Eurozone: how serious is the deflationary threat?

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Deflation in the eurozone is a *"protracted fall in prices across different commodities, sectors and countries. In other words, it is a generalized protracted fall in prices, with self-fulfilling expectations*". This is the definition of deflation that ECB President Mario Draghi gave in summer 2013[1]. At that time, Mr. Draghi said that the eurozone was just on a disinflationary trend, while risks of deflation were, however, subdued. One year later, with the inflation rate that halved and it is forecast to remain at low levels for a while, can we say that those risks are still subdued? What are the forces that are dragging down inflation? Is deflation a real threat for the eurozone? Having in mind the definition of deflation provided by Mr. Draghi, we try to answer these questions in the rest of the article.

Inflation decomposition

Energy and food have sharply declined

Let's analyse here the first part of definition of deflation: *…a protracted fall in prices across different sectors*…. The main sub-components of headline inflation are energy, food and core inflation, the latter being ex-food and ex-energy inflation. As shown in chart 1, energy and food prices, the most volatile components of the HICP index, have largely contributed to the decline of headline inflation.

Since its cyclical high of summer 2012 inflation had fallen by almost 2 percentage points (pp). Over the same, period energy prices deducted more than 1 pp and food prices around 0.4 pp from headline inflation. Those items are mainly driven by external factors such as commodity prices and the exchange rate.

Inflation decomposition

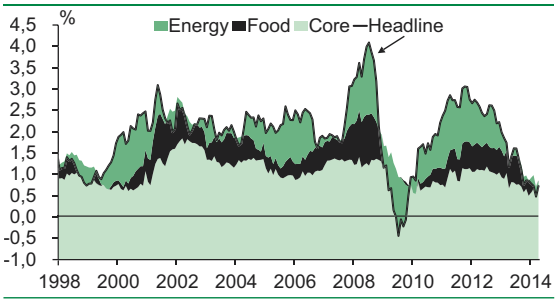

Chart 1 Source: Eurostat

Oil prices and energy inflation (12 month differences)

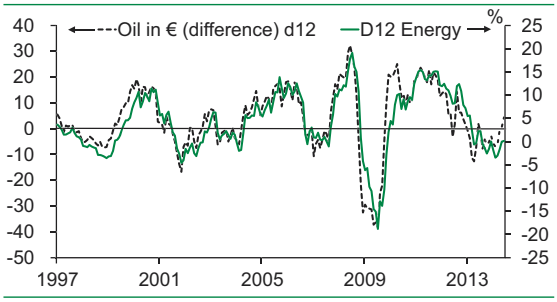

Chart 2 Sources: Eurostat, Datastream

Thanks mainly to the appreciation of the euro, the price of oil (in euro) fell by 15% between summer 2012 and April 2014, dragging down energy inflation, which accounts for around 11% of HICP inflation (see chart 2).

Should the central bank react to shock on commodity prices?

While ECB actions might have only indirect impact on the exchange rate (the ECB does not target the exchange rate), commodity prices are completely out of the control of the monetary authority. Negative supply shocks on these items are often due to geopolitical tensions or adverse weather conditions. Under the assumption that inflation expectations are well anchored, a shock on inflation due to commodity prices, might prove to be just temporary. It might create just a hump of inflation without altering inflation expectations and causing negative second round effects on wages for instance. When a central bank faces this situation, its best strategy is inaction. Otherwise it might add more volatility to inflation and activity.

Up to some months ago the rhetoric used by the ECB for not responding to the deceleration of inflation was partially based on these arguments, as ECB Governing Council members were claiming that the development was largely due to commodity prices and exchange rates movements.

The domestically oriented services inflation on a downward trend as well

Notice, however, that core inflation has been easing as well deducting 0.4 pp from headline inflation between August 2012 and April 2014 (see again chart 1). It turns useful, however, decomposing core inflation into its main two sub-components, which are Non-Energy Industrial Goods (NEIG) and Services inflation. As shown in chart 3, NEIG inflation, highly sensitive to import prices and exchange rates declined more markedly than services inflation. Yet, historically its volatility does not seem particularly uncommon.

Core decomposition

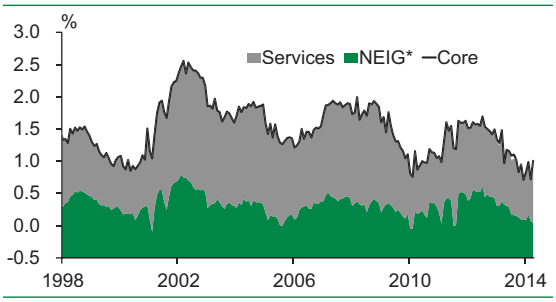

Chart 3 Sources: Eurostat

* *NEIG: Non-Energy Industrial Goods*

By contrast, the decline of services inflation, which accounts for 40% of HICP inflation, seems more worrying: as its main driving forces are domestic factors, a decrease of services inflation might indeed masks the weakness of domestic demand. For these reasons, the dynamics of services inflation is closely watched by the central bank as its actions are likely to affect these items mainly.

Disaggregating services inflation by country

Against this backdrop we decided to conduct a deep analysis of services inflation. First of all we looked at services price dynamics by country. One might expect that the weakening of inflation have been mainly localized in peripheral countries. These countries indeed have been undertaking severe measures to counter their internal and external imbalances. The corrective measures, varying from reducing public deficits, to cutting or freezing wage increase and/or raising taxes, through adopting structural reforms to rise competition in services sectors and finally to make the labour market more flexible, will likely produce positive effects in the medium-to-longer term, while in the short-term they have been weighing on domestic demand.

