

A PHILLIPS CURVE FOR THE EURO AREA

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This presentation is based on joint research with Sandeep Mazumder.

The Phillips curve says there is a short-run tradeoff between inflation and economic slack. This tradeoff is one of Mankiw's "10 Principles of Economics."

Over the last decade, many commentators have suggested that the behavior of European inflation is inconsistent with the Phillips curve.

For example, a 2017 report by a Eurosystem research network (edited by Ciccarelli and Osbat):

A "missing disinflation" in the wake of the global financial crisis and recession (2009-2011)

A "missing inflation" as the economy has recovered (2012-present)

What explains these anomalies? There are many hypotheses.

Some ideas discussed by Ciccarelli and Osbat:

De-anchoring of inflation expectations

Increased persistence of inflation shocks

Non-linearity or time-variation in the effects of economic slack

Changes in world commodity prices and exchange rates

.....

Effects of structural changes in the economy?

Digitalization and globalization (Draghi, 2019)

Growth of the service sector (Coeuré, 2019)

Many of these factors may be relevant. But this research finds...

- 1) A very simple Phillips curve captures most of the behavior of core inflation from 1999 through 2018.
- 2) The Phillips curve fits even better if we account for the pass-through of headline-inflation shocks to core inflation.

A key feature of the analysis:

Core inflation is measured by the weighted median of industry inflation rates.

This measure was proposed by Bryan and Cecchetti (1994), and Ball and Mazumder (2019) use it in work on U.S. inflation.

Measuring Core Inflation

Changes in relative prices cause fluctuations in headline inflation that are unrelated to economic slack. A Phillips curve is more likely to fit the data if we focus on a measure of *core* inflation that filters out the effects of relative-price shocks.

Most researchers recognize this point... but the common measure of core inflation is the inflation rate excluding food and energy prices. That variable filters out shocks in the food and energy industries, but many other industries also experience large price changes that influence headline inflation.

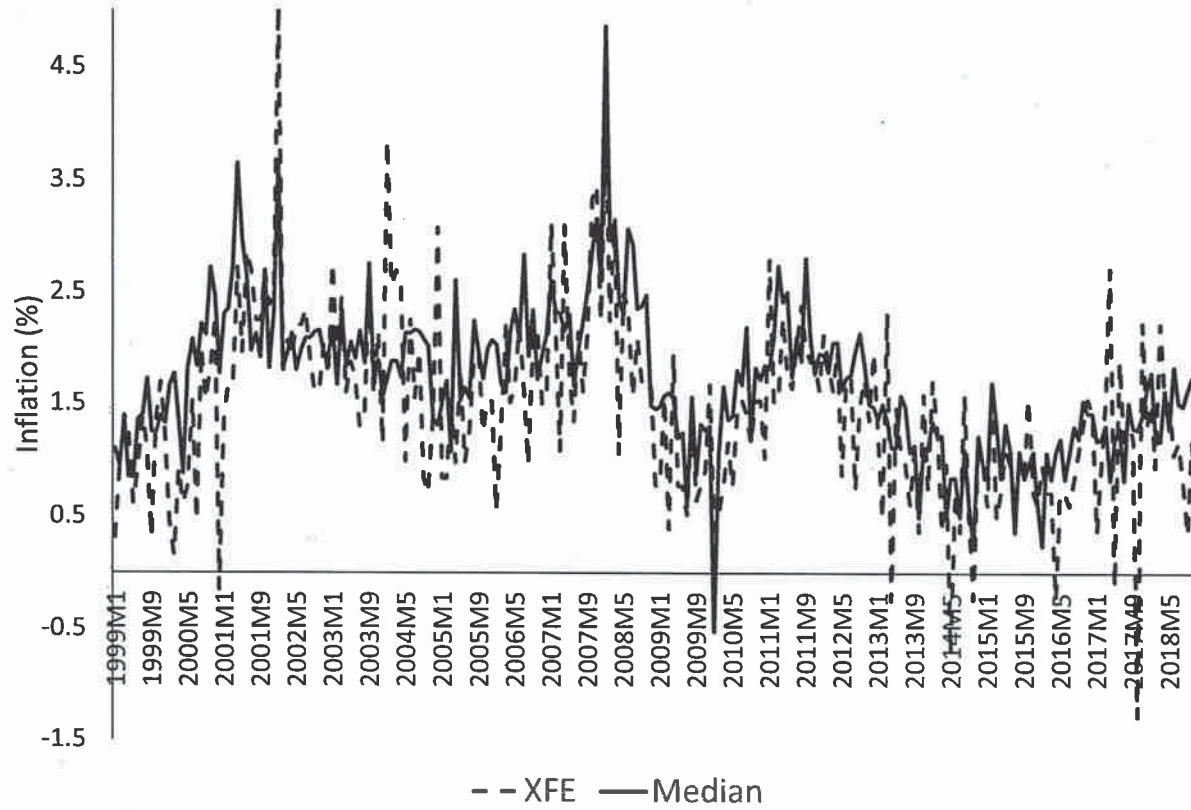
The weighted median filters out large shocks in *all* industries, producing a core-inflation measure that is less volatile and easier to explain.

