# Commentary:
Modeling Inflation After the Crisis

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It would be difficult to think of two researchers who are more knowledgeable on the topic of this session, "Modeling Inflation After the Crisis," than Professors James Stock and Mark Watson. They have a long research track record of modeling inflation, often pointing to the difficulties of forecasting inflation and the instabilities and measurement issues in Phillips-curve-based inflation modeling. In this paper, in contrast, they emphasize a remarkable stability in the association between the increase in unemployment and the fall in inflation during recessions. This finding builds on previous analysis in which they showed that, relative to naïve inflation forecasts, economic activity variables seem to have additional explanatory power for inflation in recessions, but not in other periods.[1] They propose a new unemployment gap measure that rises in recessions and is flat in booms and show that this leads to a stable Phillips-curve-based inflation forecasting model. Chart 2 of the Stock-Watson (SW) paper illustrates the basic result of the paper. An increase in unemployment of 1 percentage point during a recession is typically associated with a peak fall in inflation of between 0.5 and 1.0 percentage points depending on the type of inflation measure one looks at (0.5 for the gross domestic product (GDP) deflator and 1.0 for the consumer price index (CPI).[2]

These findings are, of course, very relevant for the current debate about the risks of inflation or deflation in the United States. According to Chart 12 in the paper and SW's preferred model, the persistently high unemployment rate would suggest another drop in core personal consumtion expenditures (PCE) inflation of about 0.5 percentage point over the next year-and-a-half. The uncertainty is, however, very large, with both downside and upside risks. One upside risk is related to the assumption regarding the non-accelerating inflation rate of unemployment (NAIRU). The proposed unemployment gap implicitly assumes that the NAIRU is constant during the recession (although it is allowed to vary across recession periods). We know from previous SW work, together with Douglas Staiger, that typically the NAIRU is time-varying and itself estimated with a high degree of uncertainty.[3] With the hysteretic European unemployment experience of the 1970s and 1980s in mind, one striking feature of current unemployment figures in the United States is its historically large longer-term component. The experience in Europe has been that for a variety of reasons the long-term unemployed do not have the same downward pressure on wages, as, for example, empirically shown by Llaudes (2005). One of those reasons is that the long-term unemployed lose skills and human capital, reducing their attractiveness for employers because of costs of retraining. Such phenomena raise the possibility that the NAIRU has increased in the current recession and that a given rise in headline unemployment may be associated with less disinflationary pressure.

Before discussing some of the other elements that may affect the inflation outlook, let me first point to some evidence that similar relationships also hold in other regions such as the euro area. Chart 1 replicates SW's Chart 2 for the euro area, based on the four recession periods identified by the Centre for Economic Policy Research (CEPR) (Europe's equivalent of the National Bureau of Economic Research). The main message is the same: Also in the euro area the rise in unemployment during a recession is associated with a fall in inflation (whether measured on the basis of the harmonized index of consumer prices, HICP or the GDP deflator). Somewhat surprisingly, the average elasticity over the four recessions (of which

Chart 1a
Unemployment and Inflation During Recessions in the Euro Area (%)
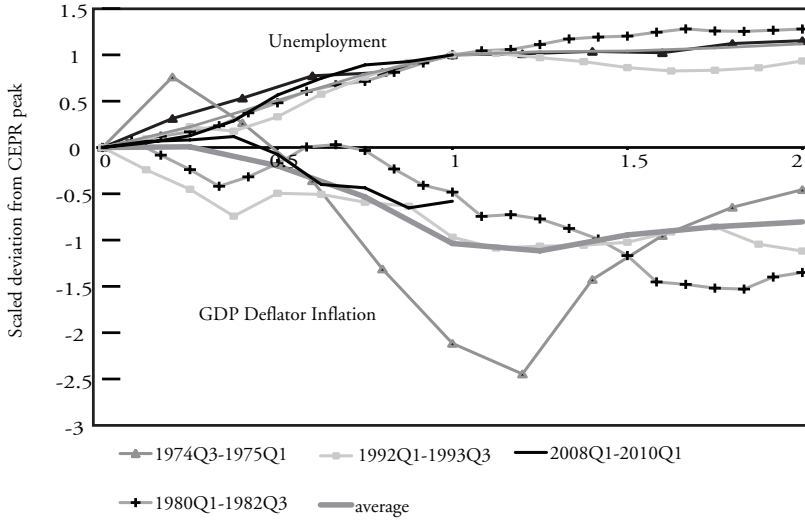
Note: See Stock and Watson (2010) for methodology. The peaks of the euro area business cycle are identified by the CEPR.