Core decomposition by country

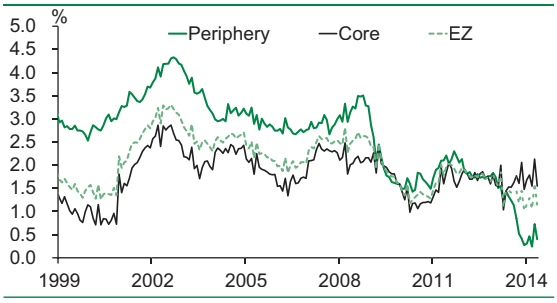

Chart 4 Source: Eurostat

Peripheral countries in this chart are: GR, ES; PT; IE, IT. Core countries are: NL; AT; LU, BE, FI, DE, FR

The ECB calls the ongoing adjustment in peripheral countries, which leads to lower inflation rate "*a genuine disinflationary trend*" as it is supposed to an adjustment in the medium-term. Within a monetary union, countries cannot use the exchange rate policy to counter shocks: they have to rely on cost and price

adjustments, triggering what is commonly called, an "internal devaluation". The effect of the adjustment would be more rapid and effective if the other countries in the zone were facing significantly higher inflation rates. Is this the case?

As shown in chart 4, services inflation in core countries is higher than in peripheral countries; yet it is everything but strong by historical standards (it is slightly below its long-term average), and for some core countries, such as Germany and the Netherlands it is now even below the eurozone average (see chart 5) suggesting that spare capacities and/or weak activity are weighing on price dynamics in core countries as well.

Services country breakdown

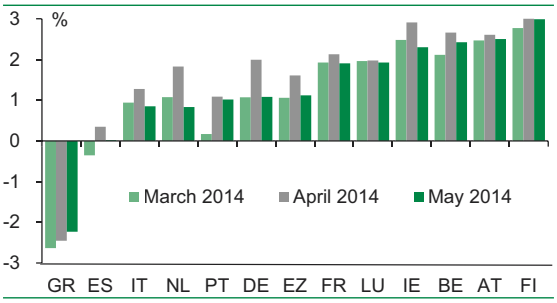

Chart 5 Source: Eurostat

…and by components…[2]

The aggregate figures for services inflation shows that some sectors in some countries are experiencing falling prices or extremely weak inflation rates in the eurozone. To evaluate deflationary risks we need to go one step farther and assess if these dynamics are spreading across sectors and countries or if they remain localized. In that purpose we analyse the 39 sub-components of the HICP for services. In charts 6 to 10 (see page 6) we have gathered, at any point in time, these sub-components in three groups: those recording a moderate annual price increase (inflation rate between 1% and 2%), those experiencing already a very subdued inflation rate (between 0% and 1%), and those where prices are actually falling. The larger the number of components in the second or third case is, the higher the risk of deflation.

Chart 6 shows the results for the eurozone as whole. While the number of services components with falling prices does not present any particularly anomaly from an historical perspective, the number of components recording weak inflation is trending higher and is slightly above the level reached following the Collapse of Lehman's Brothers in September 2008. Yet, this analysis does not detect a clear risk of deflation.

Conducting the same analysis by country, it comes with no surprise that the number of services components whose prices are falling or recording subdued increases is high and increasing among those countries like Greece Portugal Spain, which have been undertaking measures to correct their imbalances, as stressed above (see chart 7-8-9)

By contrast, conditions are very different in other countries. In Germany, only 10% of services items recorded a fall in prices in annual terms Q1 2014, and, historically, there is no anomaly (see chart 10). From an historical point of view also in France, the second largest economy of the area, services price dynamics did not show any anomaly. However, with respect to Germany, the percentage of items which has a weak inflation is rising, while in Germany it is declining. This confirms that the two economies are in a different part of the business cycle: Germany is expanding, while France is recovering at very low pace. Among the other core countries, the outlook is roughly similar in Finland, Austria and Luxembourg, but differs somewhat in the Netherlands, where the number of components with subdued or falling prices is rising.

Misleading aggregation

The ECB claims that aggregated eurozone figures are more relevant for setting a common monetary policy rather than country specific data. However, these weighted average figures are misleading if we want to look at the spreading of falling prices among components and countries and to gauge the risk of deflation. Notice that France and Germany alone account for around 50% of eurozone inflation data. Consider, for instance, the sub services component *Recreation & Culture*. Eurozone inflation could be positive just because prices are rising relatively fast in a small numbers of large countries, while they are falling among several other countries of the zone.