We construct a weighted median inflation rate from the inflation rates of 94 industries that make up the HICP price index for the Euro area.

Let's examine the behavior of this variable since 1999 and compare it to inflation ex-food and energy (XFE inflation)....

Figure 1: Euro Area XFE and Median Inflation

(a) Monthly



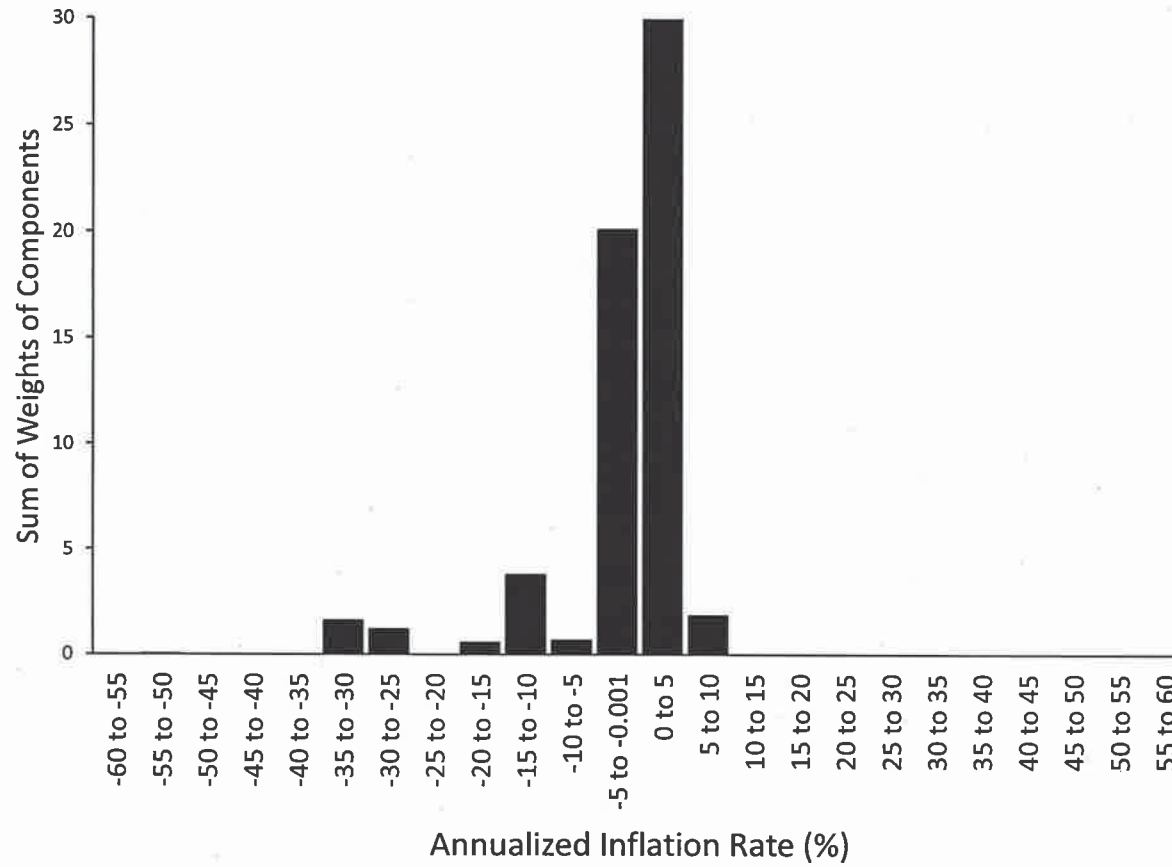
Why is XFE inflation more volatile than median inflation?