Chart 1b
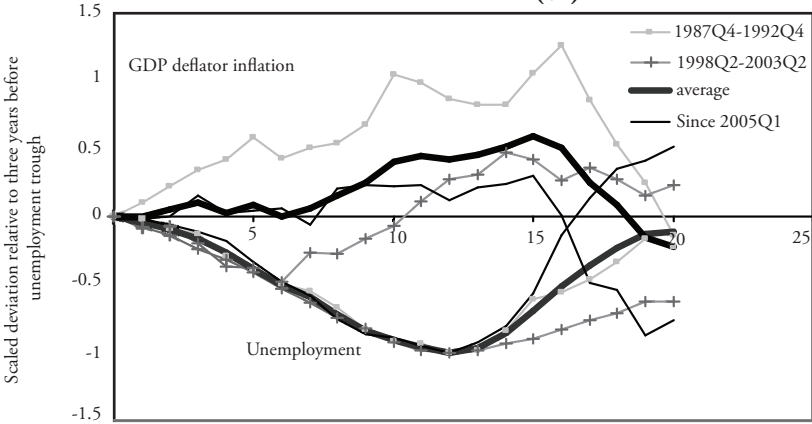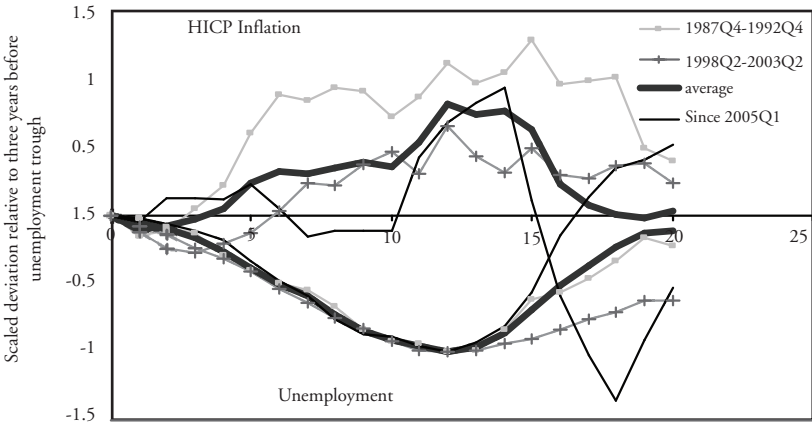## Unemployment and Inflation During Recessions in the Euro Area (%)
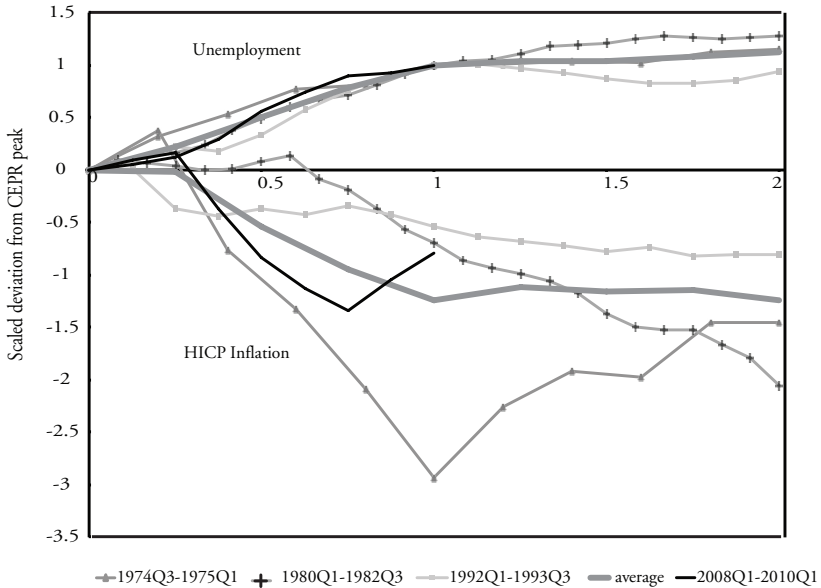
Note: See Stock and Watson (2010) for methodology. The peaks of the euro area business cycle are identified by the CEPR.

