

The Phillips curve

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Abstract

The New Keynesian Phillips curve, why the curve looked flat for twenty years, the state-level evidence, and the nonlinearity that returned in 2021.

The Phillips curve links inflation to slack. Its slope determines how much unemployment a disinflation costs and how much inflation a boom produces, so it is the parameter on which most of monetary policy's arithmetic rests. It has been declared dead several times, most recently in the 2010s, and it came back in 2021.

The New Keynesian version

With staggered price setting, the Phillips curve becomes forward-looking: inflation today depends on *expected* inflation next period and on current marginal cost, for which the output gap or unemployment gap proxies (Galí & Gertler, 1999):

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa x_t. \quad (1)$$

Iterating forward,

$$\pi_t = \kappa \sum_{k=0}^{\infty} \beta^k \mathbb{E}_t x_{t+k}, \quad (2)$$

inflation is the discounted sum of expected *future* gaps. This has a consequence that is easy to miss: in (2) there is no independent role for a long-run expectation. The anchor of Anchored expectations enters through the constant that the equation is written in deviations from. Empirical versions therefore add a long-run expectation term:

$$\pi_t = \pi_t^{LR} + \kappa x_t + \gamma (\pi_{t-1} - \pi_t^{LR}) + \varepsilon_t. \quad (3)$$

The anchor π_t^{LR} is where inflation settles when the gap is closed, and the slope κ is how far a given gap moves it. Both are estimated, and both have changed.

The flat curve

From the mid-1990s to 2019 the estimated slope in most advanced economies fell to something close to zero. Unemployment in the United States fell from 10 percent in 2009 to 3.5 percent in 2019 with core inflation barely moving. Three explanations compete.

- **Anchoring.** If expectations are anchored, inflation does not drift with the gap, and a regression of inflation on the gap finds a small coefficient even when the true κ is unchanged. The curve looks flat because policy works.

- **A genuinely flatter curve.** Globalisation, lower worker bargaining power and more strategic complementarity in pricing reduced the pass-through of slack to prices.
- **Mismeasured slack.** If the natural rate fell, the gap was smaller than measured, and inflation responded as the curve implied.

Hazell, Herreño, Nakamura and Steinsson separated these with US state-level data, where the anchor is common and slack varies across states. They found a slope that was small and had fallen only modestly since the 1980s, and concluded that most of the apparent flattening at the national level was anchoring: the Volcker disinflation of Credibility and disinflation reduced the response of expectations, not the response of prices to slack (Hazell et al., 2022).

The curve comes back

In 2021–2022 inflation rose faster than any linear estimate of (3) predicted. Benigno and Eggertsson argued that the curve is nonlinear: when labour markets are tight enough that vacancies exceed unemployed workers, the slope steepens sharply, so a small additional tightening of the labour market produces a large rise in inflation (Benigno & Eggertsson, 2023). The 1970s look the same way on this reading. A nonlinear curve reconciles the flat 2010s with the steep 2021: the same equation, different regions of it.

Definition 1 (Sacrifice ratio). The cumulative percentage-point-years of unemployment above its natural rate required to lower inflation permanently by one percentage point. In a linear Phillips curve it is inversely related to the slope; with a nonlinear curve it depends on where the economy starts.

The sacrifice ratio is the practical payoff of knowing the slope. If the curve is steep where the economy is, disinflation is cheap; if it is flat, every point of inflation costs years of slack. The next lesson uses history to put numbers on it.

What to take from the debate

- Anchoring and the slope are separate things that look the same in aggregate data; the state-level evidence is the cleanest separation available.
- The forward-looking equation (1) makes expected *future* slack matter, which is why guidance about the path of policy is a Phillips-curve instrument, not only a financial one.
- Nonlinearity means the cost of tolerating an overheated labour market is convex: the last point of tightness costs far more inflation than the first.

Benigno, P., & Eggertsson, G. B. (2023). *It's baaack: The surge in inflation in the 2020s and the return of the non-linear Phillips curve* (NBER Working Paper 31197). National Bureau of Economic Research. <https://doi.org/10.3386/w31197>

Galí, J., & Gertler, M. (1999). Inflation dynamics: A structural econometric analysis. *Journal of Monetary Economics*, 44(2), 195–222. [https://doi.org/10.1016/S0304-3932\(99\)00023-9](https://doi.org/10.1016/S0304-3932(99)00023-9)

Hazell, J., Herreño, J., Nakamura, E., & Steinsson, J. (2022). The slope of the Phillips curve: Evidence from U.S. states. *Quarterly Journal of Economics*, 137(3), 1299–1344. <https://doi.org/10.1093/qje/qjac010>