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Low inflation in the euro area: import prices and domestic slack

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Consumer price inflation in the euro area has declined continuously since 2012. At the end of 2014, it was close to zero, well below the level of 2% consistent with the medium-term objective of the Eurosystem. This evolution took place against the backdrop of strongly decelerating prices of imported goods and a slowdown of economic activity likely to weigh on domestic prices. This letter studies the impact on inflation of both factors, import prices and domestic slack, and quantifies their respective contributions. As our analysis shows, when taking these two factors into account we are able to adequately reproduce the observed dynamics of inflation. According to our results, domestic slack and decelerating import prices contributed roughly equally, at the end of 2014, to the low level of inflation compared to the medium-term target.

Between 2012 and 2014, the inflation slowdown in the euro area (EA) has repeatedly taken forecasters by surprise. This is illustrated by Chart 1, where the solid blue line shows the evolution of the Harmonised Index of Consumer Prices (HICP), the main measure of headline inflation in the EA, in year-on-year percentage change. As the chart shows, HICP inflation has decreased from close to 3% at the end of 2011 down to around 0% in the fourth quarter of 2014. It even turned negative in the first quarter of 2015, a date beyond the scope of this study, due to the fall in oil prices. The mandate of the Eurosystem being to maintain inflation rates below, but close to, 2% over the medium term, it is important to assess the causes of this decline.

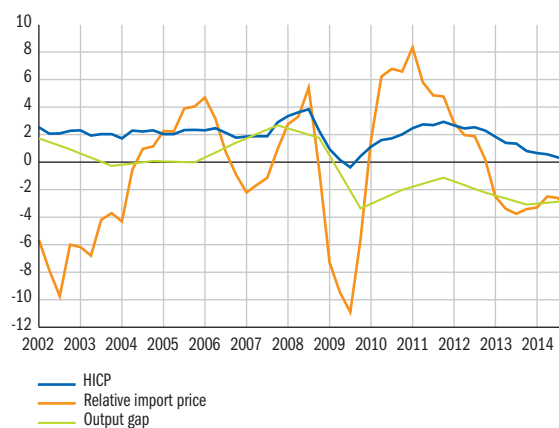
Two main categories of factors can explain the recent inflation dynamics. On the one hand, the price of the consumption basket measured by the HICP depends on the prices of imported goods, both directly in the case of imported consumption goods, and indirectly when locally produced consumption goods and services use imported intermediary goods as input. The relative price of imported goods (with respect to the price of euro area GDP) is represented by the orange line on Chart 1, in year-on-year percentage change. It has been strongly decelerating in recent years, from close to 8%

in 2011 down to -4% in 2013. The sharp fall in oil prices contributed by 7 percentage points (pp) to this slowdown and the non-energy component to 5 pp.

On the other hand, inflation also depends on domestic prices, which are influenced by the level of economic

C1 HICP, output gap and relative import price in the euro area

(year-on-year, %)



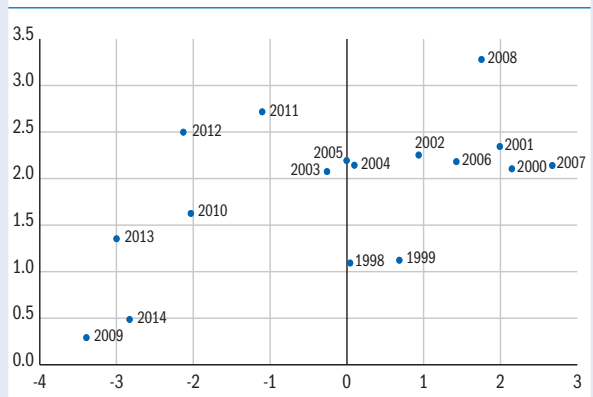
Source: European Commission.