An example: October 2017

Annualized XFE inflation = -1.3%

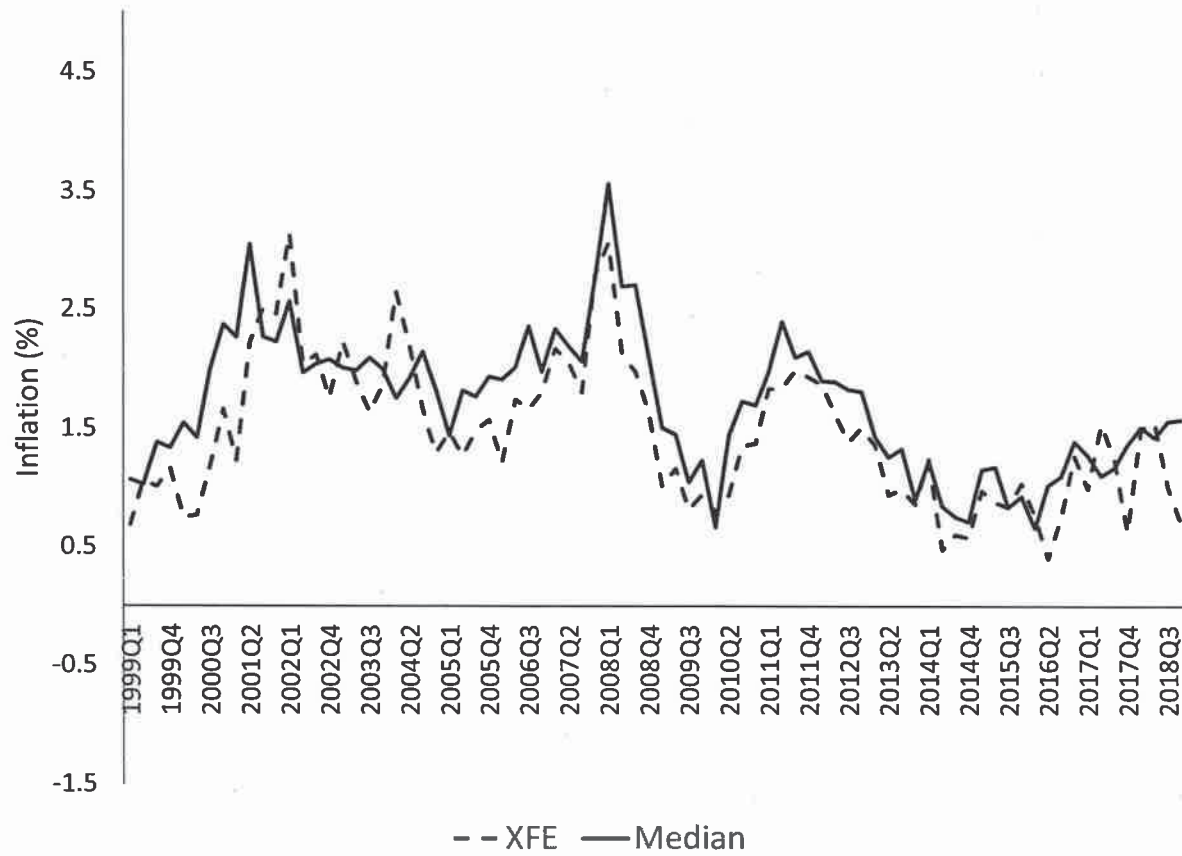
Annualized median inflation = +1.3%

Figure 2: Histogram of Industry Price Changes in October 2017

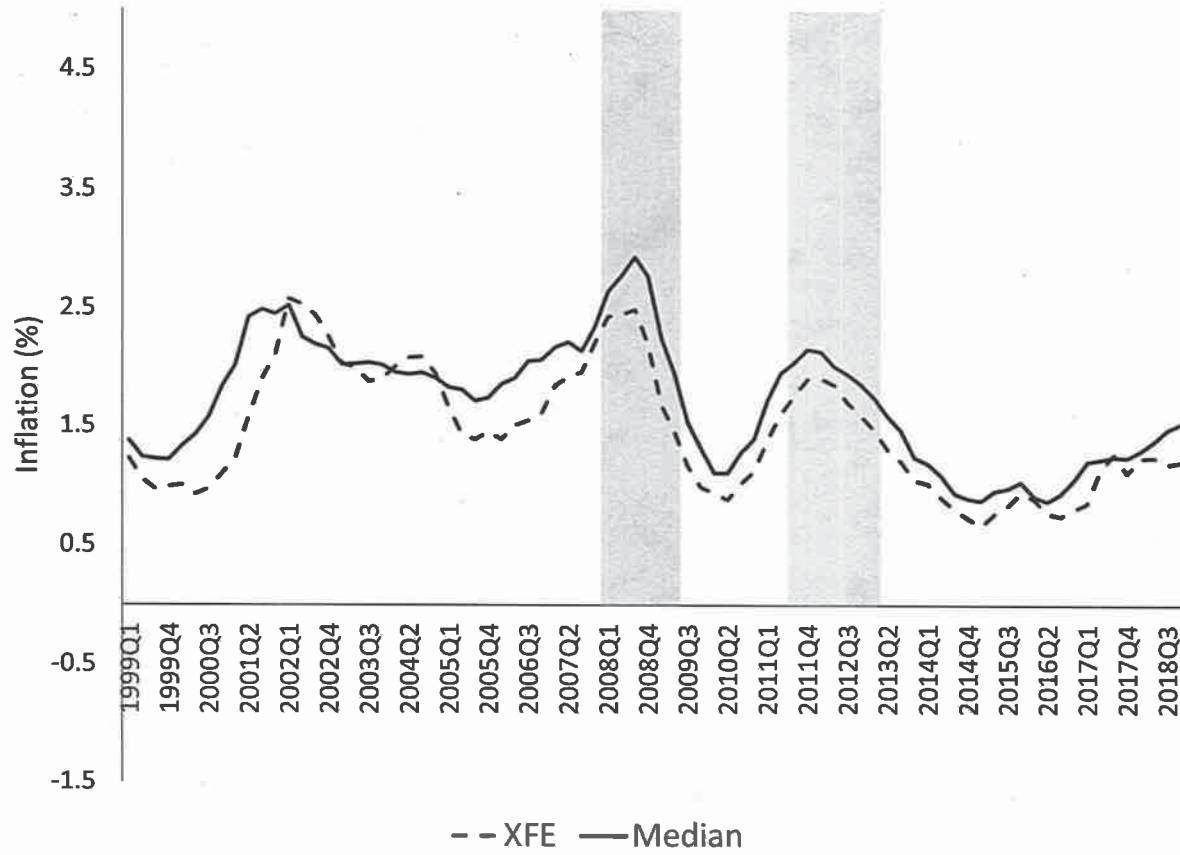


Note: The vertical axis is cut off at 30—the sum of industry weights in the 0 to 5% inflation range is 70. Food and energy industries are excluded.

(b) Quarterly



(c) 4-Quarter Moving Average



NOTES:

Average inflation rates, 1999-2018:

Headline: 1.71%

XFE: 1.45%

Median: 1.71%