Breakdown of services inflation : percentage of subcomponents with an annual inflation rate below:

2% 1% 0%

Eurozone

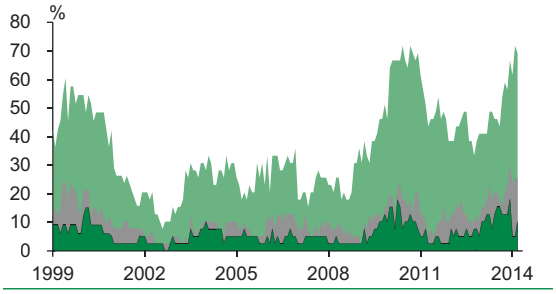

Chart 6 Sources: Eurostat, BNP Paribas

Greece

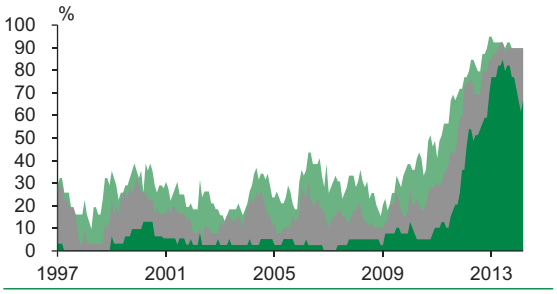

Chart 9 Sources: Eurostat, BNP Paribas

Spain

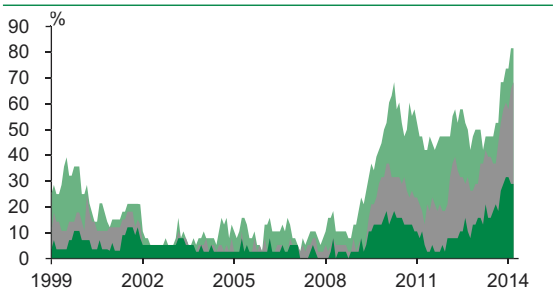

Chart 7 Sources: Eurostat, BNP Paribas

Germany

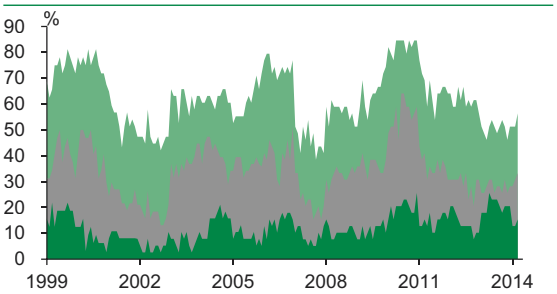

Chart 10 Source: BNP Paribas

Portugal

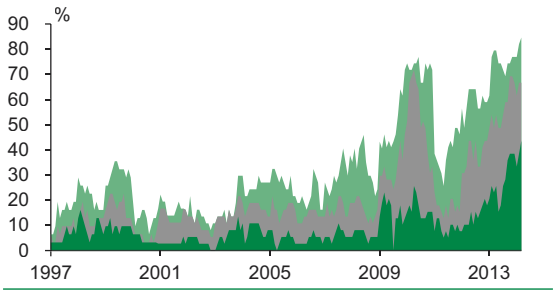

Chart 8 Sources: Eurostat, BNP Paribas

Reading the chart: Looking separately at the 39 sub-components of the services HICP for the eurozone (chart 6), around 70% (27 items) of them had an inflation rate below 2% at the end of Q1 2014, and 20% had an inflation rate below 1% and around 10% recorded a fall in inflation.

Services inflation: desaggregation by both components and countries

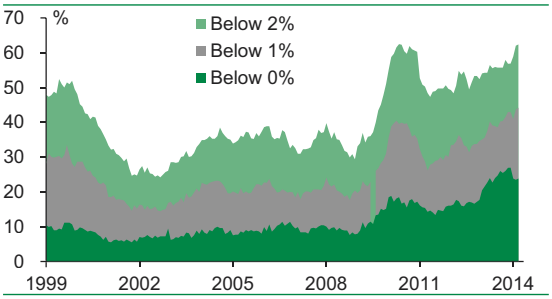

Chart 11 Sources: Eurostat, BNP Paribas

Note: Year-in-year growth rates of prices of services in the Eurozone, disaggregated according to sub-components (39) and countries (15). Percentage of services with inflation rate below 2%, below 1% and below 0%.

To get a sense of that effect, we disaggregated further, by countries, the subcomponents data used in Chart 6. We are thus now looking at evolution of prices for 39 subcomponents in 15 countries, or at 39*15=585 price indices[3]. Results are illustrated on Chart 11. The number of prices which are falling or recording very low inflation rates is increasing rapidly and has recently reached, the highest level ever recorded since the launch of the EMU.

The message coming out from chart 6 and 11 is radically different. A services decomposition considering aggregated country figures does not detect any particular anomaly regarding the risk of a generalized fall of prices. The picture is much more alarming considering data disaggregated both by components and countries. The number of services components recording falling prices is at historical high as it is the case for components recording very low inflation rates. While we are not in a situation characterized by generalized falling prices among sectors, categories and countries, this analysis suggests that we are moving in that direction.

The role of expectations[4]

As stated in the definition of deflation provided by Mr. Draghi, expectations play a key role in assessing if a country is experiencing deflation or not. If economic agents expect future prices to ease or even to decline they might decide to postpone their purchases. This behaviour might decrease demand today. Consequently current inflation might ease, and in a self-fulfilling mechanism inflation expectations decline further.

As this example shows, it is crucial having precise measures of inflation expectations, understanding how sensitive is inflation to inflation expectations and what are the determinants of inflation expectations.

How sensitive is inflation to inflation expectations?

To answer these questions we estimate a new Phillips curve[5] where inflation is function of inflation expectations, past inflation and other variables able to detect price pressures such as the output gap. The equation might be written as follows

$$(1.1)\ \pi = \alpha + \beta\pi_t^e + \gamma\pi_{t-1} + \eta gap_t + \nu_t$$

where π is core inflation, π^e are inflation expectations and is the output gap. Yet, the problem, is how to measure inflation expectations. Professional forecasters (Consensus Forecasts - CF-, Survey of Professional Forecasters - SPF- from the ECB), survey data (Panellists from the European Commission Survey) and financial markets provide monthly or quarterly series of inflation expectations at time horizon from 1 to 5 years.

