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From Volcker to the Pandemic Era: History Dependent Anchoring of Short-Run Expected Inflation*

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Abstract

We develop an endogenous measure of anchoring for short-run expected inflation in a New Keynesian model with full-information rational expectations. Specifically, we allow the fraction of non-reoptimizing firms that index prices to the inflation target, rather than lagged inflation, to depend on observed inflation persistence. The model with endogenous indexation generates a scatter plot of persistence and volatility measures for inflation that approximates the convex pattern observed in quarterly U.S. data. With endogenous indexation, the equilibrium anchoring measure exhibits history dependence. To illustrate this idea, we perform a series of disinflation simulations where the model inflation target declines to 2% at different speeds, starting from around 8% in 1980.Q1. The Volcker disinflation simulation exactly replicates the U.S. data using the model-implied anchoring measure and model-implied shock sequences. We show that a slower disinflation mitigates output losses but results in a weaker anchoring measure over subsequent decades. The Volcker disinflation produces a more severe recession in 1982 but leads to a stronger anchoring measure that renders inflation more resilient to subsequent shocks, such as those that arrive during the Great Recession and the pandemic era.

Keywords: *Anchored inflation expectations, Phillips curve, Endogenous indexation, Volcker, Great Recession, Pandemic era, History dependence.*
JEL Classification: E31, E32, E37

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1 Introduction

U.S. inflation behavior has undergone dramatic shifts over the past six decades. Low and stable U.S. inflation during the 1960s was followed by the "Great Inflation" of the 1970s and early 1980s when inflation rose to double digits and became highly volatile and persistent. The historic tightening of monetary policy under Fed Chair Paul Volcker began a disinflation process that continued into the 1990s. The onset of the Great Recession in late 2007 was followed by a prolonged period mostly low and stable inflation. Then starting in early 2021 following a global pandemic, U.S. inflation spiked to a 40-year high but has since receded back towards 2%. This paper develops a model in which the evolving behavior of U.S. inflation from the Volcker era onward influences the path of an endogenous anchoring measure for short-run expected inflation. The degree of anchoring, in turn, influences the resilience of inflation to shocks, such as those that arrive during the Great Recession and the pandemic era.

The top left panel of Figure 1 plots annualized quarterly inflation π_t based on the personal consumption expenditures (PCE) price index together with a plausible trajectory for the Fed's inflation target, denoted by π_t^*. From 1960.Q1 to 1980.Q1, π_t^* is equal to the low frequency trend defined by the Hodrick-Prescott filter with a smoothing parameter of 1600. From 1980.Q2 onward, π_t^* converges to 2% according to the law of motion $\pi_t^* = \lambda\pi_{t-1}^* + (1-\lambda)2\%$, with $\lambda = 0.94$. The trajectory for π_t^* in Figure 1 is similar to the inflation target trajectories estimated by Ireland (2007), Cogley, Primiceri, and Sargent (2010), and Aruoba and Schorfheide (2011).

The top right panel of Figure 1 shows that the persistence of quarterly inflation, as measured by the 20-year rolling autocorrelation statistic, has declined substantially since the late 1970s, but has rebounded in recent years. The 20-year rolling standard deviation of quarterly inflation (not shown) exhibits a similar pattern. The bottom left panel shows that reduced-form Phillips curve relationships have also undergone profound changes. Starting in the late 1990s, the rolling slope of the "accelerationist" Phillips curve, given by $Cov_{20}(\Delta\pi_t, y_t)/Var_{20}(y_t)$, has become flatter while the corresponding slope of the "original" Phillips curve, given by $Cov_{20}(\pi_t, y_t)/Var_{20}(y_t)$, has become steeper, where y_t is the output gap based on potential output from the Congressional Budget Office (CBO).[1] Jørgensen and Lansing (2025b) show that these patterns are robust to different measures of inflation, including detrended inflation, and different measures of economic activity.

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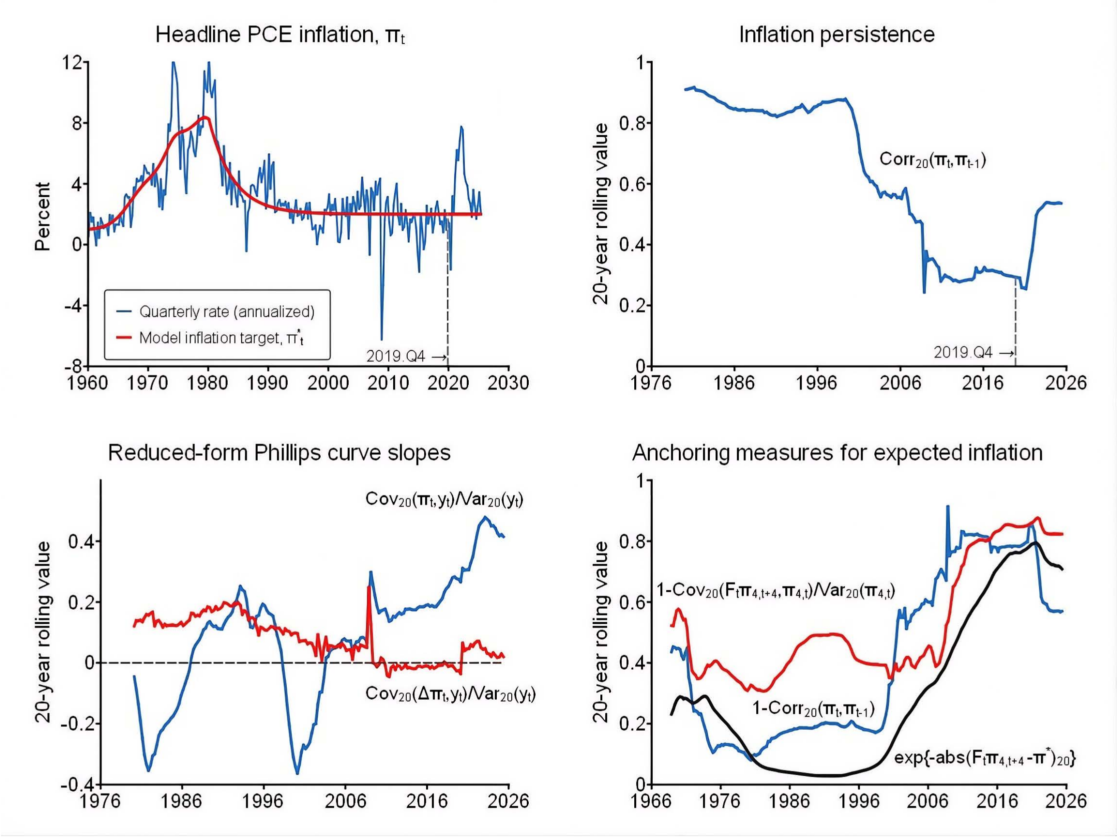
[1] The accelerationist Phillips curve regression takes the form $\pi_t - \pi_{t-1} \equiv \Delta\pi_t = c_0 + c_1 y_t$. The original Phillips curve regression takes the form $\pi_t = c_0 + c_1 y_t$.

Figure 1: U.S. Headline PCE Inflation and autocorrelation-based anchoring measure



Notes: The top left panel plots annualized quarterly inflation π_t based on the personal consumption expenditures (PCE) price index together with a plausible trajectory for the Fed's inflation target. Inflation persistence has declined substantially since the late 1970s but has rebounded in recent years. The slope coefficients in reduced-form Phillips curve relationships have also shifted. The bottom right panel plots a simple measure of anchoring for short-run expected inflation defined as 1 minus the 20-year rolling autocorrelation statistic for quarterly inflation. The autocorrelation-based anchoring measure comoves strongly with two survey-based anchoring measures for short-run expected inflation.

Following Jørgensen and Lansing (2025a), the bottom right panel of Figure 1 plots a simple measure of anchoring for short-run (one quarter ahead) expected inflation, defined as 1 minus the 20-year rolling autocorrelation statistic for quarterly inflation.[2] One quarter ahead is the relevant forecast horizon for inflation that appears in a typical New Keynesian model. The autocorrelation-based anchoring measure in Figure 1 starts trending up in the late 1990s when the Great Inflation era drops out of the moving window and is replaced by an era of low and

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[2] The anchoring measures plotted in Figure 1 are constructed using quarterly CPI inflation because the data series extends further back in time than PCE inflation.

stable inflation. The late 1990s coincides with the time when the anchoring process for *long-run* expected inflation appears to have been completed.[3] Towards the end of the data sample, the anchoring measure declines somewhat in response to the rebound in inflation persistence during the pandemic era.