Inflation rate in 2018Q4 (four-quarter moving average):

XFE: 1.19%

Median: 1.52%

Does a simple Phillips curve fit the data?

For quarterly data, we assume:

$$\pi(t) = \pi^e(t) + \alpha y(t-1) + \varepsilon(t),$$

where

π = weighted median inflation *or* XFE inflation

π^e = 5-year forecast of inflation from European SPF

(π^e ranges from 1.8 to 2.0 over the sample period)

$y(t-1)$ is the average output gap from $t-4$ through $t-1$, based on OECD estimates of potential output.

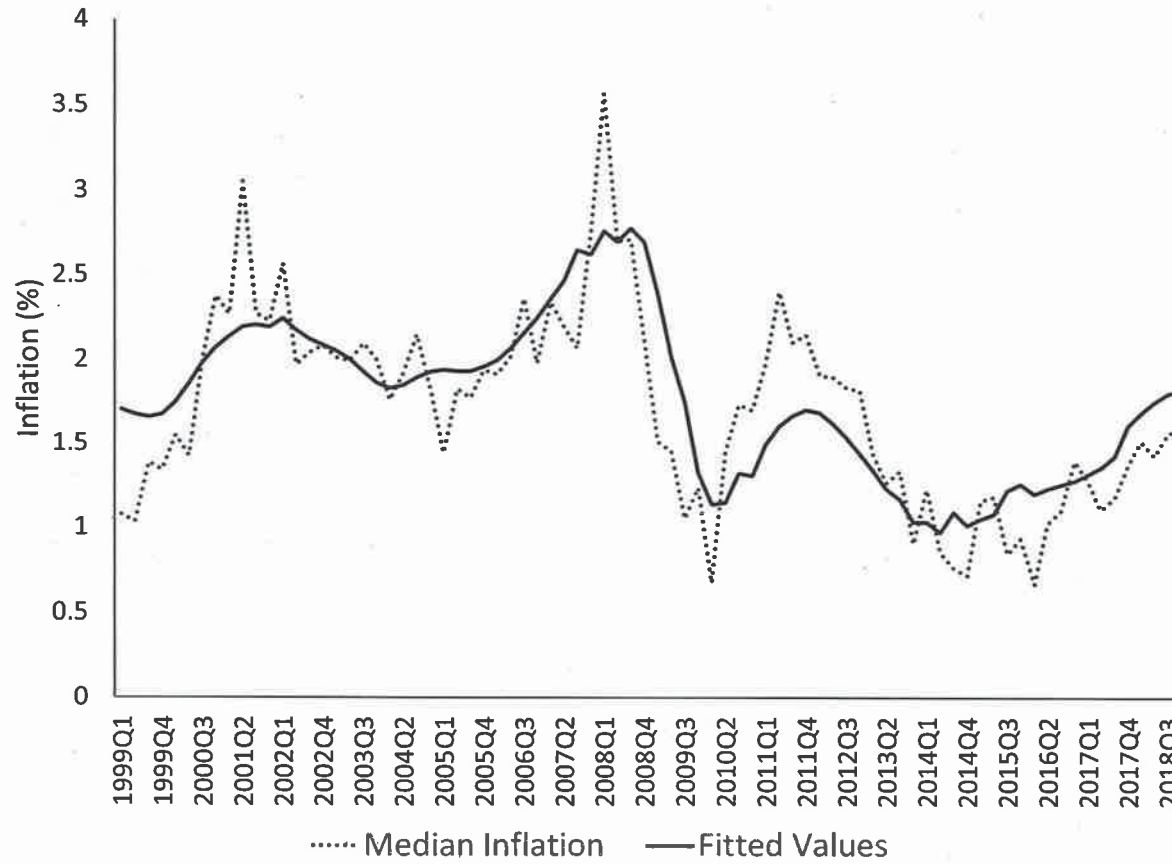
Table 1: Euro Area Basic Phillips Curve, 1999Q1-2018Q4

