Rue de la Banque

Does the Phillips curve still exist?

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Estimates from the Banque de France show that the slope of the Phillips curve in the euro area has remained weak but stable and significantly different from zero since the crisis. In the G7 countries, the coefficient of past inflation has become relatively insignificant since the 1980s, suggesting a shift towards a so-called "non-accelerating" curve. Global demand conditions are captured by import prices, including oil prices. The persistence of a negative output gap and the fall in oil prices largely explain the low level of inflation in the euro area since 2014. However, other factors such as weak wage dynamics or even the risk of an unanchoring of inflation expectations may have played out, the latter risk having called for a strong monetary policy response.

The Phillips curve (PC) is 60 years old, yet the debate on its validity remains active and intense. Today, many observers are raising the question as to the disappearance of the PC (*The Economist*, 2017, Brainard, 2017, *Trésor-Eco*, 2017).

This issue of *Rue de la Banque* aims to contribute to the debate by presenting a series of recent estimates obtained by the Banque de France. It should be reminded beforehand that there is a large number of possible specifications for the PC (for a review, see Le Bihan, 2009). Starting from a relationship between wage growth and the unemployment rate (Phillips, 1958), the PC rapidly became sophisticated by incorporating inflation expectations as early as the 1960s, and then by replacing wages by prices as the dependent variable in the 1980s (many works also replace the unemployment rate by the output gap as the explanatory variable). Finally, in its most recent version, the New Keynesian Phillips Curve (NKPC) is a relationship between inflation, expected inflation and the output gap.

Recent estimates of the Phillips curve at the Banque de France

In order to highlight the trend in this relationship at the global level, we first estimate a PC for the panel of G7 countries from the mid-1980s to 2016. This regression on quarterly panel data aims to explain inflation by (i) the gap between unemployment and its structural level and (ii) inflation expectations measured by a moving average of inflation over the last four quarters. The model is estimated over a rolling window of 60 quarters.

The slope of the Phillips curve decreased significantly from the 1980s to the mid-1990s (see Chart 1), but has since then remained relatively stable at around 0.5 in absolute value.

As regards the coefficient of past inflation, it remained below but close to 1 until the mid-1990s, then began to decline until it was no longer statistically different from zero

C1 Estimated coefficient of the unemployment gap in G7 countries

Coefficient of the unemployment gap
95% confidence interval
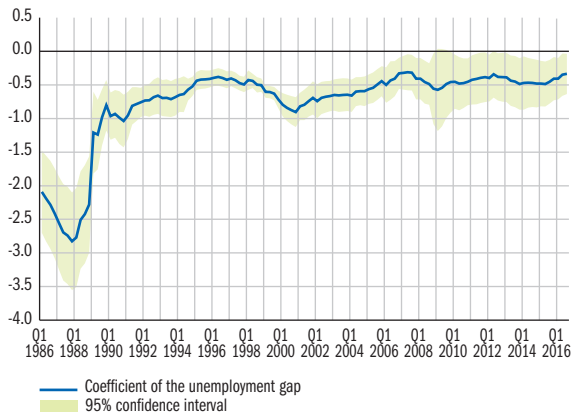
Source: authors' calculations.

C2 Estimated coefficient of past inflation in G7 countries

Coefficient of past inflation
95% confidence interval
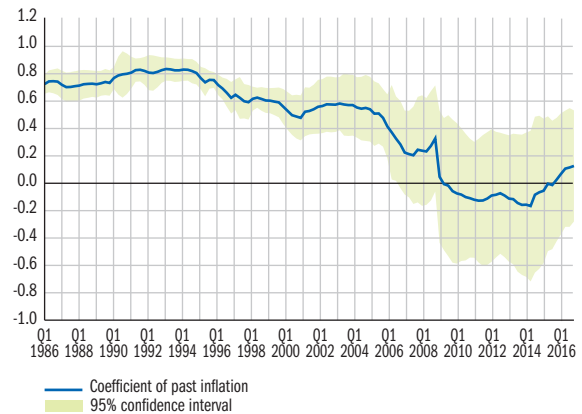
Source: authors' calculations.

over the recent period (see Chart 2). We have thus moved from a so-called "accelerationist" Phillips curve, where the unemployment rate influences inflation variations, to a so-called "non-accelerationist" curve, where it influences the level of inflation. This change mainly reflects a change in the formation of expectations by economic agents. Two potential explanatory factors have been put forward, notably by Blanchard (2018), who empirically obtains a similar result with American data. First, the improved credibility of monetary policy, in particular *via* the adoption of inflation targeting, has made the process of forming inflation expectations more forward-looking than backward-looking. Second, given that inflation is low and stable, it may no longer be taken into account in the price and wage-setting process. Distinguishing the relative importance of these two factors is not obvious, and may depend on the type of economic agents considered (households or firms).