Chart 2a
Unemployment and Inflation During Booms
in the Euro Area (%)

Chart 2b
Unemployment and Inflation During Booms in
the Euro Area (%)

only the most recent one is in the European Monetary Union (EMU) period) is somewhat larger than in the United States, i.e., more than one. But there is quite a bit of variability, and the larger average effect is partly driven by the larger fall in inflation in the 1970s recession, which is not included in the SW Chart.[4]

One question that immediately arises is whether there is symmetry: Are periods in which the unemployment rate is falling rapidly also associated with a significant rise in inflation? If the answer is yes, then one explanation for the SW finding may be that it is just easier to

detect a Phillips curve relationship when the changes in unemployment are large. Charts 2 a-b show that in the euro area there is indeed a similar association between a drop in unemployment and the rise in inflation, although the size of the elasticity is somewhat smaller and less than one. This is consistent with evidence by Barnes and Olivei (2002) that the slope of the Phillips curve is steeper for larger output gaps in either direction.
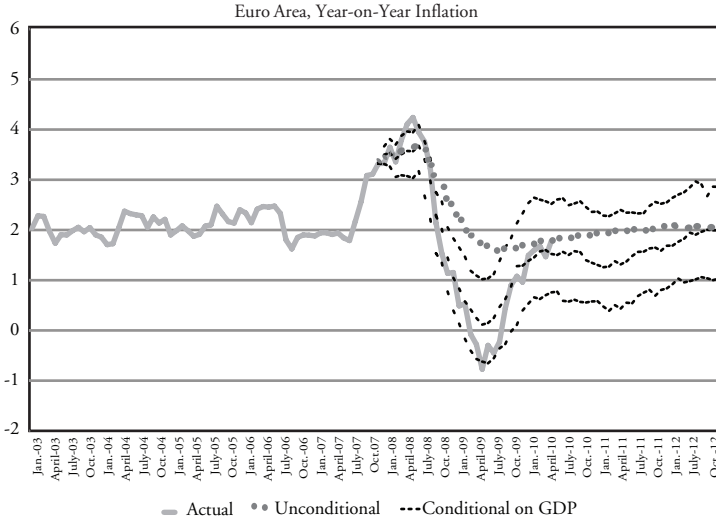
In the light of this evidence, we can also have a look at alternative tools to see to what extent the Phillips-curve relationship is alive in the current recession in the euro area. Charts 3a-b show unconditional inflation forecasts and forecasts conditional on observed and projected GDP as of the start of the current recession as identified by the CEPR. It uses a large monthly Bayesian Vector Auto Regression (BVAR) model estimated by ECB colleagues (Giannone, Lenza, Momferatou and Onorante, 2010) to generate those forecasts. Conditional on observed GDP developments since the beginning of 2008, the actual fall and subsequent rise of both headline HICP and HICP excluding non-processed food and energy can be replicated quite closely. So, the Phillips curve is alive, but so far the effects have been moderate and inflation is bouncing back as the economy has started to recover.[5] Seen from the perspective of the BVAR model, the current risks of deflation are small.

The evidence on a Phillips-curve relationship is more general. In a recent International Monetary Fund (IMF) working paper, Andre Meier (2010) looks at how inflation behaves in episodes with a persistent large output gap across 15 Organization for Economic Cooperation and Development (OECD) countries since the 1970s. He finds that inflation falls by about one-fourth of the initial inflation rate per year in such episodes. Moreover, the size of the fall in inflation is related to the size of the increase of unemployment. Importantly, this relationship becomes less clear and even disappears at very low inflation rates. As is clear from Chart 4, also in the euro area there has been evidence that the Phillips curve has flattened as average inflation has come down.

What can explain this flattening of the Phillips curve? A number of factors such as globalization and the establishment of credible,
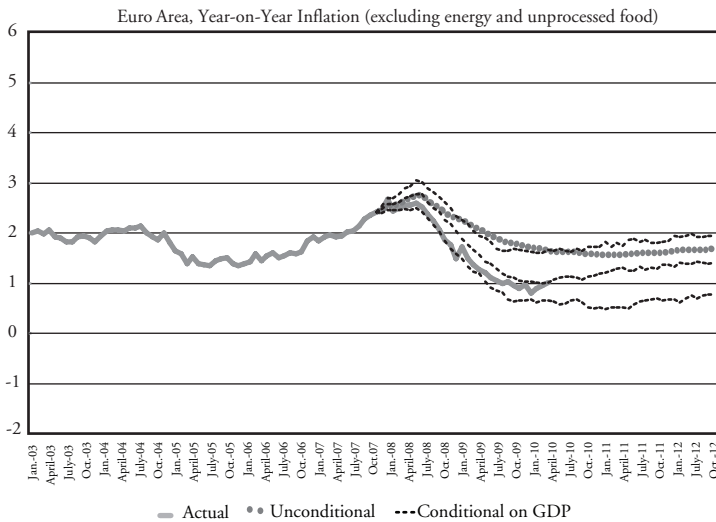
Chart 3a
## BVAR-Based Conditional Forecast of HICP Inflation as of 2008Q1