There is a direct theoretical link between an autocorrelation-based anchoring measure and an anchoring measure that is based on a regression of expected inflation on actual inflation. In a model with rational expectations, we have

$$Corr(\pi_t, \pi_{t-1}) \equiv Cov(\pi_t, \pi_{t-1})/Var(\pi_t) = Cov(E_t\pi_{t+1}, \pi_t)/Var(\pi_t), \tag{1}$$

where $Cov(E_t\pi_{t+1}, \pi_t)/Var(\pi_t)$ is the slope coefficient obtained by regressing the rational inflation forecast $E_t\pi_{t+1}$ on a constant and π_t. This result obtains because $E_t\pi_{t+1} = \pi_{t+1} + \eta_{t+1}$, where η_{t+1} is the white noise rational forecast error.

The autocorrelation-based anchoring measure in Figure 1 comoves strongly with two survey-based anchoring measures for short-run expected inflation. The anchoring measure constructed by Lansing and Nucera (2023) gauges how much professional economists adjust their one-year ahead inflation forecast in response to recent movements in actual inflation. Using a 20-year rolling window of data, they regress the median inflation forecast from surveys on a constant and 4-quarter Consumer Price Index (CPI) inflation.[4] The resulting anchoring measure is given by $1 - Cov_{20}(F_t\pi_{4,t+4,}\pi_{4,t})/Var_{20}(\pi_{4,t})$, where $Cov_{20}(F_t\pi_{4,t+4,}\pi_{4,t})/Var_{20}(\pi_{4,t})$ is the estimated slope coefficient from the rolling regression. Bems, et al. (2021) and Naggert, Rich, and Tracy (2023) construct anchoring measures that are based on the deviation of expected inflation at various forecast horizons from the central bank's inflation target. Along these lines, we construct the time series $\exp\{-\text{abs}(F_t\pi_{4,t+4,} - \pi^*)_{20}\}$, where $\text{abs}(F_t\pi_{4,t+4,} - \pi^*)_{20}$ is the 20-year rolling mean absolute gap between professional economists' one-year ahead inflation forecasts and an inflation target of $\pi^* = 2\%$.[5] A larger mean absolute gap serves to lower the anchoring measure while the inverted exponential function delivers an index that ranges between 0 and 1. All three of the anchoring measures in Figure 1 decline during the 1970s, rise gradually or hold steady during the 1990s, trend up substantially during subsequent decades,

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[3] For evidence, see Bernanke (2007), Hazell, et al. (2022), Carvalho, et al. (2023), and Jørgensen and Lansing (2025b).

[4] Before 1981.Q3, expected inflation is the median response from the Philadelphia Fed's semiannual Livingston Survey, interpolated to obtain quarterly values. Starting in 1981.Q3, expected inflation is the median response from the Philadelphia Fed's quarterly Survey of Professional Forecasters.

[5] Specifically, $F_t\pi_{4,t+4}$ is the same median one year ahead inflation forecast employed by Lansing and Nucera (2023).

and then exhibit some modest end-of-sample declines. The end-of-sample decline is largest for the autocorrelation-based measure, but this anchoring measure pertains to expected quarterly inflation at the *quarterly* forecast horizon. As the forecast horizon becomes longer, the rational inflation forecast in our model becomes less sensitive to movements in quarterly inflation.

Bernanke (2007) defines the term "anchored" to mean that *long-run* inflation expectations are "relatively insensitive to incoming data." But in models with a constant inflation target and full-information rational expectations, long-run expected inflation is well anchored by construction. But if the structural slope of the New Keynesian Phillips curve (NKPC) is relatively flat as suggested by many empirical studies, then short-run expected inflation becomes very important for determining movements in inflation. According to Coibion and Gorodnichenko (2025, p. 3): "[I]t is short-run inflation expectations which determine price-setting, not long-run expectations. This is because, from a firm's viewpoint, the only time horizon that is relevant while choosing a new price today is until their next price change." In such an environment, it follows that improved anchoring of short-run expected inflation can help the central bank achieve its goals.[6]

Using a three equation New Keynesian model, Jørgensen and Lansing (2025a) show that 1 minus the autocorrelation statistic for quarterly inflation approximates the fraction μ_π of non-reoptimizing firms that index prices to the inflation target rather than lagged inflation. Higher values of μ_π imply faster reversion of inflation to π^* in response to shocks. They further show that a shift in the collective indexing behavior of firms allows the model to account for numerous features of evolving U.S. inflation behavior since 1960. These features include lower inflation persistence and volatility, the shifting pattern of slope coefficients in reduced-form Phillips curve regressions and the decreased sensitivity of survey-based inflation forecasts to movements in actual inflation.[7]

This paper extends the model of Jørgensen and Lansing (2025a) to endogenize the anchoring measure for short-run expected inflation in a manner suggested by the model itself. Specifically, the endogenous value of μ_π is given by $1 - Corr(\pi_t, \pi_{t-1})$, where $Corr(\pi_t, \pi_{t-1})$ is the model-implied autocorrelation statistic for quarterly inflation. The model-implied au-

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[6] According to Fed Vice Chair Richard Clarida (2020): "With regard to inflation expectations, there is a broad agreement among academics and policymakers that achieving price stability on a sustained basis requires that inflationary expectations be well anchored at the rate of inflation consistent with the price-stability goal. This is especially true in the world that prevails today, with flat Phillips curves in which the primary determinant of actual inflation is expected inflation."

[7] See also Jørgensen and Lansing (2021) and Jørgensen and Lansing (2025b).

tocorrelation statistic is itself endogenous, as determined by the value of μ_π and other model parameter values. The basic model already incorporates the idea that non-reoptimizing firms can choose between indexing prices to the inflation target or lagged inflation. But the fraction of firms making either choice is typically viewed as exogenous. Instead, we postulate that the indexing behavior of non-reoptimizing firms depends on observed inflation persistence, with more persistence raising the fraction of firms that index to lagged inflation.

The notion that economic agents will adjust their behavior or forecasts in response to recent observations or news about inflation is consistent with numerous empirical studies, e.g., Carroll (2003), Malmendier and Nagel (2016), Larsen, Thorsrud, and Zhulanova (2021), Pfajfar and Roberts (2022), Binder and Makridis (2022), Weber, et al. (2025), Bracha and Tang (2025), Korenok, Munro, and Chen (2026), and Pfäuti (2025). In light of such evidence, it seems rather implausible that the collective indexing behavior of firms would remain unchanged in the face of a substantial shift in the inflation environment.

With endogenous indexation, the model exhibits a unique rational expectations equilibrium but there is also a continuum of near-rational equilibria with anchoring measures that lie above or below the equilibrium value. We demonstrate analytically that these equilibria are close to self-fulfilling, particularly when the NKPC is very flat. With endogenous indexation, the equilibrium anchoring measure exhibits history dependence. In any given sample period, shifts in monetary policy variables or realizations of exogenous shocks can influence the autocorrelation statistic for quarterly inflation. And this statistic, in turn, will influence firms' indexing behavior. The result is a time-varying anchoring measure that responds to the evolving behavior of inflation. We show that the model with endogenous indexation generates a scatter plot of 20-year rolling persistence and volatility measures that approximates the convex pattern observed in quarterly U.S. data.

An important implication of endogenous indexation is that a shift in any model parameter value that affects inflation persistence will also influence the equilibrium anchoring measure. For example, an increase in the policy rule coefficient on either inflation or the output gap will reduce inflation persistence and thereby increase the equilibrium anchoring measure. Improved anchoring can also result from an increase in the volatility of *iid* cost push shocks relative to that of *iid* demand shocks because this shift also reduces inflation persistence. In Section 4.1, we cite numerous studies that find evidence of time variation in the empirical counterparts of most model parameters. The key takeaway is that endogenous indexation complicates the empirical task of identifying the underlying source of improved anchoring. Indeed, it seems likely that observed changes in U.S. inflation behavior have been driven by multiple forces which together have led to improved anchoring of short-run expected inflation.

To further illustrate the idea of history dependence, we perform a series of disinflation simulations where the model inflation target declines to 2% at different speeds, starting from around 8% in 1980.Q1. Using the time-varying anchoring measure for PCE inflation of $\mu_{\pi,t} = 1 - Corr_{20}(\pi_t, \pi_{t-1})$ as an input, we solve for the sequences of demand and cost-push shocks that allow the model to exactly replicate the observed time paths of the CBO output gap and quarterly PCE inflation. The time series for the model-implied shocks are contingent on the path of the "proxy federal funds rate" constructed by Choi et al. (2022) to summarize the broader stance of monetary policy that includes not only the level of the federal funds rate, but also forward guidance and large-scale asset transactions that affect the size of the Federal Reserve's balance sheet. Use of the proxy rate allows us to sidestep complications of solving the model subject to an occasionally-binding lower bound on the policy interest rate. When solving for the model-implied shock sequences, we account for movements in the inflation target using the π_t^* series in Figure 1. We account for movements in the neutral real rate of interest r_t^* using the updated median time series estimate from Lubik and Matthes (2023).