The medium-to-longer terms are the ECB preferred measures of inflation expectations. However, those measures, such as the 5-year ahead derived from the SPF and the 5-year forward five-year-ahead ahead derived from financial markets suffer from some shortcomings. The former might be affected by a problem of circularity. As the ECB target is an inflation rate close but below 2%, it is not surprising that inflation expectations at longer time horizon are close to this target. Rather than being a measure of inflation expectations, the SPF 5-year ahead is probably more a measure of the credibility of the Central Bank. The latter, the five-year forward five-year-ahead derived from financial markets might reflect not only inflation expectations but also other elements such as risk prima. In addition, standard models of monetary transmission suggest that an interest rate change will have a full effect on the economy between 12-24 months ahead. For all these reasons, we resort to use inflation expectations with a time horizon between 1 to 2 years ahead derived from survey data or professional forecasters. Yet, as shown in box 1, those remaining measures do not come without problems; in particular how agents form their inflation expectations might alter

significantly the estimation results. Lastly consumers' inflation expectations derived from survey data seems more correlated to current inflation than to inflation expectation 12-month ahead and seem biased. For all these reasons results should be interpreted with caution.

As shown in table 1, inflation expectations are a key driving force of inflation: the corresponding coefficient is highly significant and greater than zero. However, it is smaller than the coefficient of past inflation, which reminds us that inflation, and particularly core inflation, is highly persistent. The output gap is also a relevant determinant of inflation, although its impact seems smaller.

Model results

	Dependent variables: core inflation (y/y)							
	Model 1		Model 2		Model 3		Model 4	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	-0.09	-0.80	0.07	1.13	-0.29	-3.90	-0.41	-4.24
Expectations								
CF 1-y ahead	0.23	3.54						
Survey 1-y ahead			0.12	6.74				
SPF 1-y ahead					0.28	5.61		
SPF 2-y ahead							0.35	6.86
Core inf(-1)	0.79	31.18	0.82	19.46	0.86	34.17	0.78	16.37
GAP			0.02	5.02	0.01	2.64	0.03	32.81
GAP(-1)	0.02	2.89						
Sample	01Q3 13Q4		96Q3 13Q4		99Q3 13Q3		99Q1 13Q3	
R2	0.85		0.84		0.83		0.84	
J-stat	10.22		11.71		9.65		11.15	
Prob(J-stat)	0.18		0.23		0.21		0.27	

Table 1 Source: BNPP Economic Research

In order to correct the model for the problem of endogeneity, we estimate equation (1.1) using the GMM technique. The instruments used are four lags of inflation, two lags of ULC, GAP and inflation expectations. We use quarterly data from Eurostat, (core inflation and unit labour costs) and from the OECD (output gap). Expectations come from the Consensus forecast, the ECB survey of professional forecasters and from the European Commission survey.

How are inflation expectations formed?

Up to this point, the issue of how inflation expectations are formed has not been addressed. In particular we know that $\pi^e = F(\Theta)$. Yet, we do not know neither the function F nor the arguments Θ of F (which might be actual inflation, past inflation expectations, activity variables etc.); we only know the results, that is the series of inflation expectations. We try, therefore, to investigate which are the determinants of inflation expectations estimating equation (1.2).

$$(1.2)\quad \pi^e{}_t = \alpha + \beta\pi_{t-1}{}^e + \gamma\pi_{t-1} + \eta gap_t + \nu_t$$

In particular we wanted to test the persistency of inflation expectations, how sensitive they are to current inflation, to the output gap and other variables such as commodity prices. It emerges (see table 2) that inflation expectations are highly persistent and that they are sensitive to current inflation.

Model results

	Dependent variables: Inflation expectations					
	CF 1 y ahead		CF 1 y ahead		SPF 1 y ahead	
Variables	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	0.61	3.67	0.84	3.04	0.68	3.52
Expectations						
CF 1-y ahead (-1)	0.50	5.41	0.42	2.37		
SPF 1-y ahead (-1)					0.52	3.53
inf HICP (-1)			0.09	3.07	0.08	2.39
inf core	0.16	2.36				
OIL (in € y/y)	0.003	4.49				
GAP						
GAP(-1)	0.03	2.35	0.04	3.02	0.02	2.80
Sample	01Q3 13Q4		01Q3 13Q4		99Q3 13Q4	
R2	0.77		0.73		0.70	
J-stat	3.81		3.77		2.28	
Prob(J-stat)	0.70		0.29		0.52	

Talble 2 Source: BNPP Economic Research

Estimation method: GMM; Instruments: 4 lags of inflation, 2 lags of ULC, GAP and inflation expectations. CF means Consensus Forecast, while SPF means Survey of Professional Forecasters. Several measures of inflation expectations against different measures of inflation (core or headline) have been tested.

Running a five years rolling sample estimate of equation (1.2), we found that the persistency of inflation expectations have increased over time (see chart 12). Is this a problem for conducting monetary policy? Indeed, it might be. If the economy is hit by a shock inflation expectations might take a longer period before coming back to their pre-shock level. A shock might detach inflation expectations. In this case, monetary authorities have to undertake stronger actions than otherwise needed to achieve their targets. Notice that central banks always try to smooth their actions. Traditional explanations for smoothing changes of policy actions refer to *i)* fears of disruption to capital markets, *ii)* loss of credibility from sudden major policy changes and *iii)* the need for consensus-building to support a policy change. Should a central bank be obliged to adopt stronger actions to achieve its target, it might cause disruption in the economy in terms of higher output losses and rising unemployment.

