1.21	1.18	1.10	0.99
Austria	0.69	1.05	1.01	1.00	0.74	0.84	0.89	0.95	0.74	0.83	0.91	0.92
Belgium	0.69	1.00	0.97	0.84	0.59	0.69	0.68	0.54	0.60	0.72	0.72	0.45
Canada	0.92	0.96	0.98	0.97	0.85	0.79	0.83	0.86	0.82	0.78	0.81	0.82
Denmark	1.01	1.24	1.16	0.96	1.39	1.31	1.20	0.90	1.32	1.24	1.21	1.05
Finland	0.80	1.03	1.04	0.85	1.30	1.23	1.24	0.95	1.27	1.33	1.43	1.03
France	0.88	1.00	1.01	0.87	1.06	0.95	0.94	0.87	0.94	0.91	0.90	0.85
Germany	0.83	1.00	0.99	0.77	0.88	0.88	0.86	0.56	0.83	0.86	0.82	0.50
Greece	0.69	1.02	1.01	0.78	0.86	0.87	0.82	0.59	0.86	0.83	0.79	0.64
Ireland	0.90	1.13	1.11	1.10	0.93	0.97	0.98	0.99	0.90	0.95	0.99	1.00
Italy	0.89	0.98	0.97	0.89	0.93	0.76	0.74	0.60	0.70	0.64	0.65	0.58
Japan	0.84	1.08	1.01	0.90	1.34	1.47	1.24	0.85	1.65	2.02	1.73	1.25
Luxembourg	0.85	0.95	0.95	0.87	0.78	0.75	0.77	0.61	0.57	0.61	0.64	0.51
Netherlands	0.63	1.01	1.01	0.97	0.97	0.98	1.11	1.03	1.03	1.10	1.25	1.19
New Zeland	1.03	1.01	1.00	0.97	1.00	0.96	0.95	0.94	0.94	0.87	0.87	0.84
Norway	0.73	1.06	1.05	0.86	0.76	0.78	0.81	0.62	0.64	0.66	0.70	0.56
Portugal	0.81	0.98	0.92	0.84	0.77	0.72	0.66	0.63	0.53	0.49	0.47	0.43
Spain	0.65	1.03	1.02	0.90	0.90	1.06	1.10	0.91	1.07	1.21	1.35	1.25
Sweden	0.68	0.98	0.97	0.90	0.69	0.72	0.79	0.74	0.62	0.62	0.67	0.70
Switzerland	0.78	0.97	0.96	0.96	0.73	0.75	0.71	0.74	0.77	0.80	0.68	0.83
United Kingdom	0.93	1.21	1.18	1.09	1.68	1.56	1.51	1.50	1.69	1.69	1.64	1.74
United States	0.79	0.96	0.99	0.97	1.04	0.90	0.96	0.93	0.94	0.86	0.93	0.91
median	0.82	1.01	1.00	0.90	0.93	0.90	0.90	0.87	0.87	0.86	0.87	0.85
mean	0.82	1.04	1.01	0.92	0.97	0.96	0.94	0.83	0.94	0.96	0.96	0.87

Note: ratio of the root mean square error of the Global inflation model forecast to the one obtained with a random walk model (equation (9) in the main text), an AR(4) (equation (8) in the main text), a factor augmented AR(4) (equation (7) in the main text) and a Phillips augmented with commodity prices and money (equation (6) in the main text). Evaluation period: 1980-2004.

Table 7c. RMSE of the Global Inflation model (4) relative to standard benchmarks (1995-2004)