Each disinflation simulation employs the same shock sequences identified from U.S. data and the same interest rate path given by the proxy federal funds rate from Choi, et al. (2022). In the Volcker disinflation simulation that replicates U.S. data, π_t^* follows the trajectory plotted in Figure 1 while the anchoring measure $\mu_{\pi,t}$ is given by $1 - Corr_{20}(\pi_t, \pi_{t-1})$, also plotted in Figure 1. Changing the speed of disinflation influences the 20-year rolling autocorrelation statistic implied by the model and the resulting endogenous value of $\mu_{\pi,t}$. In the slower disinflation, π_t^* reaches 2% in 2007.Q4 while in the Volcker disinflation, π_t^* reaches 2% in 1999.Q3. We also consider an even faster disinflation in which π_t^* reaches 2% a decade earlier in 1989.Q3.

The simulations show that a slower disinflation mitigates output losses but results in a weaker anchoring measure and a higher central bank loss function value over the full sample. The Volcker disinflation produces a more severe recession trough in 1982, but leads to a stronger anchoring measure that renders inflation more resilient to subsequent shocks, such as those that arrive during the Great Recession and the pandemic era. In the slower disinflation, the trough output gap in 1982 is -5.7% versus -6.9% in the Volcker disinflation. As the simulations proceed into the Great Recession, the slower disinflation exhibits a trough inflation rate in 2009 of -2.1% versus -1.2% in the Volcker disinflation. During the pandemic era, the peak 2022 inflation rate is 9.2% under the slower disinflation versus 6.9% under the Volcker disinflation. Under the fastest disinflation scenario, the peak 2022 inflation rate is 6.3%. A faster disinflation delivers a stronger anchoring measure over subsequent decades which reduces deviations of inflation from target and delivers a lower loss function value over the full sample. Under the slower disinflation, the loss function value is 24% higher than the value obtained under the Volcker disinflation. At the end of the simulation in 2025.Q2, the anchoring measure under the Volcker disinflation is about 60% higher than the corresponding measure under the slower disinflation.

Overall, the simulations highlight the long-lasting benefits derived from the rapid disinflation started under Fed Chair Paul Volcker. But the history dependence of the anchoring measure is a two edged sword: Allowing future inflation to depart persistently from target can open the door to equilibria in which more firms start indexing prices to lagged inflation, thereby weakening the anchoring of short-run expected inflation and lowering the resilience of inflation to shocks. All else equal, weaker anchoring would require the central bank to undertake a larger interest rate response to return inflation to target.

Related literature. In our model, non-reoptimizing firms adjust their indexing behavior in response to observations about inflation persistence. In the model of Ball, Mankiw, and Romer (1988), resetting firms adjust their pricing behavior in response to observations about the *level* of inflation. Periods of higher inflation induce firms to reset their prices more frequently, making the aggregate price level more flexible and thereby steepening the Phillips curve. Periods of lower inflation induce less frequent price adjustments by firms, which serves to flatten the Phillips curve.[8] While we abstract from such a mechanism here, we acknowledge that it could help to explain the steepening of reduced-form Phillips curve relationships in U.S. data since early 2021. Indeed, recent studies by Ball, Leigh, and Mishra (2022, 2025), Harding, Lindé, and Trabandt (2023), Benigno and Eggertsson (2023), Crust, Lansing, and Petrosky-Nadeau (2023), Hobijn, et al. (2023), and Juul and Jørgensen (2025) all show that the elevated U.S. inflation rates observed since early 2021 are consistent with a non-linear

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[8] In line with this idea, Ball and Mazumder (2011) and Lansing (2019) show that a variable which multiplies either the unemployment gap or the output gap by a measure of lagged inflation is statistically significant in reduced-form Phillips curve regressions on U.S. data.

Phillips curve that becomes steeper at lower levels of labor market slack.[9]

Our results on the history dependence of the anchoring measure connects to the large literature on central bank credibility. Anchoring measures for expected inflation can be viewed as gauges of central bank credibility. Goodfriend and King (2005) provide a detailed historical analysis of the Volcker disinflation that emphasizes the Federal Reserve's many actions designed to acquire credibility. They further emphasize how Volcker came to understand that expected inflation was a primary driver of actual inflation.[10]

Bernanke and Blanchard (2025) develop a model of post-pandemic U.S. inflation in which both short-run and long-run expected inflation exhibit history dependence. This is because model inflation expectations are adaptive, evolving as separate exponentially-weighted moving averages of past inflation, as governed by different weights assigned to the most recent inflation observation. Gennaioli, et al. (2024) develop a model of inflation expectations in which history dependence derives from "memory cues" of lifetime inflation experiences. Jacome et al. (2025) develop a New Keynesian model with "experienced learning" in which short-run inflation expectations depend on the time-decaying history of past inflation, similar to a model with adaptive expectations. They show that the framework calls for a stronger central bank response to deviations of inflation from target relative to model without history-dependent expectations. While our model has similar implications, the source of history dependence is endogenous indexation which transmits this same property to rational inflation expectations.

Our use of an endogenous indexation scheme builds on previous work by Wieland (2009) who examines the cost and speed of disinflation in a New Keynesian model with learning applied to Chile. He develops a model where non-reoptimizing firms can index prices to either the inflation target or lagged inflation depending on whether the mean of the observed inflation distribution is better approximated by the inflation target or lagged inflation. Within this setup, resetting firms are boundedly-rational and construct inflation forecasts using a regression of current inflation on lagged inflation. In contrast, resetting firms in our model employ rational expectations that take into account the indexing behavior of the non-reoptimizing firms. And since this indexing behavior is linked to observed inflation persistence, the rational inflation forecast in our model is based on readily accessible information. Along similar lines, Erceg, Lindé and Trabandt (2024) employ an endogenous indexation scheme in which

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[9] Lansing (2026) reviews the literature on the causes of pandemic-era inflation in the United States.

[10] For a review of an earlier literature on credibility and disinflation, see Huh and Lansing (2000).

the fraction of prices and wages set in a backward-looking manner is higher when observed inflation runs persistently above the inflation target.

Our contribution is to show that there exists a simple *endogenous* measure of anchoring for short-run expected inflation within a standard New Keynesian model with full-information rational expectations. Our proposed anchoring measure complements other quantitative measures of anchoring for expected inflation at various forecast horizons, including: (1) measures based on the value of a gain parameter in imperfect information or learning models (Lansing 2009, Milani 2014, Carvalho, et al. 2023, Gati 2023, Jørgensen and Lansing 2025b, Jørgensen 2024), (2) measures based on a regression of expected inflation on actual inflation (Demertzis, Massimiliano, and Nicola 2012, Ehrmann 2015, Ball and Mazumder 2019, Guerrieri, et al. 2023, Lansing and Nucera 2023), (3) measures based on a regression of long-run expected inflation on short-run expected inflation (Strohsal and Winkelmann 2015, Buono and Formai 2018), (4) measures based on high-frequency financial market data (Gürkaynak, Levin and Swanson 2010, Beechey, Johannsen and Levin 2011, Bauer 2015, Bundick and Smith 2025, Bocola, et al. 2025), and (5) measures linked to the deviation of agents' subjective beliefs or forecasts from the central bank's actual inflation target (Meyer and Webster 1982, Bomfim and Rudebusch 2000, Huh and Lansing 2000, Andolfatto and Gomme 2003, Erceg and Levin 2003, Kozicki and Tinsley 2005, Wieland 2009, Gibbs and Kulish 2017, Grishchenko, Mouabbi, and Renne 2019, Bems, et al. 2021, Naggert, Rich, and Tracy 2023, Diegel 2023, Jørgensen and Lansing 2025a).