| $\pi_t = \pi_t^e + \alpha \overline{(y - y^*)}_{t-1} + \epsilon_t$ | | | | |
|--|------------------|-------------------|------------------|-------------------|
| | Median Inflation | | XFE Inflation | |
| <i>Constant</i> | | -0.052 (0.060) | | -0.320 (0.086) |
| α | 0.228 (0.024) | 0.221 (0.025) | 0.238 (0.037) | 0.194 (0.031) |
| \overline{R}^2 | 0.643 | 0.646 | 0.207 | 0.459 |
| <i>S.E.of Reg.</i> | 0.345 | 0.343 | 0.540 | 0.447 |

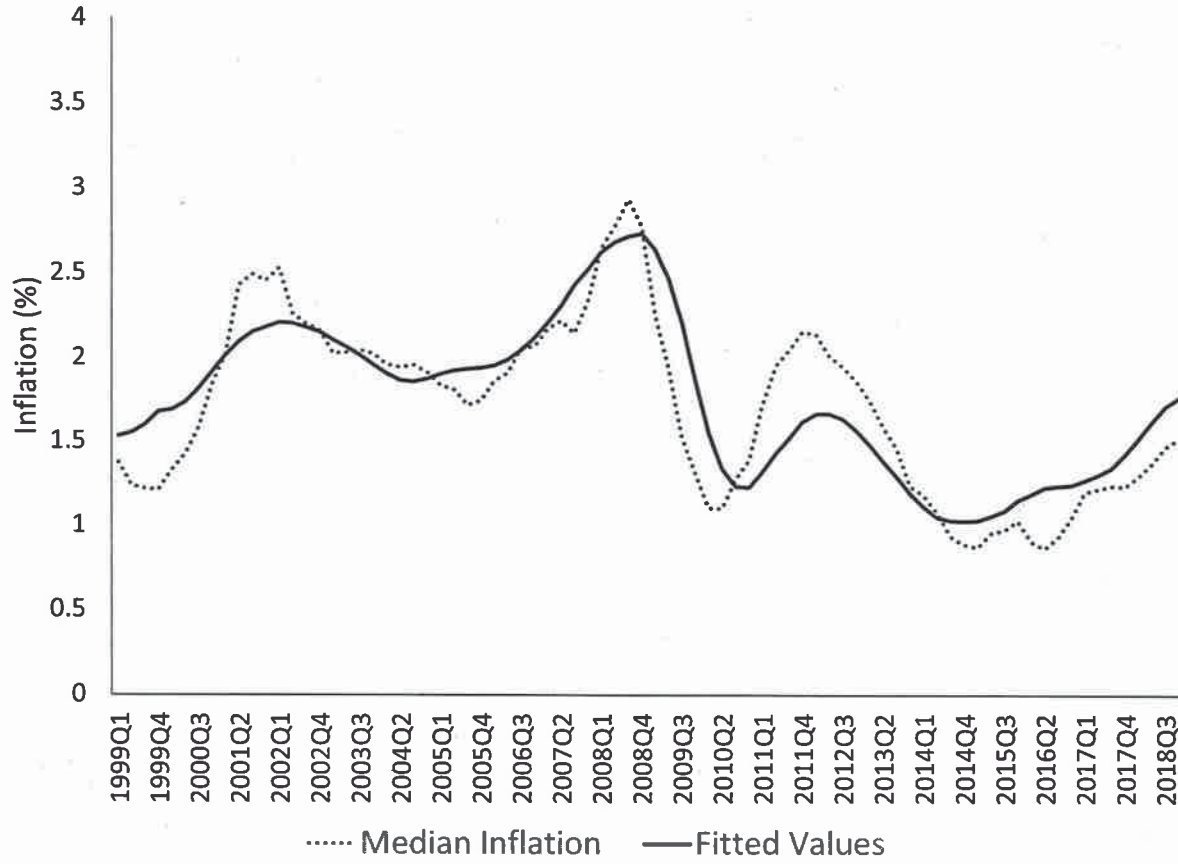
Note: OLS with robust (HAC) standard errors is used (standard errors in parentheses). π_t is represents core inflation, and π_t^e is the ECB's SPF mean point forecast of 5-year ahead inflation (1999Q2-4 and 2000Q2-Q4 are linearly interpolated due to missing data). The gap variable uses OECD data on the output gap to derive estimates for $\overline{y^*}$.