Persistency of inflation expectations

Chart 12 Source: BNP Paribas

Box 1

Are the measures of inflation expectations biased?

In equation (1.1) different measures of inflation expectations were used. However, it is quite difficult to assess they accuracy. For instance, inflation expectations derived from the European Commission Consumer Survey have some shortcomings. Each month, panellists are asked whether they think the rate of inflation will increase, remain stable or decrease. Results are then summarized and a qualitative measure of inflation expectations one year ahead is derived. Using a probabilistic approach, a quantitative analysis of inflation expectations might be built[6]. It seems, however, that this measure of inflation expectations is too much related to current inflation (see chart 13) and to other factors, such as oil prices, which affect inflation after a very short period of time.

Consumer inflation expectations and inflation

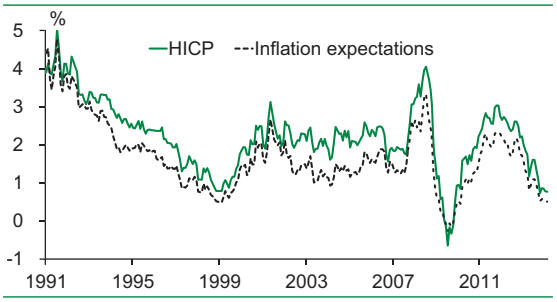

Chart 13 Source: BNP Paribas

By contrast, the ability of these inflation expectations to predict future inflation seems poor. In particular, we cannot reject the hypothesis that this measure is biased. Biased inflation expectations imply that, on average, economic agents systematically under or over predicts inflation. If agents systematically commit the same errors, it means that they are not rational. Non-rational inflation expectations are a problem for monetary authorities. If a shock hits the economy and inflation and inflation expectations overreact to this shock, monetary authorities may be forced to undertake stronger actions than otherwise needed to keep inflation expectations anchored and consistent with the central bank inflation target A formal test to check if inflation expectations are biased can be conducted using the following equation, where π^e are inflation expectations (in this case the one derived from European Commission Consumer survey) and π is headline inflation

$$\pi^e{}_t = \alpha + \beta\pi_{t-12} + \nu_t$$

and testing simultaneously if

$$H_0 = (\alpha;\beta) = (0;1)$$

The test significantly rejects the null hypothesis, and consequently consumer's inflation expectations cannot be defined as rational and we opted to use measures of inflation expectations derived from professional forecasters in equation (1.1).

Yet, we do not know how professional forecasters form their expectations, and this might be a problem as well. In applied economic studies the version of the New Phillips curve is often estimated as follows:

$$(1.3)\ \pi = \alpha + \beta E(\pi_{t+1}) + \gamma\pi_{t-1} + \eta\Phi_t + \nu_t$$

Inflation π is function of expected inflation $E(\pi_{t+1})$, past inflation π_{t-1} and other variables such as the output gap or unit labour costs which might detect price pressures. Notice that in equation (1.3) the function $E(\ )$ which determines the expectations is unknown and the way to measure inflation expectations remains an issue. This problem might be solved by estimating equation (1.3) using the Generalized Method of Moments (GMM) technique, which makes it possible to estimate equation (1.3) without specifying the form of expectations.

To fit equation (1.3) with the data, the unobservable forecast variable is eliminated adding and subtracting to (1.3) $\beta\pi_{t+1}$. Therefore (1.3) might be rewritten as

$$\pi = \alpha + \beta\pi_{t+1} + \gamma\pi_{t-1} + \eta\Phi_t + \varepsilon_t$$

$$(1.4)\ \varepsilon_t = \beta\underbrace{(E(\pi_{t+1}) - \pi_{t+1})}_{\text{Forecast error}} + \underbrace{\nu_t}_{\text{iid error}}$$

The starting point for the GMM estimator is a theoretical relationship that variables should satisfy: Normally we look for orthogonality conditions between some function of the parameters (in our case, the expected function for future inflation) and a set of variables. Let's define z_t as the vector of observed variables at time *t,* (in our case, the set of instruments used). Based on rational expectations, the

forecast error at time *t* in equation (1.4) is uncorrelated with the set of variables observed at time *t*, which is z_t in our case. z_t is also uncorrelated with the error term ν_t which is assumed to be *i.i.d.* These assumptions provide us with a set of orthogonality conditions.

$$E\left(\varepsilon_t \middle| z_t\right) = 0 \Rightarrow$$

$$E\left\{\left(\pi_t - \alpha - \beta\pi_{t+1} - \gamma\pi_{t-1} - \eta\Phi_t\right) z_t\right\} = 0$$

Given these orthogonality conditions, we can estimate the model (1.4) using GMM. The set of variables included in z_t, following what done by Gali et all (2001) –see endnote n. *V*- are 4 lags of inflation, 2 lags of unit labour costs, wages, and the output gap (as measured by the OECD). Table 3 shows the results. The coefficient of inflation expectations is greater than the corresponding coefficient of past inflation and significantly different from zero. Unit labour costs, chosen here as a factor accounting for price pressures rather than the outputgap, are also a relevant factor of inflation; however, their impact is smaller than the one of past inflation and inflation expectations. We tried different specifications (output gap rather than unit labour costs, core inflation rather than GDP deflator), but results were not significantly affected.