Brunnermeir (2024) defines "resilience" as the ability of a system "to bounce back after a shock to the system." Roughly speaking, resilience coincides with notions of mean reversion and anchoring. So too does an autocorrelation statistic. Many of the anchoring measures cited above have direct links to inflation persistence. Bems, et al. (2021) use cross-country data to show that an improvement in their survey-based anchoring measure is associated with less persistent responses of inflation to terms-of-trade shocks. An endogenous gain parameter in learning models bears similarity to the endogenous indexing parameter in our model; both parameters influence the weight assigned to recent inflation in agents' forecasts. The Kalman gain parameter in the signal extraction model of Lansing (2009) is computed using the autocorrelation statistic for inflation changes which provides an observable signal about the relative contributions of persistent versus transitory shocks to inflation. Carvalho, et al. (2023) employ a learning algorithm for firms that switches between a constant or decreasing gain parameter depending on the size of recent inflation forecast errors.

Jørgensen and Lansing (2025b) employ a rational expectations model along the lines of Erceg and Levin (2003) in which agents' lack full information about the central bank's inflation target. As agents acquire more information, inflation persistence declines and the anchoring measure for expected inflation improves. In the model developed here, agents can fully observe the inflation target but it can still influence inflation persistence and the equilibrium anchoring measure for short-run expected inflation when the target moves over time. Jørgensen (2024) examines how the degree of anchoring for *long-run* expected inflation can influence the output costs of disinflation when comparing the Volcker disinflation (with weak long-run anchoring) to the post-pandemic disinflation (with strong long-run anchoring).

2 Model

The framework for our analysis is the following New Keynesian model:

$$y_t = \mu_y \, E_t \, y_{t+1} + (1 - \mu_y) \, y_{t-1} - \alpha[i_t - E_t \, \pi_{t+1} - r_t^*] + v_t, \qquad v_t \sim N\left[0, \, \sigma_v^2\right], \tag{2}$$

$$\begin{aligned}\pi_t - \pi_t^* = {} & \underbrace{\frac{\beta}{1 + \beta(1 - \mu_{\pi,t})}}_{\equiv \gamma_{f,t}} (E_t \, \pi_{t+1} - \pi_t^*) + \underbrace{\frac{(1 - \mu_{\pi,t})}{1 + \beta(1 - \mu_{\pi,t})}}_{\equiv \gamma_{b.t}} (\pi_{t-1} - \pi_t^*) \\ & + \kappa y_t + u_t, \qquad u_t \sim N\left[0, \, \sigma_u^2\right],\end{aligned} \tag{3}$$

$$i_t = \pi_t^* + r_t^* + g_\pi \left(E_t \pi_{av,t+1} - \pi_t^*\right) + g_y E_t y_{t+1} + \varepsilon_t, \qquad \varepsilon_t \sim N\left[0, \, \sigma_\varepsilon^2\right], \tag{4}$$

$$\pi_{av,t} \equiv \omega \pi_t + (1 - \omega) \pi_{av,t-1}, \tag{5}$$

where equation (2) is the representative agent's consumption Euler equation, equation (3) is the NKPC, and equation (4) is the central bank's monetary policy rule. The variable y_t is the output gap (the log deviation of real output from potential output), π_t is the annualized quarterly inflation rate (based on the log difference of the price level), and i_t is the "proxy" or "shadow" policy interest rate that reflects not only the level of the short-term nominal interest rate, but also forward guidance and large-scale asset transactions that affect the size of the central bank's balance sheet (Choi, et al. 2022). As in Wu and Zhang (2019), use of the proxy rate allows us to sidestep complications of solving the model subject to an occasionally-binding lower bound on the policy interest rate.

The presence of y_{t-1} in equation (2) can be motivated by habit formation in consumption behavior with smaller values of the parameter $\mu_y \in [0,1]$ implying a stronger habit motive (Fuhrer 2000). The presence of π_{t-1} in equation (3) can be motivated by a variety of modeling devices.[11] We adopt a version of the NKPC specification developed by Cogley and Sbordonne (2008) that allows for drifting trend inflation and price indexation by non-reoptimizing firms. When π_t^* and $\mu_{\pi,t}$ are constant, we obtain the NKPC specification described by Mavroeidis, Plagborg-Møller, and Stock (2014, p. 131).

Equation (5) defines "average inflation" $\pi_{av,t}$ to be an exponentially-weighted moving average of current and past quarterly inflation rates so as to approximate the compound average inflation rate over the past 4 quarters—a typical central bank goal variable.[12] The proxy interest rate responds to the rational forward-looking forecasts $E_t\pi_{av,t+1}$ and $E_t y_{t+1}$. Levin, Wieland, and Williams (2003) argue that forecast-based policy rules are robust to model misspecification and provide a reasonable description of central bank behavior. Coibion and Gorodnichenko (2011) estimate forecast-based policy rules to describe Federal Reserve behavior both before and after the Volcker disinflation. Nikolsko-Rzhevskyy (2011) finds that estimated forward-looking policy rules fit the data better than backward-looking rules. Although the policy rule does not contain an explicit interest rate smoothing term involving i_{t-1}, Jørgensen and Lansing (2025a) demonstrate that the equilibrium policy rate i_t exhibits a high degree of persistence because the rational forecasts $E_t\pi_{av,t+1}$ and $E_t y_{t+1}$ are themselves highly persistent.[13] The variables π_t^* and r_t^* represent the central bank's inflation target and the neutral real rate of interest rate (r-star), respectively. The model allows for a demand shock v_t, a cost-push shock u_t, and a monetary policy shock ε_t which are uncorrelated with each other and across time.

As in Calvo (1983), each firm in the economy has a constant probability of optimally resetting its price in any given period. This probability influences the value of the NKPC slope parameter κ, with lower probabilities implying more price rigidity and hence lower pass-through from economic activity to inflation, i.e., a flatter slope parameter.

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[11] See for example, Buiter (1981), Fuhrer and Moore (1995), Roberts (1997), Galí and Gertler (1999), Christiano, Eichenbaum, and Evans (2005), Nimark (2008), and Angeletos and Huo (2021).

[12] As in Lansing (2021), the value of ω is set to achieve $\pi_{av,t} \simeq \pi_{4,t} = [\Pi_{j=0}^{3}(1+\pi_{t-j})]^{0.25} - 1$.

[13] See Jørgensen and Lansing (2025a, Figure 2).

Given the set of firms that do not optimally reset prices each period, a fraction $\mu_{\pi,t} \in [0, 1]$ index prices to the inflation target π^*_t while the remainder index prices to lagged inflation π_{t-1}. But even when $\mu_{\pi,t} = 0$, the NKPC continues to exhibit a significant forward-looking component with $\gamma_{f,t} = \beta/(1 + \beta)$ and $\gamma_{b,t} = 1/(1 + \beta)$. Jørgensen and Lansing (2025a) show that the value of $\mu_{\pi,t}$ serves as a simple measure of anchoring for short-run expected inflation. When π^*_t, r^*_t, and $\mu_{\pi,t}$ are constants, the model implies $\mu_\pi \simeq 1 - Corr(\pi_t, \pi_{t-1})$, where $Corr(\pi_t, \pi_{t-1})$ is the model-implied autocorrelation statistic for quarterly inflation. The autocorrelation-based anchoring measure has a direct theoretical link to an anchoring measure that gauges the sensitivity of short-run expected inflation to movements in actual inflation. Specifically, the model implies $Corr(\pi_t, \pi_{t-1}) = Cov(E_t\pi_{t+1}, \pi_t)/Var(\pi_t)$. They further show that $Cov(E_t\pi_{t+h}, \pi_t)/Var(\pi_t) \rightarrow 0$ as $h \rightarrow \infty$, implying that long-run expected inflation remains well-anchored by construction in a model with rational expectations and a constant inflation target.

For the analysis that follows, we first examine the properties of the model when π^*_t, r^*_t, and $\mu_{\pi,t}$ are constants and the indexing parameter μ_π is allowed to shift in an exogenous manner.[14] Next, we perform model simulations and disinflation scenarios in which π^*_t and r^*_t can evolve over time while the endogenous value of $\mu_{\pi,t}$ is linked to a model-implied measure of inflation persistence.

3 Parameter values

Table 1 shows the baseline parameter values for the quantitative analysis in which π^*_t, r^*_t, and $\mu_{\pi,t}$ are constants. In Sections 4 and 5, we examine how shifts in many of these parameter values influence the properties of the model.

The value $\mu_y = 0.5$ is close to the maximum likelihood estimate of 0.46 obtained by Fuhrer and Rudebusch (2004) for an Euler equation specification similar to ours using CBO output gap data from 1966.Q1 to 2000.Q4. The value $\alpha = 0.1$ for the interest rate coefficient in equation (2) is consistent with the small empirical sensitivity of either consumption or the output gap to changes in the interest rate, as shown by Campbell and Mankiw (1989) and Fuhrer and Rudebusch (2004).[15] Roberts (2006) also employs the values $\mu_y = 0.5$ and $\alpha = 0.1$.