The Phillips curve

In a famous article published in 1958, A.W. Phillips highlights a statistical relationship between nominal wage growth and unemployment in the United Kingdom between 1861 and 1913. The Phillips curve, originally relating wage inflation to unemployment, quickly became a general macroeconomic relationship between monetary variables such as price or wage inflation and real variables capturing the level of economic activity. For example, current standard models often positively relate price inflation to the output gap, as in the chart below. Important controversies took place on its stability over time and across countries, the time horizon at which the relationship is valid, or the role of expectations (see Le Bihan 2009 for an overview). Despite these, the Phillips curve has remained an important part of macroeconomic analysis in particular when analysing the effects of monetary policy.

Output gap and price inflation

(x-axis: output gap; y-axis: HICP year-on-year, %)



Source: European Commission.

activity. The idea of a positive correlation between the level of economy activity and inflation, the so-called Phillips curve, has become a cornerstone of macroeconomic analysis (see box). Other things being equal, an overheating economy should lead to higher inflation while economic slack should lead to lower inflation. A possible measure of economic slack is the output gap (OG): the relative difference between actual and potential GDP. The European commission provides a measure of the OG in the EA, represented by the green line in Chart 1; it has also been declining since 2011, from -1% to -3%.

To assess the relative contributions to the slowdown in inflation of both factors, namely decelerating import prices and increasing economic slack, we estimate a Phillips curve augmented with import prices to explicitly account for the role of external factors in headline inflation.

A Phillips curve augmented with import prices

We use quarterly data from the first quarter of 1997 to the last quarter of 2014 in the euro area to estimate the following Phillips curve augmented with import prices:

$$\pi_t = c + \alpha\pi_{t-1} + \beta x_{t-1} + \gamma m_t + \varepsilon_t$$

where π is the quarterly rate of HICP inflation, x is a measure of the output gap, and m is the quarterly growth rate of the price of imports relative to the GDP deflator.¹ We use a model-based measure of the OG produced by the European commission and represented in Chart 1.

This specification assumes well-anchored expectations.² With a zero output gap and stable relative import prices, inflation converges to $c/(1-\alpha)$, corresponding to the long-term inflation rate. A positive (negative) OG leads to higher (lower) inflation without changing this long-run anchor. If $0 < \alpha < 1$, inflation adjusts gradually to changes in the OG. The coefficient β is the short-term response of inflation to a change in the OG, but we are more interested in the response after this first adjustment has taken place. This is given by $\beta/(1-\alpha)$, which we refer to as the “medium-term” slope of the Phillips curve.

Inflation and the output gap

Table 1 reports the estimated coefficients of this model, together with the medium-term slope expressed in annual terms, for the whole sample as well as for a subsample made of the last eight years of data, from 2007 Q1 to 2014 Q4.

According to our estimates, the medium-term slope of a benchmark Phillips curve for the euro area is close to 0.3: an increase by 1 pp of the OG increases yearly headline inflation by 0.3 pp.

Comparing the estimation over the whole sample with the estimation for the eight last years of data, we do not find evidence for a change in the slope of the Phillips curve in recent years. This is confirmed by estimations of

¹ Quarterly inflation is constructed using a seasonally adjusted price index constructed with the X12-ARIMA method.
² See the discussion in Ball and Mazumder (2014) on what is sometimes referred to as a “non-accelerationist Phillips curve”. The accelerationist Phillips curve imposes the restriction $\alpha=1$ implying that a positive output gap leads to the acceleration of inflation instead of a simple change in level. Theoretically, this is an appropriate description for an economy where agents adjust their long-term expectations according to recently observed inflation. But, from the nineteen-eighties to 2014, both inflation and long-term inflation expectations have been remarkably stable and the restriction $\alpha=1$ is clearly rejected by the data.

T1 Benchmark estimation

	Whole sample	2007 Q1-2014 Q4
Constant c	0.34 (4.3)	0.38 (5.4)
Lag α	0.26 (0.3)	0.23 (1.7)
Output gap β	0.05 (2.2)	0.05 (3.6)
Relative import price γ	0.07 (3.3)	0.14 (4.9)
Adjusted R^2	0.47	0.74
Annualised medium-term response to output gap ^{a)}	0.27	0.26

Note: t -stat are reported in parenthesis.

a) The medium-term response of inflation to the output gap is in annual terms and computed as $4\beta/(1-\alpha)$.

the Phillips curve on eight-years rolling windows. The resulting medium-term slope (in annual terms) is reported in Chart 2. As the chart shows, it has remained in recent years close to the value estimated on the whole sample.