Figure 3: Actual and Fitted Values from Euro Area Basic Phillips Curve (Table 1, column 1)

(a) Quarterly



(b) 4-Quarter Moving Average



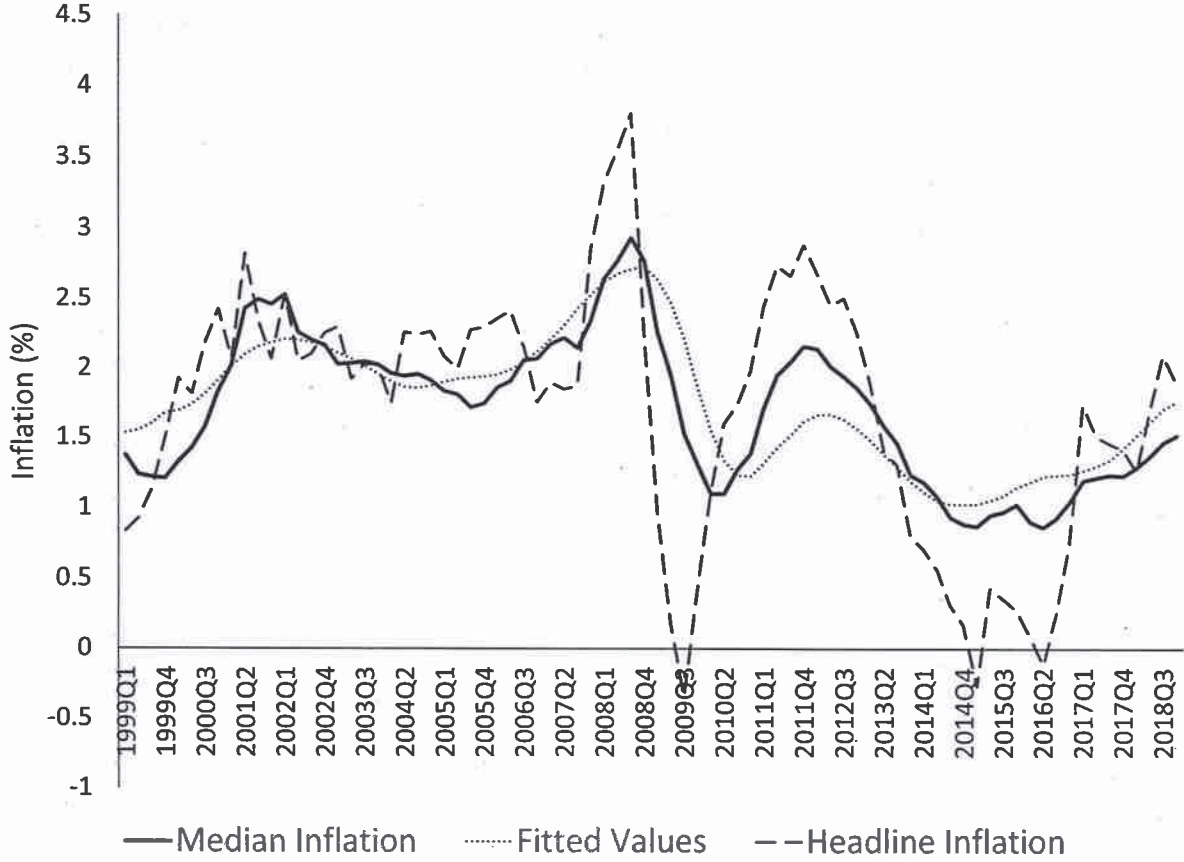
The Phillips curve for median inflation fits fairly well, but some puzzles remain:

Some missing deflation around 2011

Some missing inflation since 2014

The residuals in the Phillips curve are closely related to fluctuations in headline inflation...