	1 step ahead forecast				4 steps ahead forecast				8 steps ahead forecast			
	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL	RW	AR	FAR	PHIL
Euro area	0.77	1.05	1.00	0.94	0.71	0.86	0.78	0.55	0.52	0.66	0.66	0.42
Australia	0.77	0.94	0.96	0.93	0.82	0.81	0.84	0.64	0.68	0.74	0.74	0.55
Austria	0.66	0.97	0.96	0.89	0.43	0.67	0.70	0.60	0.38	0.59	0.64	0.55
Belgium	0.65	0.98	0.98	0.96	0.64	0.84	0.75	0.57	0.64	0.79	0.73	0.52
Canada	0.73	1.00	0.99	0.88	0.95	0.98	0.94	0.70	1.24	1.16	1.03	0.77
Denmark	0.73	1.11	0.99	0.69	1.15	1.46	0.88	0.47	0.79	0.99	0.69	0.29
Finland	0.80	1.12	0.96	0.88	0.87	1.05	0.86	0.66	0.75	0.90	0.74	0.63
France	0.73	1.05	1.00	0.84	0.70	0.84	0.76	0.46	0.60	0.70	0.69	0.39
Germany	0.69	0.99	0.97	0.81	0.69	0.80	0.80	0.32	0.77	0.82	0.82	0.25
Greece	0.78	1.09	0.99	0.90	0.93	0.81	0.75	0.61	0.74	0.67	0.67	0.50
Ireland	1.00	1.20	1.17	0.88	1.30	1.32	1.26	0.68	1.55	1.54	1.50	0.87
Italy	0.98	1.21	0.96	0.70	0.88	0.94	0.76	0.37	0.68	0.81	0.78	0.41
Japan	0.85	1.14	0.99	0.98	1.05	1.13	0.87	0.65	0.78	0.82	0.69	0.45
Luxembourg	0.80	1.06	1.01	0.94	1.20	1.15	1.04	0.72	1.44	1.25	1.10	0.67
Netherlands	0.54	1.01	1.00	0.99	0.36	0.57	0.60	0.53	0.33	0.53	0.57	0.53
Norway	0.83	0.99	0.99	0.71	0.85	0.88	0.95	0.52	0.78	0.75	0.83	0.43
New Zeland	0.72	1.00	0.98	0.87	0.85	0.94	0.83	0.61	0.80	0.81	0.64	0.46
Portugal	0.64	1.12	1.08	0.77	1.14	1.55	1.31	0.49	1.01	1.25	1.10	0.42
Spain	0.66	1.00	0.98	0.98	1.11	1.02	0.96	0.73	0.72	0.75	0.77	0.55
Sweden	0.83	1.09	1.14	0.96	1.13	1.17	1.26	0.78	1.29	1.33	1.56	0.78
Switzerland	0.67	1.04	1.01	0.88	0.93	1.25	1.07	0.59	0.87	1.22	1.19	0.59
United Kindom	0.81	1.09	1.05	0.82	1.16	1.40	1.08	0.67	1.45	1.39	1.04	0.58
United States	0.68	1.00	1.00	0.94	0.75	0.85	0.84	0.56	0.74	0.88	0.80	0.55
median	0.73	1.05	0.99	0.88	0.88	0.94	0.86	0.60	0.77	0.82	0.77	0.53
mean	0.75	1.05	1.01	0.88	0.90	1.01	0.91	0.59	0.85	0.93	0.87	0.53

Note: ratio of the root mean square error of the Global inflation model forecast to the one obtained with a random walk model (equation (9) in the main text), an AR(4) (equation (8) in the main text), a factor augmented AR(4) (equation (7) in the main text) and a Phillips augmented with commodity prices and money (equation (6) in the main text). Evaluation period: 1980-2004.