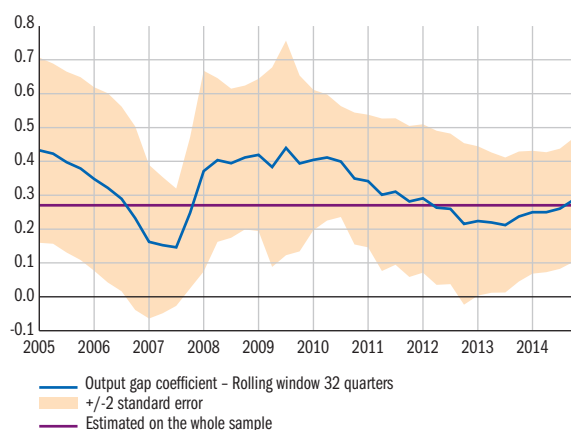
The response of inflation to import prices, given by the coefficient γ , being substantially larger in the last part of the sample, our preferred specification is the one estimated on the latter period, 2007 Q1-2014 Q4. As illustrated in Chart 3, the fit of the model estimated for the period 2007 Q1-2014 Q4 is overall quite good.³

This model relates headline inflation to import prices and the OG, but there are many other possibilities depending on the price index considered and the measure of economic slack.

Table 2 reports medium-term slopes obtained with two alternative measures of inflation:⁴ supercore inflation,

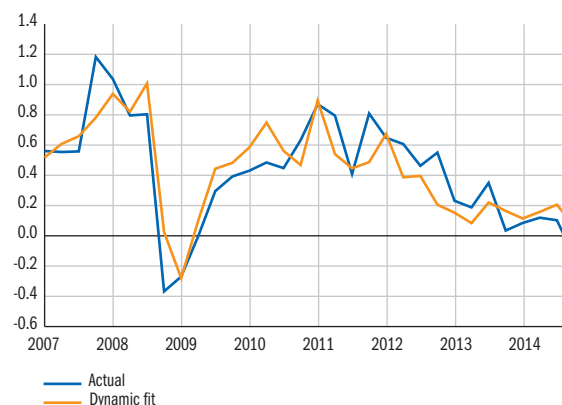
C2 Rolling regressions on eight-years windows for the euro area/Medium-term coefficient of the output gap

(in annual terms)



C3 Actual and fitted inflation 2007 Q1-2014 Q4

(HICP: quarter-on-quarter, seasonally adjusted, %)



which excludes energy and food, and the deflator of value added in the private sector, which measures inflation from domestic wages and profits; and an alternative measure of the output gap: short term unemployment (that is, inferior to 12 months).

Overall, the different estimates are relatively close to the benchmark and give us a range of [0.1 – 0.3] for the medium-term slope.

T2 Robustness with respect to the price index and the output gap

Measure of slack	Price index	Euro area	
		1996 Q2-2014 Q4	2007 Q1-2014 Q4
Output gap	HICP	0.3	0.3
	Core HICP	0.1	0.1
	VA deflator	0.2	0.1
Short-term unemployment	HICP	0.3	0.3
	Core HICP	0.2	0.2
	VA deflator	0.2	0.2

Note: Coefficients adjusted to be comparable with the elasticity of headline inflation vis-à-vis the output gap.

Elasticity of headline inflation vis-à-vis core inflation: 0.8

Elasticity of headline inflation vis-à-vis VA deflator: 0.5

Okun coefficient: 2.

³ Dynamic forecasting beginning at the start of the forecast sample (2007 Q1) then using the recursively computed forecast of the lagged value of the dependent variable.

⁴ To be compared with our estimation, these slopes are adjusted for the difference between measures of inflation and economic slack. For example, the slope of the VA deflator with respect to short-term unemployment is -0.7 . It is adjusted to $0.5 \times (-0.7) / (-2) = 0.2$, where 0.5 is the elasticity of headline inflation to the VA deflator and -2 is the Okun coefficient (link between short-term unemployment and the output gap). These coefficients are estimated on our data sample.