Figure 4: Euro Area 4-Quarter Averages of Median Inflation, Fitted Values from Basic Phillips Curve, and Headline Inflation



ECB policy discussions often suggest that non-core movements in headline inflation--especially movements caused by oil price changes--will pass through partially to core inflation (e.g., Economic Bulletins for 2017-2018).

Channels:

Chain of production (Economic Bulletin, 2014)

Response of nominal wages to headline inflation (e.g. Peersman and Van Robays, 2009)

A modified Phillips curve:

$$\pi(t) = \pi^e(t) + \alpha y(t-1) + \gamma(\pi^h - \pi)(t) + \varepsilon(t),$$

where $(\pi^h - \pi)(t)$ is the difference between headline and core inflation from $t-3$ through t

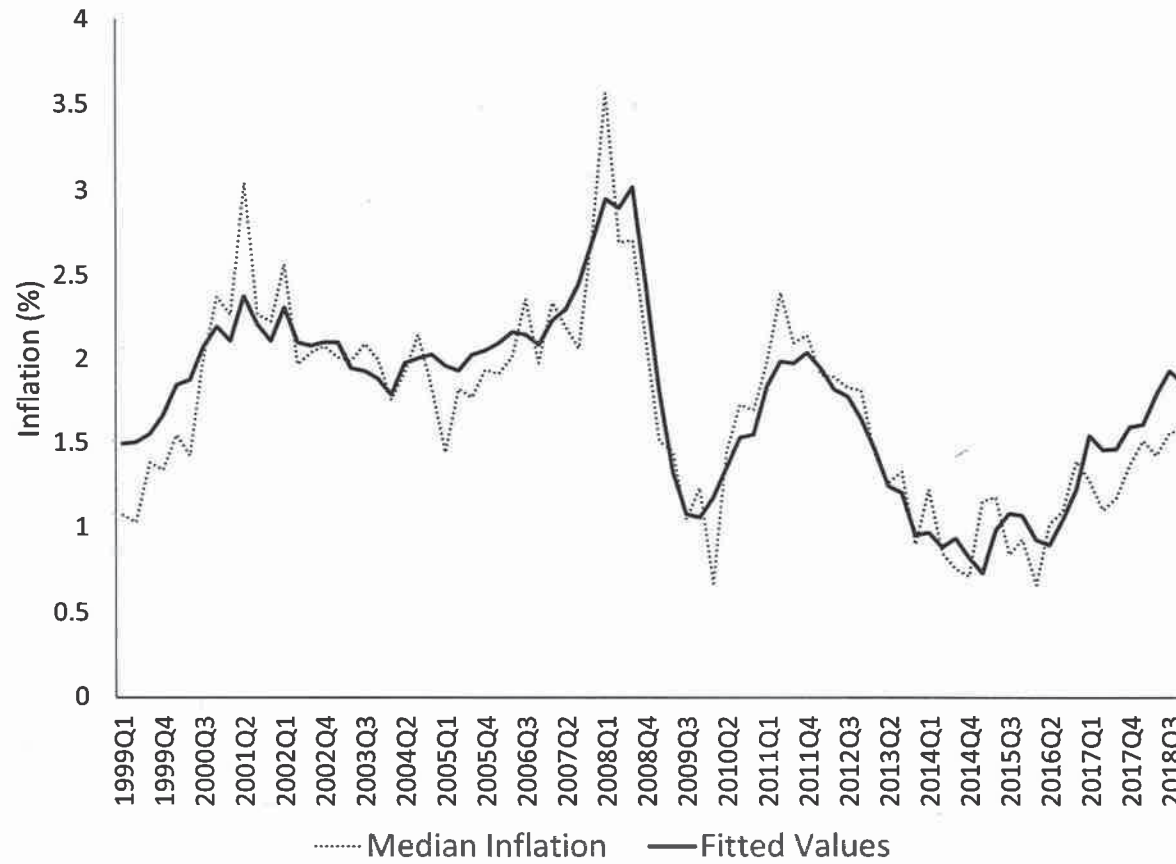
Table 2: Euro Area Phillips Curve with Price Shock, Median Inflation, 1999Q1-2018Q4

| | | |
|---|------------------|-------------------|
| $\pi_t = \pi_t^e + \alpha \overline{(y - y^*)}_{t-1} + \beta \overline{(\pi^h - \pi)}_t + \epsilon_t$ | | |
| <i>Constant</i> | | -0.066 (0.047) |
| α | 0.209 (0.017) | 0.200 (0.019) |
| β | 0.341 (0.065) | 0.349 (0.062) |
| \overline{R}^2 | 0.755 | 0.764 |
| <i>S.E.of Reg.</i> | 0.286 | 0.280 |