Model results

Dep variable: Inf	GDP deflator (y/y)		Core inflation y/y	
	Coef	t-stat	Coef	t-stat
Const.	-0.08	-8.07	-0.01	-0.58
Exp(inf(+1))	0.61	34.88	0.54	34.78
inf(-1)	0.42	27.90	0.46	27.71
ULC	0.02	3.96	0.01	3.07
Sample	97Q1 13Q2		96Q3 13Q3	
R2	0.93		0.90	
J-stat	9.58		9.65	
Prob(J-stat)	0.21		0.21	

Table 3 Source: BNPParibas

Note : Estimates computed using GMM
Instruments: are 4 lags of inflation, 2 lags of unit labour costs, wages, output gap (as measured by the OECD). The J statistic for overidentified restrictions does not reject the validity of instruments used

Comparing model results from equation (1.4) and (1.1) it emerges that, in the former, the coefficient of inflation expectations is greater and larger than the coefficient of past inflation, while the opposite occurs when the model of equation (1.1) is used. This might suggest that wondering how inflation expectations are formed is not an irrelevant question and might biased the results; inflation might be even more sensitive to inflation expectations than what is suggested by the model equation (1.1) when available measures of inflation expectations derived from professional forecasters are used.

Yet, the approach used in equation (1.4) does not come without problems. In particular, some problems might emerge when we have to use the model (1.4) to conduct out of sample projections for inflation, as the user has to produce projections for all the instruments used. For this reason we resort to use the model of equation (1.1) In particular, we decided to replace the expectation operator $E(\pi_{t+1})$ of equation (1.3) which is unknown, with $F(\pi_{t+1}) = \pi^e$. The function $F(\ )$ is unknown but the results π^e are known, and equal to the different series of inflation expectations. The equation we want to estimate, therefore, is the following:

$$\pi = \alpha + \beta \underbrace{F(\pi_{t+1})}_{\pi^e} + \gamma\pi_{t-1} + \eta\Phi_t + \nu_t$$

which is exactly equation (1.1).

Combining all information together…

Up to this point we found that inflation expectations are a key driving force of current inflation, while the latter is a driving force of inflation expectations. Yet, determining who drives the other is not an easy exercise. A *Granger causality test* does not detect any clear direction of the relationship [7]. Therefore, given the tight relationship between inflation and inflation expectations it is probably warranted to estimate equations (1.1) and (1.2) in a system of simultaneous equations (see box 2 for more details).

The dynamic solution of the system replicates past data relatively well (see charts 14, 15, 16). The greater distance between actual data and model results, occurred between 2011 and 2013. Many factors might be behind these results; in particular, rigidities in the labour and product markets are factors which might have prevented inflation from decelerating as massively as suggested by theoretical models despite the large fall of activity. These rigidities in some sense reduce the risk of deflation for the eurozone. In addition, the lack of precision in estimating the output gap, (particularly after a financial crisis where several series might present structural breaks) is another factor which might explain the spread between actual inflation and model results.

The out of sample estimates for 2014 and 2015 are provided in charts 17, 18, 19. Inflation expectations are projected to remain relatively low and progressively recover over the forecast horizon. Core inflation seems subject to downward pressures. The large and negative output gap will continue, indeed, to exert downward pressures on core inflation. Yet, thanks to the recovery of the other components (food and energy), HICP will moderately increase.

System results

In sample

Out of sample

Inflation expectations
(SPF-Survey of Professional Forecasters-1y ahead)