For the euro area, we tested a number of specifications using various variables of underemployment (unemployment and different output gap measures) and of import prices (import deflator, Brent prices, etc.). While the results are largely similar, our *preferred specification*[1] is the following:

$$\Delta log\, HICP_t^{SA} = const + c_1 \Delta log\, HICP_{t-1}^{SA} + c_2 OG_{(t-1)} + c_3 \Delta log\, PI_t + c_4 DVAT_t + \varepsilon_t$$

where $HICP_t^{SA}$ is the seasonally adjusted harmonised index of consumer prices, OG is the output gap, PI is the relative price of imports (non-euro area import prices, divided by the GDP deflator), and DVAT is a dummy variable indicating the change in the main VAT rate.

The recursive estimate of this equation over a rolling window of 36 quarters[2] enables us to assess the variation in the "medium-term" slope of the Phillips curve (i.e. $\frac{c_2}{1-c_1}$). The results (see Chart 3) show a stable slope, at around 0.4 in annual terms. It is also significantly different from zero on all the samples considered.

Auer, Borio and Filardo (2017) stress the growing role of the global output gap and the diminishing role of the domestic output gap in domestic price dynamics, in a context of global integration of production chains.

C3 Slope of the Phillips curve in the euro area

(rolling window over 36 quarters, start of the first estimate: Q4 1998)

Output gap medium-term coefficient
+/- 2 standard error
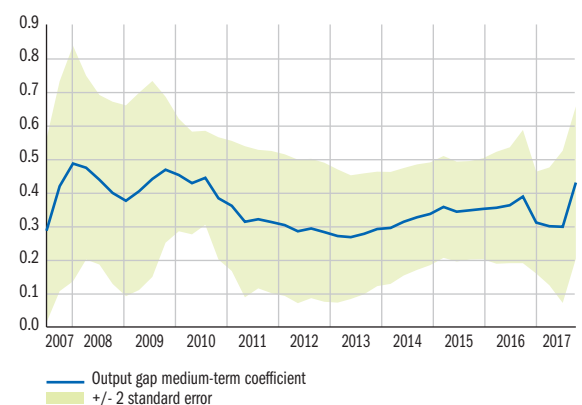
Source: authors' calculations.
Note: Annual medium-term slope given by 4*c_2/(1-c_1).

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1 See also *Rue de la Banque No. 6 and No. 37.*
2 *Data for the euro area starts in 1999, which leads us to reduce the size of the rolling window to cover the period of the crisis.*

T1 **Phillips curves for the total euro area HICP[a)]**

(1999-2017, quarterly data)

| Endogenous variable: $\pi(t)$	Equation 1	Equation 2
Constant	0.26***	0.32***
$\pi(t-1)$	0.39***	0.27**
Output gap euro area $(t-1)$	0.04*	0.07***
Global output gap excluding euro area $(t-1)$	0.00	-0.02
Δ import price (t)		0.09***
VAT increase dummy	0.17**	0.22***
Adjusted R^2	0.23	0.57

Source: authors' calculations.
a) Harmonised index of consumer prices.
*Note: The global output gap excl. euro area is calculated using a Hodrick Prescott filter. The results are robust to the use of other measures, derived from production functions. The ***, ** and * signs indicate the significance at the thresholds of 1%, 5% and 10% respectively.*

C4 **Contributions to euro area inflation**

(deviation from the sample average, in percentage points)

Legend: Output gap; VAT; Relative import prices; Residuals; HICP (%, year-on-year)
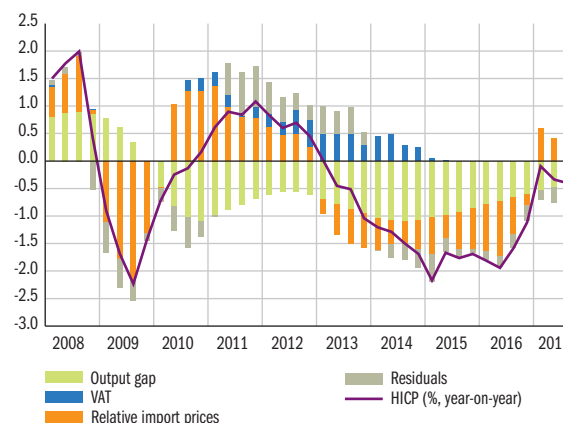
Source: authors' calculations.
Note: Average HICP inflation of the sample: 1.9%.

However, there is no consensus on these conclusions. Mikolajun and Lodge (2016) conclude that the global output gap has no direct effect on inflation in OECD economies. The authors consider that once commodity prices have been taken into account, it is not necessary to include other global factors in the Phillips curve.