Figure 1: Measures of Global Inflation

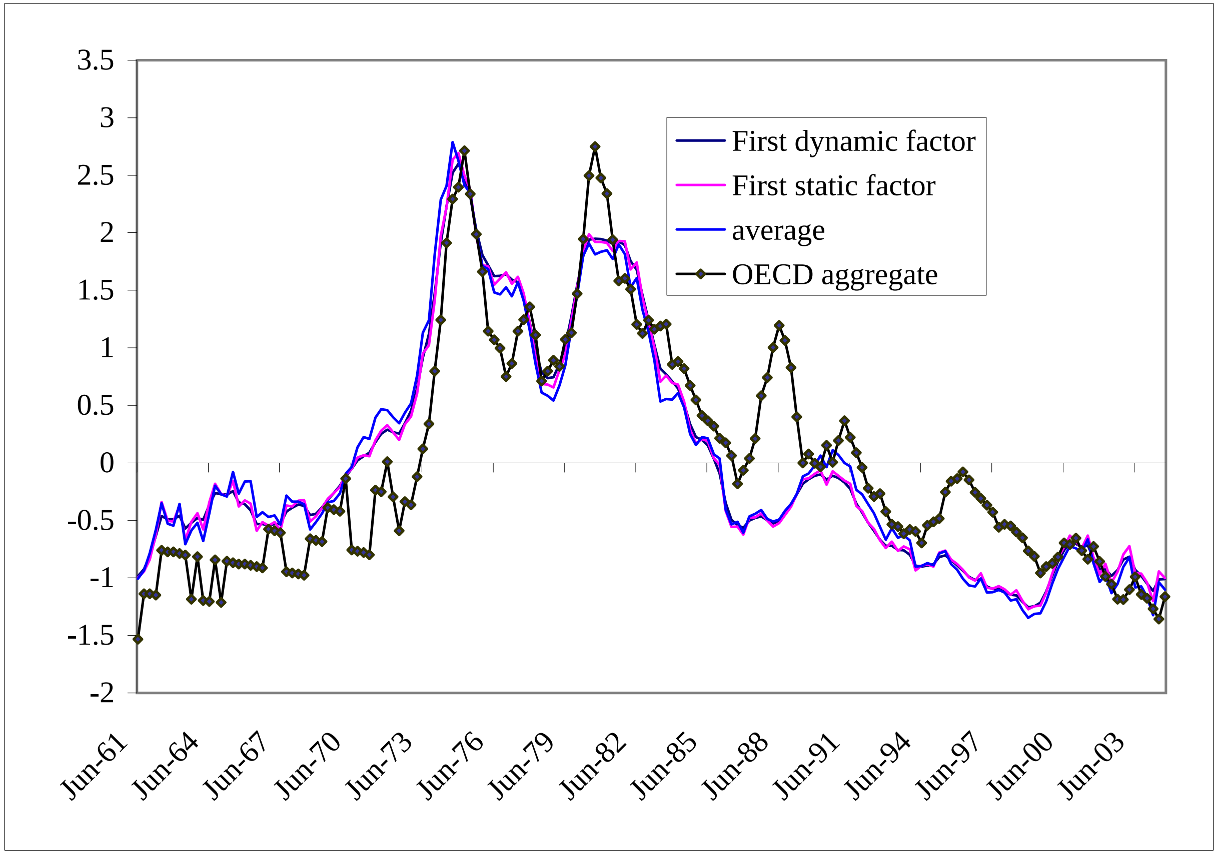

Figure 2a : G7 and euro area inflation and their projection on Global Inflation

United States, Japan, Canada and United Kingdom (1961-2004)