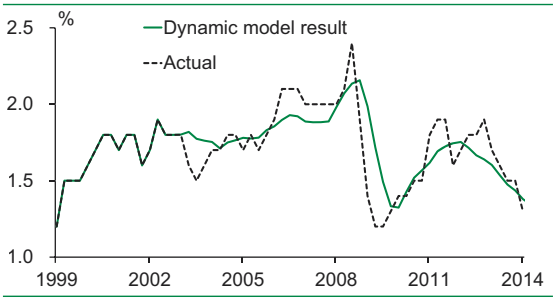

Chart 14 Source: BNP Paribas

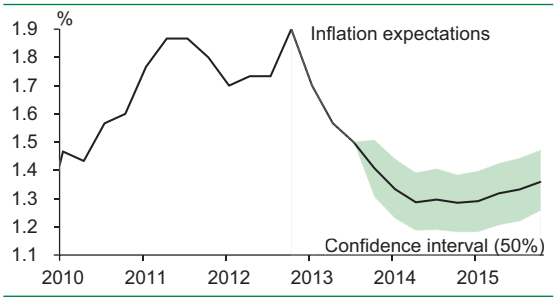

Chart 17 Source: BNP Paribas

Core inflation

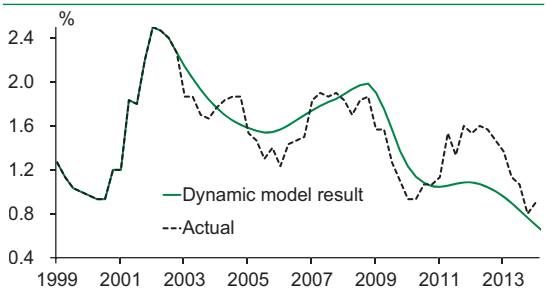

Chart 15 Source: BNP Paribas

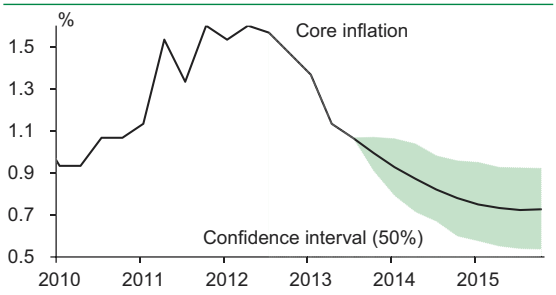

Chart 18 Source: BNP Paribas

HICP Inflation

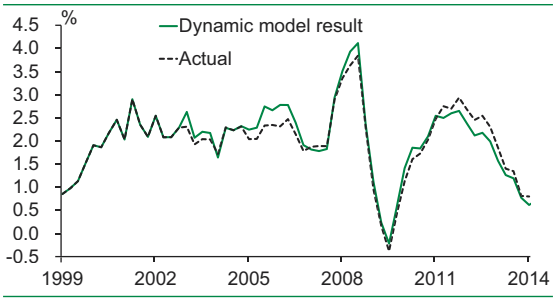

Chart 16 Source: BNP Paribas

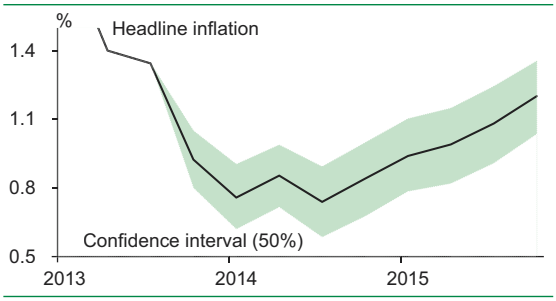

Chart 19 Source: BNP Paribas

Box 1

Inflation and inflation expectations: a joint analysis

Given the link between inflation and inflation expectations we resort to estimate equations (1.1) and (1.2) in a system of simultaneous equations, that is

$$(1.5)\quad \begin{cases} \pi_t^e = \alpha + \beta \pi_{t-1}^e + \lambda gap_{t-j} + \theta oil_t + \delta \pi_{t-j}^{core,HICP} + \varepsilon_t \\ \pi_t^{core} = \alpha + \beta \pi_t^e + \lambda gap_{t-j} + \theta oil_t + \delta \pi_{t-j}^{core} + \nu_t \\ \pi_t^{HICP} = \eta^1 \pi_t^{Core} + \eta^2 \pi_t^{Energy} + \eta^3 \pi_t^{Food} \\ \sum_i^3 \eta^i = 1 \end{cases}$$

Different specifications were used, considering several measures of inflation expectations (CF 1-year ahead, SPF, 1-y or 2-y ahead) and different measures of actual inflation (core or headline with different lags j). The system was estimated using the GMM to avoid endogeneity problems. The instruments used are four lags of inflation, two lags of unit labour cost, outputgap and inflation expectations. All variables are significantly different from zero and the J-statistics does not reject the validity of the instruments used (results are available upon request to the author). Notice that while the first two equations of the system (1.5) are stochastic, the third one is just an accounting equation, with the η^i coefficient equal to the weight of the components of core, energy and food within the HICP inflation. For the out of sample forecasts, we used output gap projections from the OECD, while oil prices, food and energy inflation rates are in house projections.

Simulation results require, as always some cautions. First of all an incorrect specification of the model, due to omitted variables, might create instability in the simulation period. Omitted variables might be "silent" in the estimation period, but become relevant thereafter. In addition, potential structural breaks are other elements which may alter simulation results.

To sum up, the analysis presented in this paragraph confirms that inflation expectations are a key driver of actual inflation, which is itself a key determinant of inflation expectations. A sudden fall in inflation expectations might push down inflation which, in a self-fulfilling mechanism might push down inflation expectations as well. A negative shock on inflation might trigger the same process. Inflation expectations at a time horizon between 1 up to 2 years are currently at their lowest levels ever recorded. Should this trend continue, the deflationary risks for the eurozone would increase.

Current economic environment and risks of deflation

The evolution of economic conditions is another key element to assess the risks of deflation. On this point there are some positive signs. The eurozone is gradually recovering. Available information suggests that domestic demand is strengthening. While Germany is still outperforming its peers, activity growth is increasing in the peripheral countries. Better prospects of demand combined with rising profits might induce firms to invest. In this environment firms might decide to hire new staff, and rising employment might support consumption and eventually activity.

Yet, how strong is the recovery? Will it be able to raise inflation and inflation expectations? Unfortunately, the answer on this point is somewhat less positive. First of all, the level of spare capacities, however they are measured (output gap, unemployment gap) remains large. In addition, subdued credit growth, high unemployment rates and ongoing deleveraging process are factors that keep the pace of the recovery rather weak. This suggests that the outputgap should decline only moderately over the coming years. International organisations estimate it in the range of -3.8% and -2.2% in 2014 and in the range of -3% and -1.7% in 2015. Notice that standard estimates of the Phillips curve suggest that inflation is more sensitive to the level of the outputgap than to its dynamics. Therefore a large negative ouptuput gap, although declining, will continue to exert downward pressures on inflation. While a 5-year rolling sample analysis conducted on the equation (1.1) suggests that the coefficient of the outputgap in the Phillips curve has increased, it remains relatively modest (see chart 20), suggesting that the Phillips curve is rather flat. A flatter Phillips curve implies that greater increase of output would be needed to raise inflation than in the case if it was more sensitive to activity. While the lack of flexibility of the eurozone economy prevented inflation from falling as largely as models would have predicted, it would also limit the increase of inflation when activity start to recover.