The Phillips curves estimated for the euro area show (see Table 1) that global demand conditions do impact domestic inflation, but through import prices, in particular oil prices.

Why inflation has remained weak

Between 2014 and 2017, inflation in the euro area averaged 0.5%, well below its long-term average. Our preferred PC specification described above enables us to quantify the role played by the economic cycle and international prices in the recent decline in inflation in the euro area (see Chart 4). This breakdown shows that the fall in import prices caused by the decrease in oil prices and the negative output gap contributed to lowering inflation over the 2014-2016 period, in similar proportions. However, the presence of negative residuals from 2014 suggests that other factors may have played a role.

These negative residuals can be partly explained by the weak wage dynamics since the recovery. Several factors can be put forward, among which: (i) workforce composition effects; (ii) a compensation of downward nominal wage rigidity; (iii) an ageing labour force.
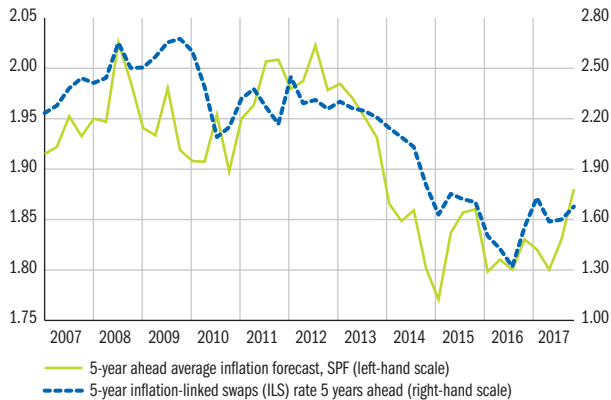
During the 2008-2011 period, the limited adjustment of average wages is mainly due to the fact that job losses concerned low-skilled and inexperienced workers with lower wages (Verdugo, 2016). During a recovery, the same workforce composition effect should work in the opposite direction: less qualified and less experienced workers are reintegrated into the workforce, thus lowering the average wage.

The empirical literature on wage developments shows the existence in Europe of downward nominal wage rigidity (see in particular Marotzke et al., 2017). In times of low inflation, this may have reduced firms' ability to adapt to negative shocks. In times of growth, firms take into account this rigidity and anticipate the difficulty of making future wage cuts. They are thus able to limit wage growth when activity picks up (Elsby, 2009).

The ageing of the population may also have limited wage hikes during the recovery. From 2009 to 2016, the share in employment of the over-50s increased compared to the share of the 15-49 age group, as a result of the various pension reforms as well as the generational effects related to increased women participation in the labour market. This rise represents a positive shock to labour supply, which is likely to put downward pressure on wages (Mojon and Ragot, 2018).

C5 Inflation expectations in the euro area

(annual average - %)

- 5-year ahead average inflation forecast, SPF (left-hand scale)
- 5-year inflation-linked swaps (ILS) rate 5 years ahead (right-hand scale)

Sources: ECB (SPF); Bloomberg (ILS).
Note: The ILS are expressed in quarterly terms by forming calendar averages.

Monetary policy response

Another factor is the sharp drop in long-term inflation expectations in mid-2014 compared to the target "below, but close to 2%" (see Chart 5), whether they are measured using the results of the Survey of Professional Forecasters (SPF) or using market data (inflation linked-swaps, ILS). At the same time, the share of HICP fluctuations explained by the residuals of the Phillips curve increased significantly (see Chart 4). According to new neoclassical synthesis models, these negative residuals may also be the sign of a downward drift in inflation expectations. All of these elements point to a risk of an unanchoring of inflation expectations (see Mario Draghi's speech at Jackson Hole, August 2014).

This is the reason why the Eurosystem then implemented a series of measures to support demand and credit.

These measures, by their number and unprecedented scale, have helped to sustain demand and stem the fall in inflation expectations. In line with the usual time lags for the transmission of monetary policy to the real economy, they aim to get inflation to converge towards its long-term target, close to but below 2%.

Conclusion

The results of our estimates show that the price-activity relationship flattened out in the 1980s but has remained significant since then. The implications for monetary policy are twofold: (i) First, an accommodating monetary policy is less likely to result in an inflationary spiral; (ii) However, the real economy lever for halting a drop in inflation expectations would be less powerful than it was before 1990. Given that the risk of declining inflation expectations has not been completely eliminated, this could argue for maintaining an accommodative bias in the monetary policy normalisation process. However, our estimates of the Phillips curve remain uncertain. We must remain attentive to all the determinants of inflation and, in particular, to the structural changes in the economy, notably those related to globalisation and new technologies, both in the goods and services market and in the labour market.

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