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[14] Appendix A provides details of the model solution when π^*_t, r^*_t, and $\mu_{\pi,t}$ are constants.

[15] According to Fuhrer and Rudebusch (2004, p. 1141): "[T]here is a clear negative relationship between the estimated size of the expectational parameter [μ_y] and the size of the interest rate sensitivity parameter [α]."

Table 1. Baseline parameter values

Parameter	Value	Description/Target
μ_y	0.5	Weight on $E_t y_{t+1}$ in Euler equation.
α	0.1	Interest rate coefficient in Euler equation.
β	0.995	Discount factor in Phillips curve.
κ	0.03	Slope coefficient in Phillips curve.
σ_ν	1.1%	Std. dev. of demand shock.
σ_u	1.0%	Std. dev. of cost push shock.
σ_ε	0.5%	Std. dev. of monetary policy shock.
r^*	1.5%	Steady state real interest rate.
π^*	2.0%	Steady state inflation target.
ω	0.464	$\pi_{av,t} \simeq$ 4-quarter PCE inflation rate.
g_π	1.20	Policy rule response to inflation forecast.
g_y	0.75	Policy rule response to output gap forecast.
μ_π	0.510	Equilibrium value when $\mu_\pi = 1 - Corr(\pi_t, \pi_{t-1})$.

The values $\beta = 0.995$ and $\kappa = 0.03$ imply a low rate time preference together with a relatively flat NKPC. Empirical estimates of κ in full-information rational expectations models with hybrid NKPCs are typically small or not statistically different from zero (Galí, Gertler, and López-Salido 2005, Rudd and Whelan 2007, Del Negro, et al. 2020, Hazell, et al. 2022, Inoue, Rossi, and Wang 2026). Our calibration of $\kappa = 0.03$ roughly corresponds to a slope coefficient of $\kappa/4 = 0.0075$ when π_t is not annualized. As shown below in Table 2, the value $\kappa = 0.03$ delivers slope coefficients for reduced-form Phillips curve relationships that are numerically close to those observed in U.S. data when π_t is measured as annualized quarterly inflation.

The standard deviations of the three fundamental shocks v_t, u_t, and ε_t influence the persistence and volatility of the model variables. We choose values that deliver persistence and volatility measures that approximate those in U.S. data since 1988.Q1—a sample period of consistent U.S. monetary policy. The steady state real interest rate of $r^* = 1.5\%$ is close to the sample average of the median time series estimates reported by Lubik and Matthes (2023) for data since 1988.Q1.[16] The inflation target of $\pi^* = 2\%$ is based on the Federal Open Market Committee's (FOMC) stated longer-run goal for the year-over-year change in the PCE price index. Following Lansing (2021), we compute the value $\omega = 0.464$ so that $\pi_{av,t}$ approximates the 4-quarter PCE inflation rate from 1961.Q1 to 2025.Q2. When $\omega = 0.464$, the cumulative weight on the first four terms π_t through π_{t-3} in the moving average is 0.918. The monetary policy rule coefficients g_π and g_y are close to values obtained by regressing either the actual

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[16] Updated Lubik-Matthes estimates are available from www.richmondfed.org/research/national_economy.

federal funds rate or the proxy federal funds rate on 4-quarter PCE inflation and the CBO output gap using data from 1988.Q1 through 2019.Q4.[17] But it should noted that the model interest rate responds to the rational forecasts of these variables rather than to the variables themselves.

Given the other model parameter values, we set $\mu_\pi = 0.510$. This is the equilibrium value of μ_π in the model with endogenous indexation, to be described later in Section 5. With endogenous indexation, the indexing behavior of non-reoptimizing firms depends on observed inflation persistence according to the relationship $\mu_\pi = 1 - Corr(\pi_t, \pi_{t-1})$. This relationship is suggested by the model itself as μ_π ranges exogenously between 0 and 1. When $\mu_\pi = 0.510$, we have $\gamma_f = 0.67$ which is close to the value of 0.74 estimated by Jørgensen and Lansing (2025b) using data on core CPI inflation and the CBO output gap from 2007.Q4 to 2019.Q2. Using data from 1960.Q1 to 1997.Q4, Rudd and Whelan (2007) report estimates of γ_f that range from 0.473 to 0.684. Mavroeidis, Plagborg-Møller, and Stock (2014) survey the large literature on estimates of μ_π. Across the various studies, estimates range from 0.35 to 0.95. Inoue, Rossi, and Wang (2026) estimate a time-varying value for γ_f that trends up from around 0.4 in the mid-1980s to about 0.65 in 2021.Q4. An increase in the value γ_f over time is consistent with an increase in the empirical counterpart of the model's anchoring measure μ_π, as plotted in Figure 1.

4 Model with exogenous indexation

We begin our analysis by showing how an exogenous increase in the anchoring measure μ_π influences the properties of the model. Higher values of μ_π increase the NKPC coefficient γ_f that is applied to $E_t\pi_{t+1}$ and decrease the coefficient γ_b that is applied to π_{t-1}. When $\mu_\pi = 0$, we have $\gamma_f \simeq \gamma_b \simeq 0.5$. As $\mu_\pi \to 1$, we have $\gamma_f \to \beta$ and $\gamma_b \to 0$.

Table 2 updates the results of Jørgensen and Lansing (2025a) using additional U.S. data. The table compares the moments of U.S. data variables for two different sample periods to those predicted by the model for two different values of μ_π. An increase in μ_π from 0.1 to 0.510 serves to reduce inflation persistence and volatility, flatten the slope of the accelerationist Phillips curve as given by $Cov(\Delta\pi_t, y_t)/Var(y_t)$, and steepen the slope of the original Phillips curve as given by $Cov(\pi_t, y_t)/Var(y_t)$. All of these patterns are consistent with U.S. data when moving from the first sample period to the second sample period. Notably, the patterns in

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[17] Including data from the pandemic and its aftermath reduces the value of both regression coefficients.

U.S. data are robust to using a measure of detrended quarterly inflation π_t^d, along the lines of Carlstrom and Fuerst (2008) and Lansing (2009).

A simplified version of the model helps to illustrate the intuition for the shifting slope patterns of the reduced-form Phillips curve relationships. The simplified model sets $\mu_y = 1$, $E_t y_{t+1} = 0$, $\beta = 1$, $\gamma_f = \mu_\pi$, $\gamma_b = 1 - \mu_\pi$, $g_y = 0$, and $\omega = 1$. In this case, the model can be reduced to the following two equations

$$y_t \;=\; -\,\alpha(g_\pi - 1)[E_t\,\pi_{t+1} - \pi^*] \,+\, v_t, \tag{6}$$

$$\pi_t - \pi^* \;=\; \mu_\pi(E_t\,\pi_{t+1} - \pi^*) \,+\, (1-\mu_\pi)(\pi_{t-1} - \pi^*) \,+\, \kappa y_t \,+\, u_t, \tag{7}$$

where the form of equation (6) now resembles an optimal central bank targeting rule under discretion, except that here the targeted inflation variable would be $E_t\,\pi_{t+1}$ rather than π_t.[18]

Table 2. Unconditional moments: Data versus model

	U.S. Data		Model	
	1960.Q1-1987.Q4	1988.Q1-2025.Q2	$\mu_\pi = 0.1$	$\mu_\pi = 0.510$
$Std\ Dev\ (\pi_t)$	3.03%	1.74%	3.08%	1.69%
$Std\ Dev\ (\pi_t^d)$	1.60%	1.42%	–	–
$Corr(\pi_t, \pi_{t-1})$	0.89	0.55	0.81	0.49
$Corr(\pi_t^d, \pi_{t-1}^d)$	0.62	0.33	–	–
$Std\ Dev\ (y_t)$	2.57%	1.89%	2.36%	2.26%
$Corr(y_t, y_{t-1})$	0.93	0.85	0.73	0.71
$Cov(\Delta\pi_t, y_t)/Var(y_t)$	0.120	0.028	0.160	0.084
$Cov(\Delta\pi_t^d, y_t)/Var(y_t)$	0.086	0.028	–	–
$Cov(\pi_t, y_t)/Var(y_t)$	−0.072	0.318	0.074	0.161
$Cov(\pi_t^d, y_t)/Var(y_t)$	0.099	0.186	–	–

Notes: For U.S. data, y_t is the CBO output gap, π_t is quarterly PCE inflation (annualized), π_t^d is detrended quarterly inflation using the HP filter with $\lambda = 1600$, $\Delta\pi_t \equiv \pi_t - \pi_{t-1}$, and $\Delta\pi_t^d \equiv \pi_t^d - \pi_{t-1}^d$. Model moments are computed analytically as described in Appendix A.