Euro Area, Year-on-Year Inflation

— Actual   • • Unconditional   - - - Conditional on GDP

Chart 3b
Conditional Forecast of "Core" HICP Inflation as of 2008Q1

Euro Area, Year-on-Year Inflation (excluding energy and unprocessed food)

— Actual   • • Unconditional   - - - Conditional on GDP

Note: The BVAR contains 14 monthly variables, including the five components of the HICP. See Giannone, Lenza, Momferatou and Onorante (2010). The conditional forecast is conditional on actual and projected GDP over the forecasting period. The confidence bands are at the 15 and 85 percentile. 2008Q1 is the peak before the current recession as identified by the CEPR.

Chart 4
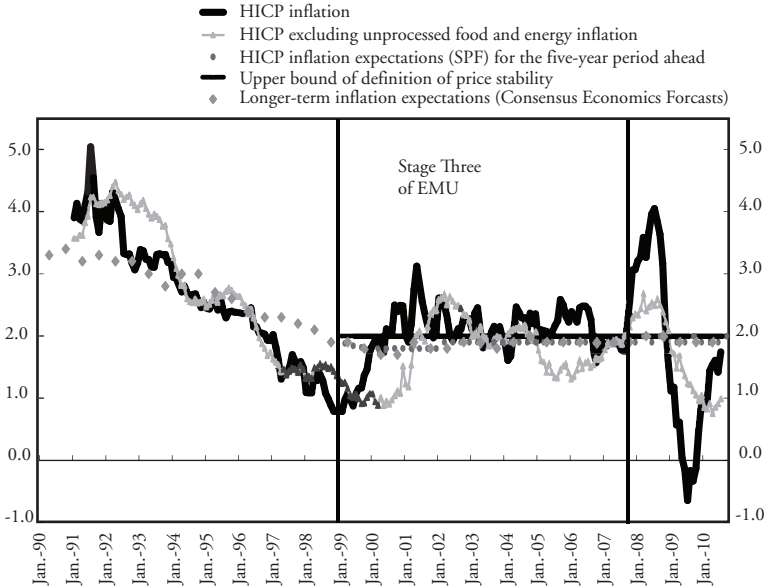**HICP Inflation and Unemployment Gaps in the Euro Area (%)**
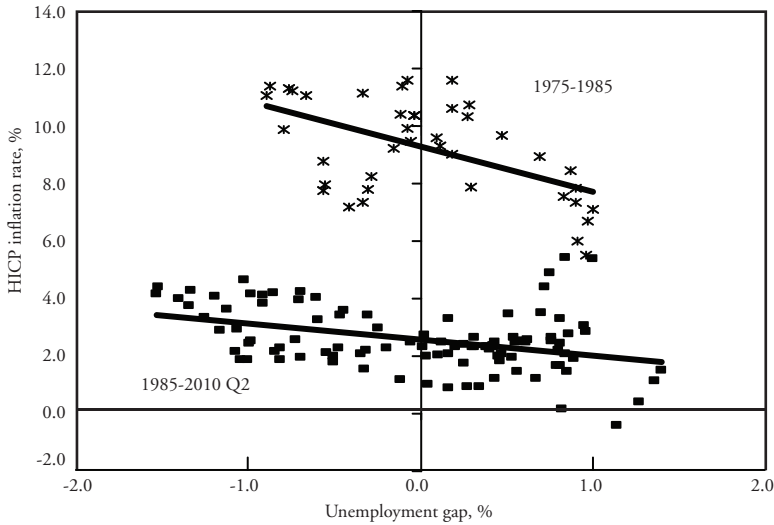
Note: Unemployment gap computed as difference between unemployment rate and trend unemployment derived on the basis of an HP filter.
Source: ECB area-wide model database (see Fagan, et al., 2001)

stability-oriented monetary policy regimes have been discussed, including at previous Jackson Hole conferences.[6] Here I want to focus on two elements: the role of anchored inflation expectations and downward nominal wage rigidity. In Section V of their paper, SW point out that a crucial element of uncertainty in the inflation outlook is how variable trend inflation is, i.e., to what extent trend inflation responds to actual inflation. A key factor determining this sensitivity is the stability of longer-term inflation expectations. In SW's work, the sensitivity of trend inflation to actual inflation is captured by a parameter, theta, which fluctuates around an all-time high since the early 2000s, suggesting a high degree of stability or low sensitivity of the inflation trend to current inflation. This is consistent with the evidence of a remarkable stability of longer-term inflation expectations in most industrial countries even during the financial crisis. For the euro area, this is illustrated in Chart 5.