Contributions of import prices and domestic slack to low inflation

We now use this model to decompose the contributions of decelerating import prices and increasing slack to low inflation in recent years.

To do so, we simulate a counterfactual scenario where the OG is assumed to gradually close between 2012 and 2014, the period of substantial decline of inflation. Results are reported in Chart 4 and Table 3.

In the last quarter of 2014, realised inflation was 0.2% year-on-year. Inflation in the counterfactual scenario is 1.3%. The distance of realised inflation to the 2% objective, 1.8 pp, can be decomposed into 0.7 pp due to weak growth of import prices, 0.8 pp due to the output gap, and 0.3 pp from the unexplained residual between realised and predicted inflation. The conclusion of this exercise is that the slowdown in import prices and the persistent output gap have contributed roughly equally to below-target inflation.

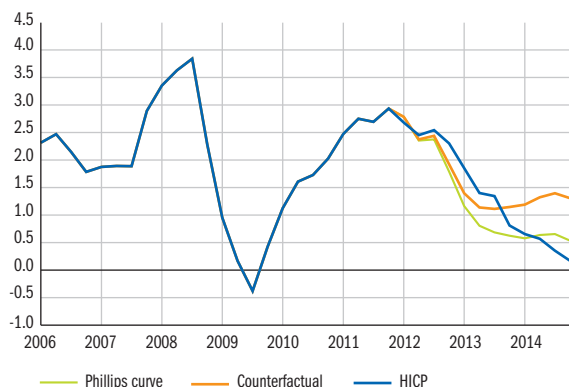
In Chart 5 realised inflation (in absolute deviation from sample mean) is decomposed into the four components of the estimated Phillips curve: the initial condition, import prices, the OG, and an unexplained residual.

It reflects how import prices and the output gap equally contributed to low inflation in recent quarters.

C4 Euro area counterfactual scenario with a closing output gap

Estimation on 2007 Q1-2014 Q4

(HICP year-on-year, %)



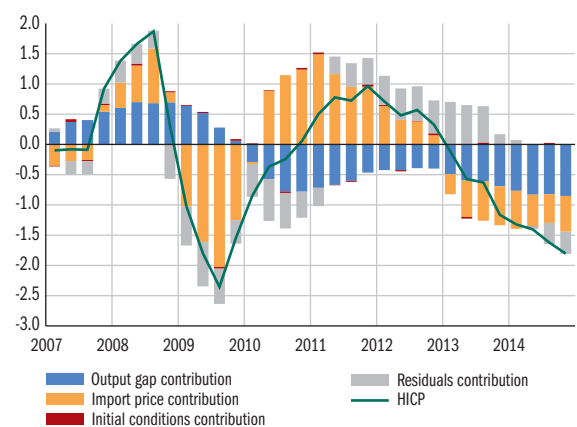
T3 Contributions to the distance of inflation to the 2% target

Realised inflation 2014 Q4 (year-on-year, %)	0.17
Predicted inflation (year-on-year, %)	0.53
Counterfactual (year-on-year, %)	1.31
Distance to 2% target	1.83
Contribution of import prices (=2-counterfactual)	0.69
Contribution of output gap (=counterfactual-predicted)	0.78
Contribution of residual (=predicted-realised)	0.36

C5 Decomposition of euro area inflation into its explanatory components

Estimation on 2007 Q1-2014 Q4

(HICP: year-on-year, %, absolute deviation from sample mean)



References

Ball (L.) and Mazumder (S.) (2014)

“A Phillips curve with anchored expectations and short-term unemployment”, *NBER Working Paper* No. 20715.

Le Bihan (H.) (2009)

“1958-2008, avatars et enjeux de la courbe de Phillips”, *Revue de l'OFCE* 111, October.

Phillips (A. W.) (1958)

“The relation between unemployment and the rate of change of money wages rates in the UK, 1861-1957”, *Economica*, vol. XXV, November.

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