First consider the accelerationist Phillips curve. When $\mu_\pi \simeq 0$ (weak anchoring), equation (7) implies $Cov(\Delta\pi_t, y_t)/Var(y_t) = \kappa$. When $\mu_\pi \simeq 1$ (strong anchoring), inflation is not persistent such that $E_t\pi_{t+1} \simeq \pi^*$. In this case, equation (7) implies $Cov(\Delta\pi_t, y_t)/Var(y_t) = \kappa[1 - Corr(y_{t-1}, y_{t-1})]$ which shows that the slope will become flatter when anchoring improves, provided that the output gap exhibits some persistence such that $Corr(y_{t-1}, y_{t-1}) \in (0,\, 1)$. The output gap in the full model does exhibit persistence due to the term involving y_{t-1} in

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[18] For examples of such targeting rules in New Keynesian models, see McLeay and Tenreyro (2020) and Jørgensen and Lansing (2025b). The case when $g_\pi \to \infty$ would correspond to "strict inflation targeting."

the Euler equation (2). As noted by Jørgensen and Lansing (2021), an implication of strong anchoring is that $\Delta\pi_t$ will depend positively on Δy_t, not on the value of y_t itself.

Now consider the original Phillips curve. When $\mu_\pi \simeq 0$ (weak anchoring), inflation is highly persistent such that $E_t\pi_{t+1} \simeq \pi_t$ and equation (6) implies $Cov(\pi_t, y_t) < 0$ whenever $g_\pi > 1$, i.e., whenever the Taylor principle is satisfied. When $\mu_\pi \simeq 1$ (strong anchoring), inflation is not persistent such that $E_t\pi_{t+1} \simeq \pi^*$. In this case, equation (7) implies $Cov(\pi_t, y_t)/Var(y_t) = \kappa$ which shows that the slope will go from negative to positive as anchoring improves. This is exactly the pattern observed in U.S. data (Table 2).

4.1 Effects of other model parameters

While maintaining the baseline parameter setting of $\mu_\pi = 0.510$, we now examine whether shifts in other model parameters can account for the shifting patterns of U.S. inflation behavior shown in Table 2. There is ample evidence for time variation in the empirical estimates of most model parameters. Using a New Keynesian model similar to ours, Lubik and Schorfheide (2004) find evidence of significant time variation in parameters governing the monetary policy responses to inflation and the output gap, the slope of the NKPC, and the volatilities of fundamental shocks. Studies by Cogley and Sbordonne (2008), Del Negro, et al. (2020), Hadjani (2023), and Inoue, Rossi and Wang (2026) all demonstrate evidence of time-varying parameter values in estimated versions of the NKPC. Studies by Galí and Gambetti (2009) and Bergholt, Furlanetto, and Vaccaro-Grange (2026) present evidence of shifts in the relative importance of demand versus supply shocks. A vast finance literature finds evidence of time-varying risk aversion which would imply a time-varying interest rate sensitivity parameter α in the Euler equation (2).[19]

A key indicator for this exercise is whether a shift in a given parameter value can account for the shifting slope patterns of the two reduced-form Phillips curve relationships, as measured by $Cov(\Delta\pi_t, y_t)/Var(y_t)$ and $Cov(\pi_t, y_t)/Var(y_t)$. And if so, whether shifts in that same parameter value can also account for significant declines in both inflation volatility and persistence. The top left panel of Figure 2 reproduces the exercise in Jørgensen and Lansing (2025a). Starting from low levels, higher values of μ_π serve to flatten the slope of the accelerationist Phillips curve as given by $Cov(\Delta\pi_t, y_t)/Var(y_t)$ but steepen the slope of the original Phillips curve as given by $Cov(\pi_t, y_t)/Var(y_t)$. This pattern is consistent with the U.S. data

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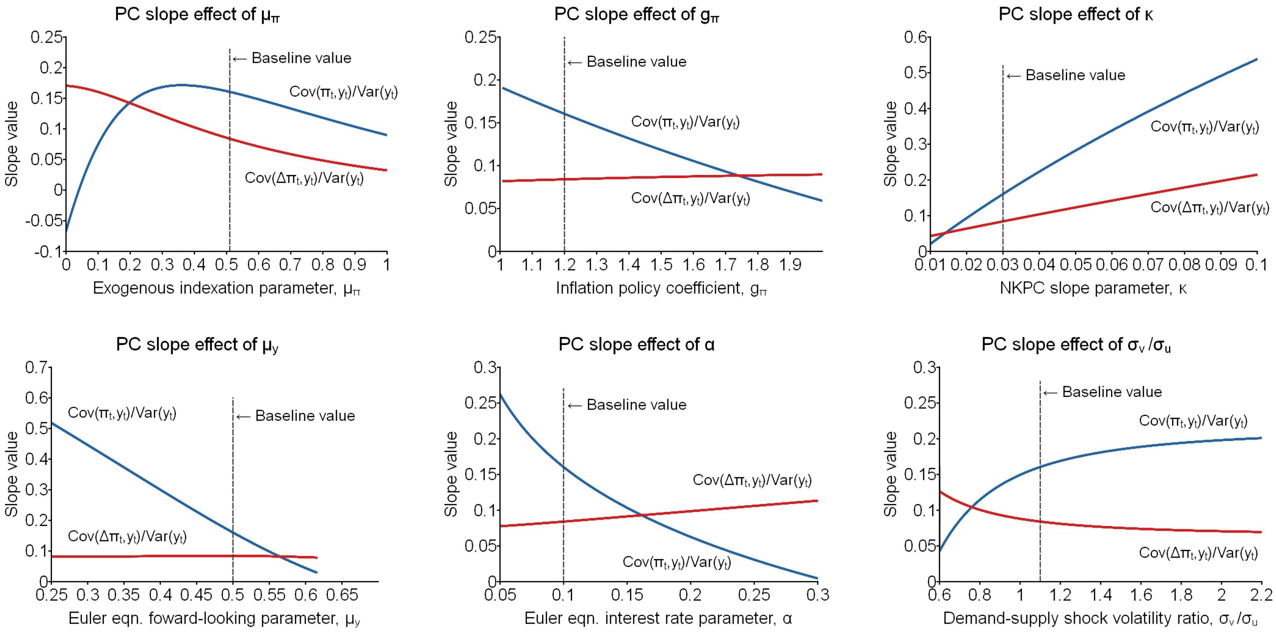
[19] See, for example, Bekaert, Engstrom, and Xu (2021) and the references cited therein.

in Table 2 when going from the first sample period to the second sample period.

Figure 2: Effects of model parameters on reduced-form Phillips curve slopes



Notes: Starting from low levels, higher values of μ_π (top left panel) serve to flatten the slope of the accelerationist Phillips curve as given by $Cov(\Delta\pi_t, y_t)/Var(y_t)$ but steepen the slope of the original Phillips curve as given by $Cov(\pi_t, y_t)/Var(y_t)$, consistent with the U.S. data in Figure 1 and Table 2. Shifts in the values of other model parameters generally cause the slopes of the two reduced-form Phillips curves to move in ways that are not consistent with U.S. data. The two exceptions (bottom middle and bottom right panels) have counterfactual implications for inflation persistence and/or inflation volatility.

Figure 2 shows that shifts in the values of most other model parameters cause the slopes of the two reduced form Phillips curves to move in ways that are not consistent with U.S. data. For example, the top middle panel shows that a decline in the inflation policy coefficient g_π can deliver a steeper original Phillips curve, but the slope of the accelerationist Phillips curve is essentially unchanged. While not shown in Figure 2, decreasing the value of the output gap policy coefficient g_y produces movements in the reduced-form slope values that are qualitatively similar to those obtained when decreasing the value of g_π. Moreover, a decline in either g_π or g_y leads to counterfactual increases in inflation volatility and persistence.