This stability in longer-term inflation expectations plays a crucial role in reducing the size and the persistence of the effect of excess

Chart 5
Inflation and Longer-Term Inflation Expectations in the Euro Area
(%)

━━ HICP inflation
╌┼╌ HICP excluding unprocessed food and energy inflation
• HICP inflation expectations (SPF) for the five-year period ahead
━━ Upper bound of definition of price stability
♦ Longer-term inflation expectations (Consensus Economics Forcasts)


capacity on inflation, thereby contributing to a flattening of the reduced-form Phillips-curve relationship. Importantly, it has also played a crucial role in reducing the impact of the financial crisis on economic activity. To illustrate the importance of anchored long-term inflation expectations, Chart 6 shows the results from a counterfactual simulation of euro-area inflation and GDP growth in the most recent recession, if the perceived long-term inflation anchor would have shifted with observed inflation.[7] Even a relatively low sensitivity of the long-term inflation anchor to observed inflation would have increased the cost of the financial crisis quite dramatically with a deeper recession and greater disinflation. Given the lower bound on short-term interest rates, such a scenario could have been particularly costly. Anchoring longer-term inflation expectations remains therefore also crucial going forward.

Another factor that can explain why inflation may respond less to large output gaps in a low inflation environment is the presence of downward nominal wage rigidity. SW dismiss this argument on the

Chart 6
The Impact of a Downward Shift in the Inflation Anchor (%)
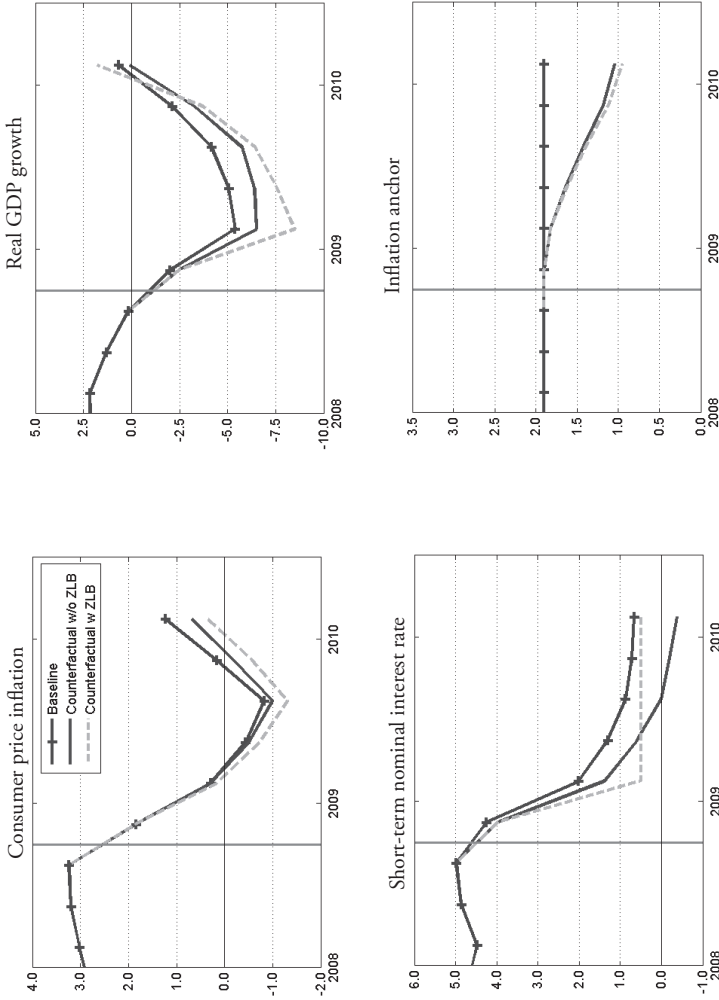
Note: Simulations with New Area Wide Model (NAWM). See Christoffel, Coenen and Warne (2008). In the baseline, the NAWM is used to replicate the actual euro area developments in HICP inflation, real GDP growth and the short-term euribor rate under the assumption of a constant inflation anchor. The counterfactuals assume that the inflation anchor responds to past inflation with and without a lower bound on the short-term interest rate.