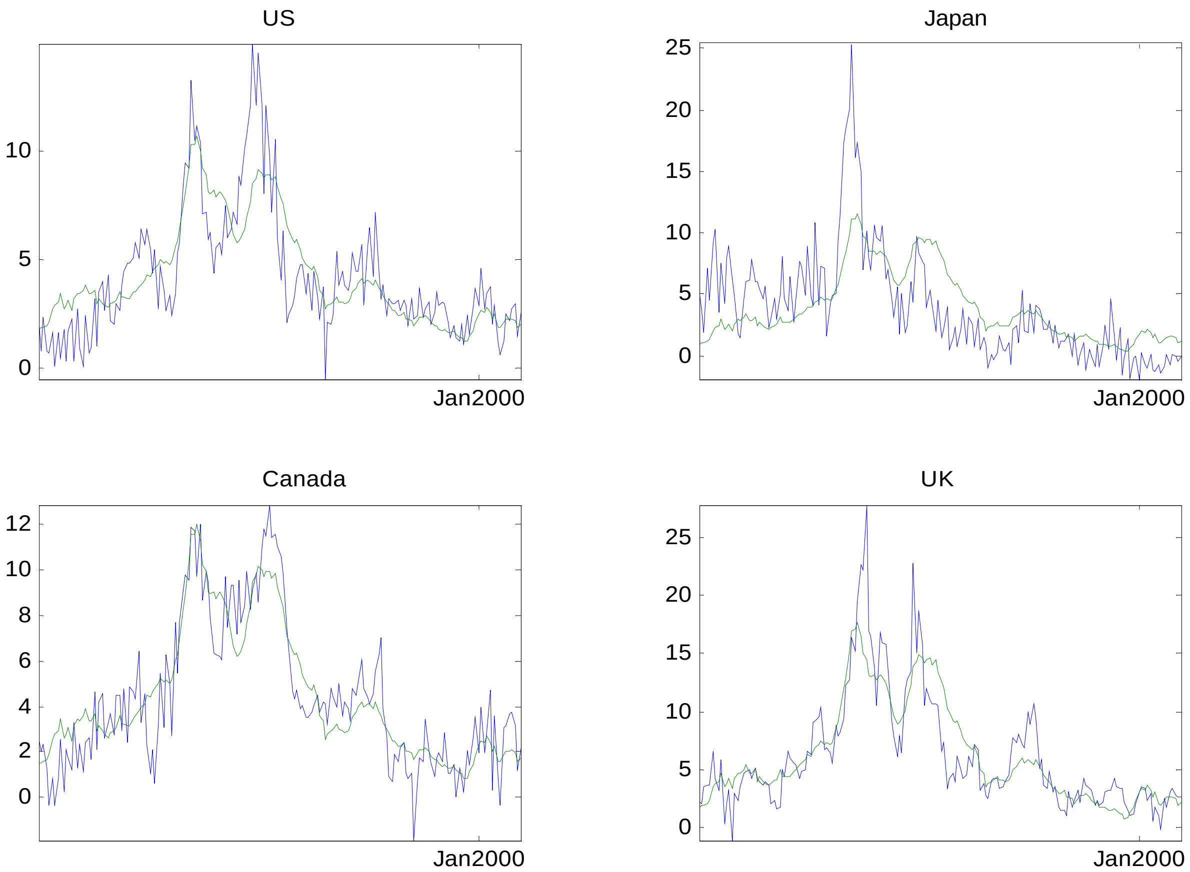

Figure 2b : G7 and euro area inflation and their projection on Global Inflation

Germany, France, Italy and euro area (1961-2004)

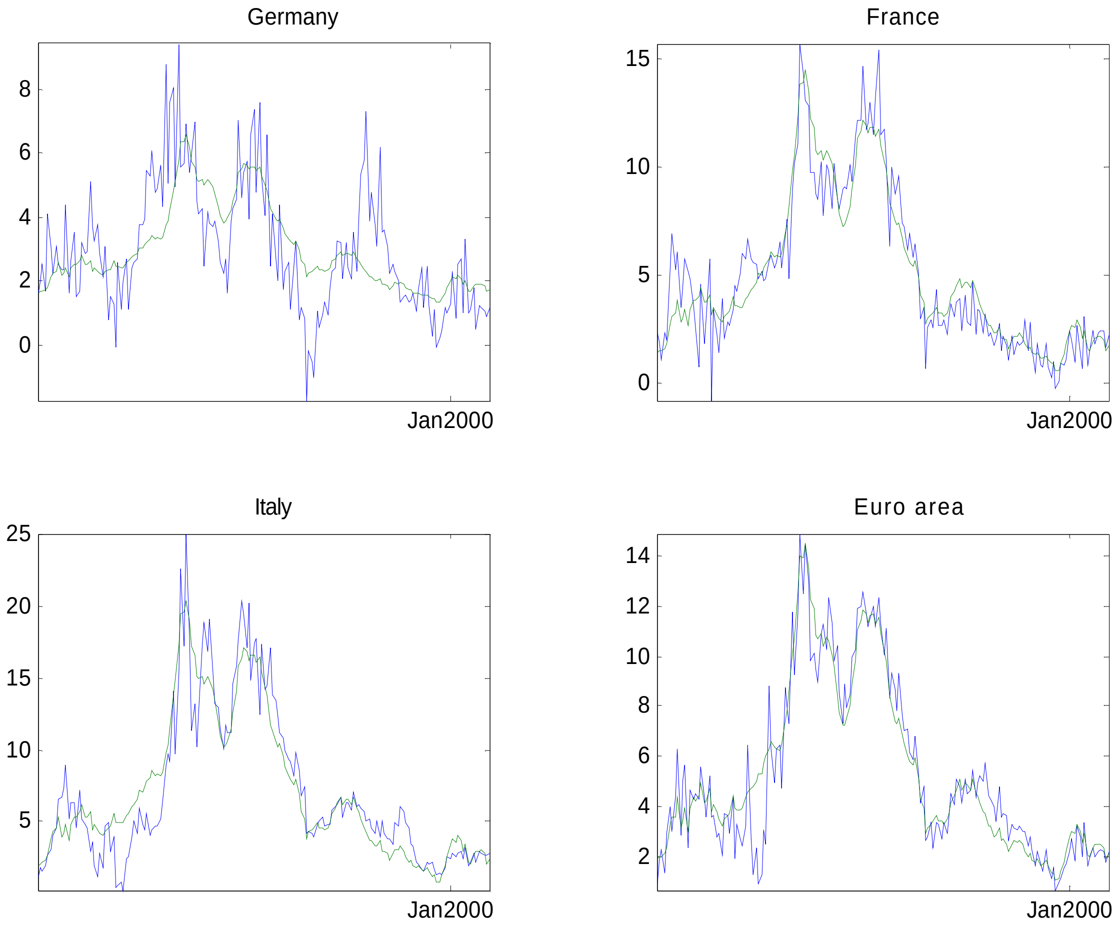

Figure 3: Measures of Global de-trended Inflation