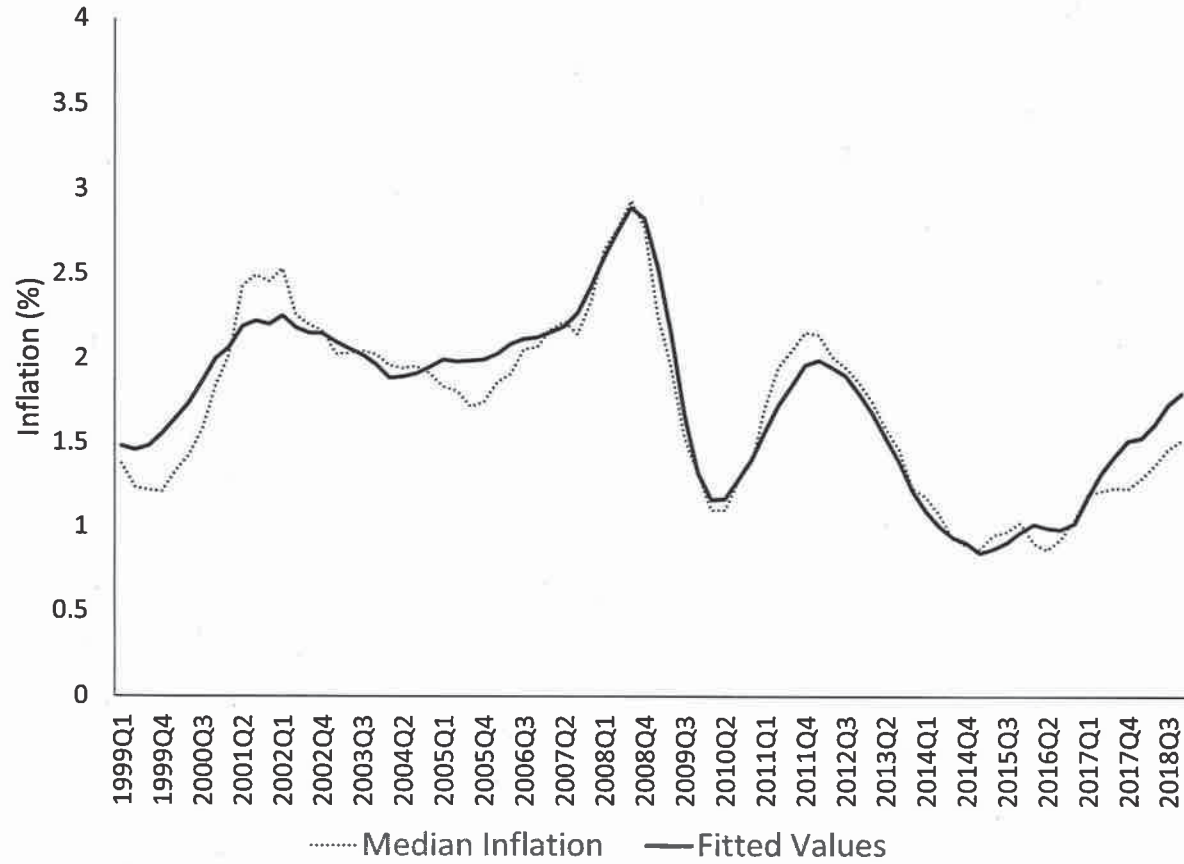
Note: OLS with robust (HAC) standard errors is used (standard errors in parentheses). π_t is represents core inflation, π_t^H is headline inflation, and π^e is the ECB's SPF mean point forecast of 5-year ahead inflation (1999Q2-4 and 2000Q2-Q4 are linearly interpolated due to missing data). The gap variable uses OECD data on the output gap to derive estimates for $\overline{y^*}$.

Figure 5: Actual and Fitted Values from Euro Area Phillips Curve with Price Shock (Table 2, column 1)

(a) Quarterly



(b) 4-Quarter Moving Average



For this specification of the Phillips curve:

No missing disinflation.

Only a modest amount of missing inflation over 2017-2018 (difference between fitted and actual values of 4-quarter inflation < 0.3 percentage points).