Table 1
Downward Nominal Wage Rigidity

Incidence of wage cuts and freezes during the crisis: follow-up survey

	% of firms cutting wages			% of firms freezing wages		
	Original survey	Follow-up survey		Original survey	Follow-up survey	
		did cut	will cut		did freeze	will freeze
Total	2.6	3.2	3.1	9.5	34.5	34.5
Euro area	1.3	2.1	3.3	7.6	37.1	43.1
Non-euro area	6.4	6.5	2.7	14.8	27.4	10.3

Notes: Figures for the original survey have been calculated including only the firms that are in the 2009 sample. Figures are employment-weighted and rescaled excluding "do not know" answers. The sample includes AT, BE, CZ, EE, ES, FR, IT, NL and PL. The construction sector is not covered by the follow-up survey in ES, FR and IT. The financial intermediation sector is not covered by the follow-up survey in CZ, EE, ES and FR. Country details in Table 5.2 of the WDN Report.

The surveys were conducted in the context of the ESCB Wage Dynamics Network (WDN). See *http://www.ecb.europa. eu/home/html/researcher_wdn.en.html* for the main findings of the WDN and details of the surveys conducted. The original survey was conducted mostly during 2007. The follow-up survey was conducted mostly in the beginning of 2009.

Source: Messina and Rõõm (2009)

basis that there is little evidence of downward nominal rigidity in prices at the micro level. At face value this is indeed the case: Also in the euro area, typically about 45 percent of micro-level price changes in the consumer price index are price falls. However, if one believes that downward nominal rigidity comes mostly from nominal wages rather than prices, then this is not sufficient evidence. At the micro price level, the average share of wage costs in total costs is very small because of the importance of intermediate inputs. If one focuses on prices of products with a higher labor content, like services, there is more evidence of asymmetry in prices.[8] A Eurosystem research network on the dynamics of wages in the euro area has recently re-examined the hypothesis that nominal wages are downwardly rigid and confirmed that there is evidence of downward nominal rigidity in base wages.[9] The incidence and the nature of the rigidity (in particular whether it is real or nominal) differs across countries in the euro area and depends on labor market institutions such as whether nominal wages are automatically indexed, the importance of employment protection legislation, the presence of minimum wages and the coverage of collective wage bargaining.[10] We also found that firms have other ways of managing their wage bill (such as through cutting bonuses or hiring cheaper employees, etc.), which may alleviate some

of these constraints, but overall there remains a rigidity at the macro level. Table 1 shows the results of a survey in a selected number of EU countries in which we asked firms whether they have cut wages. The answers are striking and show that even in the midst of the crisis (the second survey took place at the beginning of 2009) with a few exceptions there was little intention to cut nominal wages, whereas there were many plans to freeze them. Downward nominal wage rigidity may therefore put a floor on how far prices can fall.[11]

Let me conclude. I agree with SW that the Phillips curve is alive, but I am not sure it is kicking. Like many other reduced-form economic relationships, it is varying over time and is very much influenced by the policy environment and expectation formation.[12] The establishment of monetary policy frameworks oriented toward price stability has contributed to a remarkable stability of longer-term inflation expectations. In the face of the deepest recession since World War II, this anchor has not only muted the impact of unemployment on inflation, it has also contributed to greater stability in economic activity itself.

Endnotes

[1]See Stock and Watson (2009).

[2]Note, however, that the 1973 recession is excluded from the sample.

[3]See, for example, Staiger, Stock and Watson (2002).

[4]Also note that historically unemployment in the euro area does not fall much in the years following its peak and that, accordingly, inflation does not rebound strongly.

[5]However, to use the Phillips curve for forecasting inflation, one needs to forecast output and unemployment, which by itself is not an easy task.

[6]Rogoff (2006) and Bean (2006).

[7]This simulation uses the ECB's New Area Wide Model (NAWM). See Christoffel, Coenen and Warne (2008).

[8]See, for example, the evidence on services prices in Altissimo et al. (2008).

[9]See WDN (2009) for a summary of the WDN evidence.

[10]See Babecký et al. (2009 a,b).

[11]Of course, downward nominal wage rigidity may also worsen the impact on unemployment by slowing down the adjustment mechanism. It also has implications for the optimal inflation rate: See, for example, Fahr and Smets (2010) and Fagan and Messina (2010) for a recent analysis.

[12]For historical evidence on the changing nature of the Phillips curve going back to the early 20th century, see Benati (2010).

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