Slope of the Phillips curve
Evolution of the output gap coefficient

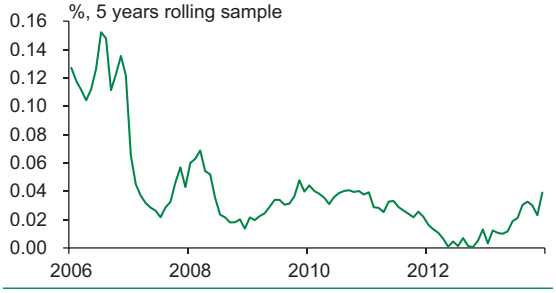

Chart 20 Source: BNP Paribas

If defined as Mr Draghi did, deflation is not the situation where the eurozone currently is. Our analysis did not find that the eurozone is in deflation. Yet, many alarm bells are ringing. The ongoing disinflationary process might turn into a deflationary one.

Disaggregating services inflation we found that the number of subcomponents whose prices are falling in annual terms or are recording very limited increases is getting worse and reached its highest level recently. This is particularly worrying as services inflation is mainly driven by domestic forces. The eurozone is not experiencing a "generalized fall of prices"; yet our analysis suggests that we are moving in that direction.

Empirically we found that inflation expectations are a key driving force of actual inflation, which is itself a key determinant of inflation expectations. A decline in inflation expectations might therefore push down inflation and, in a self-fulfilling mechanism, inflation expectations as well. On this point, data are not very encouraging either: inflation expectations with a time horizon between 1 and 2 years are trending downwards. Further falls of inflation expectations might switch the current disinflationary trend towards a deflationary one.

The ongoing recovery in the eurozone is clearly welcomed. Yet, its pace is rather weak and unable to rapidly reduce the huge level of excess capacities, which continues to exert downward pressures on inflation. In addition, the Phillips curve is rather flat; this means that its sensitivity to outputgap or activity is rather modest. Therefore significant increase of activity is needed to push inflation up. Unfortunately the eurozone is experiencing everything but a buoyant recovery.

For all these reasons, the package of measures adopted by the ECB in June 2014[8] is clearly welcomed. They are designed to ease further the ECB monetary policy stance and to enhance the transmission mechanism of the monetary policy. As these measures are planned to strengthen demand and credit growth and to decrease the external value of the euro, they might eventually lift inflation expectations and inflation.

1st July 2014

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NOTES

[1] *See ECB: "Introductory statement to the press conference (with Q&A)" , June 2013 available at http://www.ecb.europa.eu/press/pressconf/2013/html/is130606.en.html.*

[2] *Frederique Cerisier has contributed to this paragraph.*

[3] *We considered 15 out of 18 countries. The excluded countries are Slovakia, Estonia and Malta, for which not all services inflation figures were available.*

[4] *This paragraph is largely derived from "How important are inflation expectations?" EcoWeek 14-17 BNPParibas published the 02/05/2014.*

[5] *The main difference between the New and old version of the Phillips curve is that the former links inflation to inflation expectations and the output gap, while the traditional one linked current inflation just to past inflation and the output gap. The "hybrid" version of the Phillips curve links inflation to expected inflation, past inflation and the outputgap. This curve is derived from a profit maximization model of two kinds of firms: one that sets prices based on forward-looking behaviour and another that sets prices according to a backward-looking rule of thumb. As a result, both future inflation and past inflation are included. Firms fix prices as a mark-up on marginal costs. In applied studies, these are replaced by unit labour costs. Theoretically and under certain conditions, marginal costs are proportional to the output gap. For the more details see Gali, J. Gertler M., Lopez-Salido J.D (2001)., "European Inflation Dynamics" European Economic Review 45 (7) : pag. 1237-70 and Gali J. (2008) "Monetary Policy, Inflation and the Business Cycle: An Introduction to the New Keynesian Framework", Princeton University Press, March.*

[6] *On this point see, among others, Arnold Iand Lemmen J (2006) "Inflation expectations and inflate uncertainty in the Eurozone: Evidence from survey data" CESIFO Working Paper N. 1667.*

[7] *The Granger Causality test wants to assess whether a series x causes a series y . This is done by analysing how much of y is caused by past values of y and from the past value of x . The series y is said to be Granger caused by x if past values of x help predicting y . In particular, a Wald statistics test for the joint hypothesis that all coefficients of the past values of x are equal to zero is conducted. In our case we cannot reject the hypothesis that inflation expectations does not Granger cause inflation and we cannot reject either that inflation does not Granger cause inflation expectations The following table reports the result of the test:*

Pairwise Granger Causality Tests

Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*
*Inflation does not Granger Cause Inflation expectations**	*155*	*0.95*	*0.42*
*Inflation expectations does not Granger Cause Inflation**		*1.95*	*0.12*

Table 4 *Source: BNPParibas*

**Inflation expectations : 1-year ahead from CF, inflation=core inflation*

[8] *On this point see "The ECB plays hard" Ecoweek 14-21 BNPParibas, 6 June 2014.*

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