Figure 2 shows that the correct slope patterns can arise from a *decrease* in the interest rate sensitivity parameter α (bottom middle panel) or an *increase* in the demand-supply shock volatility ratio σ_v/σ_u (bottom right panel).[20] However, a decrease in α serves to counterfactually increase both inflation persistence and volatility while an increase in σ_v/σ_u serves to increase inflation persistence but decrease inflation volatility.[21]

Lower values of α (implying higher risk aversion) mute the effects of monetary policy on inflation that works through the output gap. This leads to increased comovement between π_t and y_t that comes from demand shocks. Higher values of σ_v/σ_u raise the importance of demand shocks directly, also resulting in increased comovement between π_t and y_t. This intuition accounts for the steepening of the original Phillips curve. When π_t exhibits persistence, lower values of α or higher values of σ_v/σ_u also lead to increased comovement between π_{t-1} and y_t, but along a different gradient. Given that $Cov(\Delta\pi_t, y_t) = Cov(\pi_t, y_t) - Cov(\pi_{t-1}, y_t)$, the slope of the accelerationist Phillips curve will become flatter if $Cov(\pi_{t-1}, y_t)$ increases along a faster gradient than $Cov(\pi_t, y_t)$. This is precisely what happens when we decrease the value of α or increase the value of σ_v/σ_u. But again, these shifts lead to counterfactual predictions for other inflation statistics.

When we shift the value of the interest rate sensitivity parameter α in Figure 2, we do not enforce the theoretical connection between the value of α and the value of the NKPC slope coefficient κ, as implied by the derivation of the NKPC.[22] The theoretical connection implies that a decrease in α would contribute to an increase in κ. But the top right panel of Figure 2 shows that higher values of κ tend to steepen both of the reduced-form Phillips curve relationships. Moreover, a higher value of κ would lead to higher inflation persistence as transmitted from the output gap via the term κy_t in the NKPC (3).

We also verified that shifts in the value of the discount factor β have only tiny effects on the relevant inflation statistics. The key takeaway is that shifts in other model parameter values cannot explain all of the stylized facts in U.S. data. These results extend and complement the findings of Jørgensen and Lansing (2025a,b).

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[20] In contructing the bottom right panel of Figure 2, we vary the ratio σ_v/σ_u while maintaining the baseline condition $\sigma_v + \sigma_u = 2.1\%$.

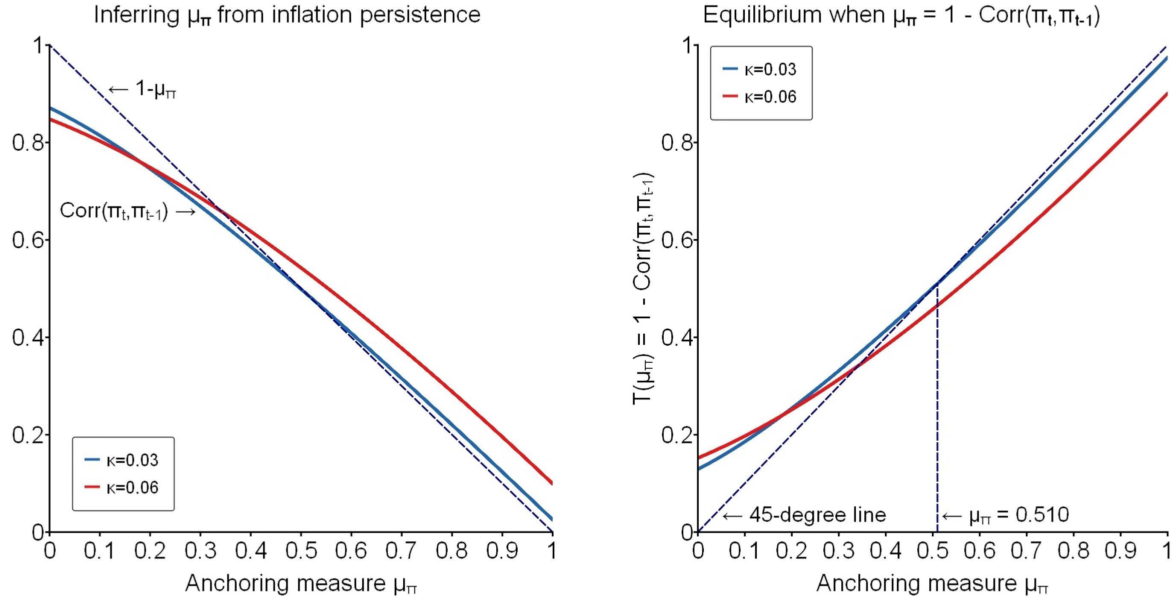
[21] As the value of α goes from 0.3 to 0.05, $Corr(\pi_t, \pi_{t-1})$ goes from 0.45 to 0.55 and *Std Dev*(π_t) goes from 1.61% to 1.83%. As the value of σ_v/σ_u goes from 0.6 to 2.2, $Corr(\pi_t, \pi_{t-1})$ goes from 0.49 to 0.57 and *Std Dev*(π_t) goes from 1.69% to 1.25%.

[22] Specifically, $\kappa = (1-\theta)(1-\beta\theta)(\alpha^{-1}+\varphi)/\theta$, where $1-\theta$ is the representative firm's Calvo probability of resetting its price each period and φ is the labor supply elasticity. See Walsh (2003) or Galí (2008).

5 Endogenous indexation and history dependence

Having explored the model properties with exogenous movements in the anchoring measure μ_π, we now endogenize the value of μ_π in a manner suggested by the model itself. Specifically, we postulate that the indexing behavior of non-reoptimizing firms depends on observed inflation persistence, with higher persistence raising the fraction of non-reoptimizing firms that index prices to lagged inflation. Our setup is consistent with an environment where non-reoptimizing firms react to observed shifts in the inflation environment.

Figure 3: Equilibrum when indexation depends on inflation persistence



Notes: The left panel shows that the approximate value of the model anchoring measure μ_π can be inferred from the observed persistence of quarterly inflation rates such that $1 - \mu_\pi \simeq Corr(\pi_t, \pi_{t-1})$. When the indexing behavior of non-reoptimizing firms depends on inflation persistence according to the relationship $\mu_\pi = 1 \quad Corr(\pi_t, \pi_{t-1})$, the model exhibits a unique rational expectations equilibrium at $\mu_\pi = 0.510$ (right panel). But there is also a continuum of near-rational equilibria with anchoring measures that lie above or below the equilibrium value. Higher values of κ, implying a steeper NKPC, serve to increase inflation persistence and thereby reduce the equilibrium anchoring measure.

The left panel of Figure 3 shows that $Corr(\pi_t, \pi_{t-1}) \simeq 1 - \mu_\pi$ when μ_π increases exogenously from 0 to 1. The right panel of Figure 3 shows the model's equilibrium outcome when we endogenize the indexing behavior of non-reoptimizing firms using the map $\mu_\pi = T(\mu_\pi) \equiv$

$1 - Corr(\pi_t, \pi_{t-1})$, where $Corr(\pi_t, \pi_{t-1})$ in the analytical autocorrelation statistic for inflation computed from the model solution. For the parameter values in Table 1 with $\kappa = 0.03$, the unique fixed point of the map occurs at $\mu_\pi = 0.510$. At the fixed point, we have $T^{'}(\mu_\pi) < 1$ which implies that the equilibrium is learnable and stable under typical adaptive learning algorithms.[23] If we increase the NKPC slope coefficient to $\kappa = 0.06$, the equilibrium anchoring measure is lower at $\mu_\pi = 0.341$. This result is due to the higher persistence transmitted to inflation from the output gap via the term κy_t in equation (3). The resulting autocorrelation statistic for inflation is now 0.66, which exceeds the value of 0.55 observed in U.S. data from 1988.Q1 to 2025.Q2 (Table 2).

The close proximity of the map $T(\mu_\pi)$ to the 45-degree line implies that there is a continuum of near-rational equilibria with anchoring measures that lie above or below the equilibrium value $\mu_\pi = 0.510$. This property of the model implies that the equilibrium anchoring measure will exhibit history dependence. In any given sample period, shifts in monetary policy variables or realizations of exogenous shocks will influence the autocorrelation statistic for quarterly inflation and thereby influence firms' indexing behavior, giving rise to a time-varying anchoring measure. And the time-varying anchoring measure, in turn, will influence observed inflation persistence.

The right panel of Figure 3 shows that there is a wide range of anchoring measures for which the equilibrium value of μ_π is close to self-fulfilling. To illustrate this idea more formally, consider a simplified version of the model with an extremely flat Phillips curve such that $\kappa \simeq 0$. In this case, the NKPC (3) becomes

$$\pi_t - \pi^* = \frac{\beta}{1+\beta(1-\mu_\pi)}(E_t\,\pi_{t+1} - \pi^*) + \frac{(1-\mu_\pi)}{1+\beta(1-\mu_\pi)}(\pi_{t-1} - \pi^*) + u_t. \tag{8}$$

A conjectured solution to the above equation takes the form $\pi_t - \pi^* = b_\pi(\pi_{t-1} - \pi^*) + b_u u_t$, where b_π and b_u are undetermined coefficients. Iterating the conjectured solution ahead one period, taking the rational expectation and then substituting $E_t\,\pi_{t+1} - \pi^*$ into equation (8) yields the following expression that confirms the form of the conjectured solution:

$$\pi_t - \pi^* = \underbrace{\frac{(1-\mu_\pi)}{1+\beta(1-\mu_\pi)-\beta b_\pi}}_{=\,b_\pi}(\pi_{t-1} - \pi^*) + \underbrace{\frac{1+\beta(1-\mu_\pi)}{1+\beta(1-\mu_\pi)-\beta b_\pi}}_{=\,b_u} u_t, \tag{9}$$

where the value of b_π must satisfy $\beta b_\pi^2 - [1+\beta(1-\mu_\pi)]b_\pi + 1 - \mu_\pi = 0$. It is straightforward

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[23] Evans and Honkapohja (2001, p. 30) outline the conditions needed for "expectational stability" of a rational expectations equilibrium under adaptive learning.

to verify that $b_\pi = 1 - \mu_\pi$ satisfies the quadratic equation. Since u_t is white noise, the model solution (9) implies $Corr(\pi_t, \pi_{t-1}) = b_\pi$. Then, under endogenous indexation, we have

$$\begin{aligned} \mu_\pi &= T(\mu_\pi) \equiv 1 - Corr(\pi_t, \pi_{t-1}), \\ &= 1 - \underbrace{b_\pi}_{=1-\mu_\pi} \\ &= \mu_\pi, \end{aligned} \tag{10}$$

which shows that any $\mu_\pi \in [0,1]$ will satisfy the equilibrium map $\mu_\pi = T(\mu_\pi)$. Keep in mind that this illustrative example is special because $\kappa \simeq 0$ would imply that monetary policy has no ability to influence inflation or expected inflation. Nevertheless, the example helps to explain why the map $T(\mu_\pi)$ in the full model stays close to the 45-degree line over a wide range of values for μ_π.[24]

With endogenous indexation, sampling variation in the autocorrelation statistic for inflation can influence firms' indexing behavior, giving rise to a time-varying anchoring measure and time-varying inflation dynamics. To illustrate this idea, Figure 4 plots the results from model simulations of 10,000 periods for three separate anchoring scenarios: $\mu_\pi = 1$, $\mu_\pi = 0.5$, and $\mu_{\pi,t} = \min\{1 - Corr_{20}(\pi_t, \pi_{t-1}),\ 0.7\}$ where $Corr_{20}(\pi_t, \pi_{t-1})$ is the autocorrelation statistic computed using a trailing 20-year rolling window of model-generated data. The upper limit of $\mu_{\pi,t} = 0.7$ in the simulation is based on the approximate minimum value of $Corr_{20}(\pi_t, \pi_{t-1})$, as plotted in Figure 1. All other parameters are set to the values shown in Table 1.

In the simulation with endogenous indexation, we solve the model each period and construct the rational decision rules that would prevail under the assumption that the latest value of $\mu_{\pi,t}$ will prevail over agents' forecast horizons.[25] During the simulation, sampling variation in the trailing 20-year rolling autocorrelation statistic causes the value of $\mu_{\pi,t}$ to gradually drift over time while agents' decision rules and forecasts adapt to this drift. Agents' decision rules and forecasts conform to the "anticipated utility" model of Kreps (1998) that is typically employed in adaptive learning models with time-varying parameters (Sargent 1999, Cho, Williams, and Sargent 2002, Orphanides and Williams 2005, Wieland 2009). Specifically,

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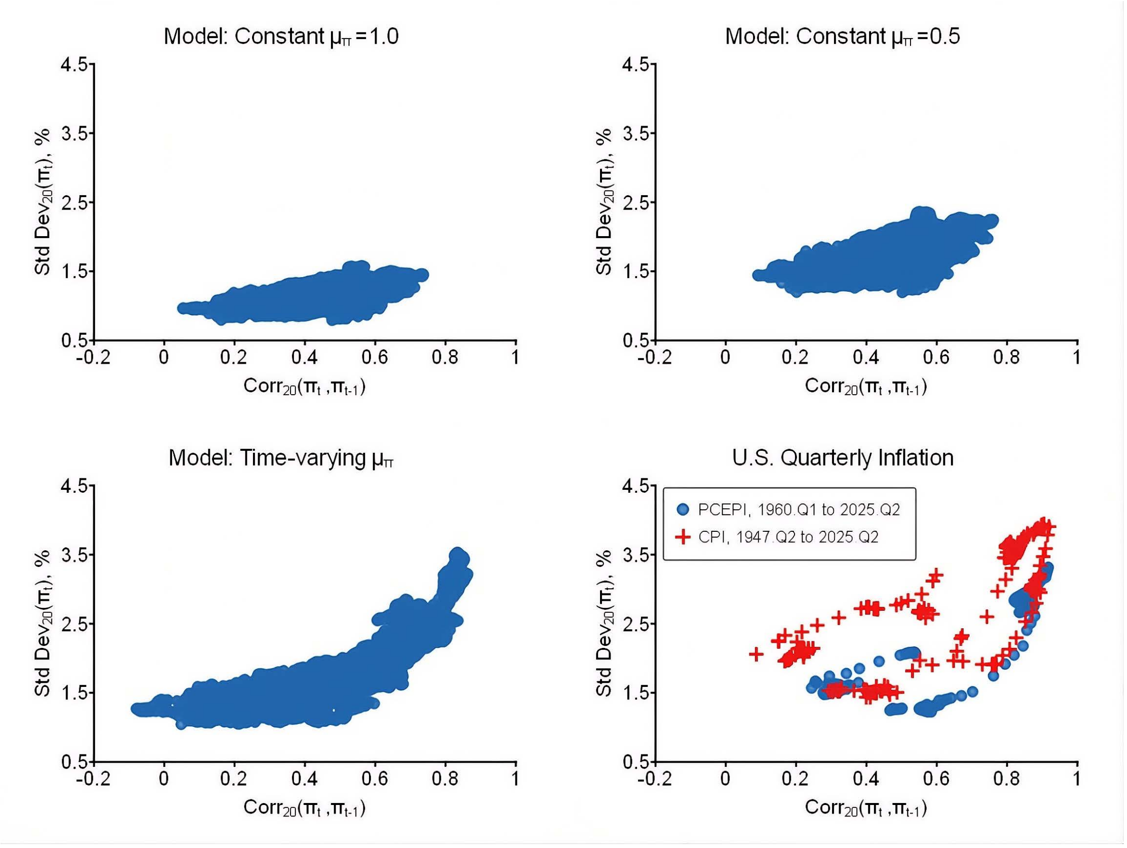
[24] Lansing (2009) illustrates a similar self-confirming equilibrium mechanism in a New Keynesian model with boundedly-rational inflation expectations that respond to the persistence of inflation changes.

[25] Given the model parameter values from Table 1 together with the observed 20-year autocorrelation statistic for inflation in period $t-1$, we solve the model in each period t to obtain expressions for y_t, π_t and $\pi_{av,t}$ in terms of the state variables y_{t-1}, π_{t-1}, $\pi_{av,t-1}$, ν_t, u_t, and ε_t. Given the simulated time series for π_t, we then construct $\pi_{4,t} = [\Pi_{j=0}^{3}(1+\pi_{t-j})]^{0.25} - 1$.

agents' forecasts presume that any time-varying parameters evolve as a random walk. The simulated value of $\mu_{\pi,t}$ is highly persistent, exhibiting an autocorrelation statistic of 0.997.

Figure 4: Model simulations: Constant versus time-varying indexation parameter



Notes: The figure plots simulation results using either a constant or time-varying indexation parameter μ_π. The simulation with a time-varying μ_π reflects endogenous indexing behavior such that $\mu_\pi = \min\{1 - Corr_{20}(\pi_t, \pi_{t-1}),\ 0.7\}$. The upper limit of 0.7 is based on the approximate minimum value of $Corr_{20}(\pi_t, \pi_{t-1})$ for quarterly PCE inflation, as plotted in Figure 1. The model with endogenous indexation (bottom left panel) approximates the convex scatterplot observed in quarterly U.S. data (bottom right panel).

Figure 4 shows that the model with endogenous indexation (bottom left panel) exhibits a scatterplot of time-varying inflation statistics that resembles the convex pattern observed in quarterly U.S. data (bottom right panel). The U.S. scatter plot employs two measures of quarterly inflation computed from the PCE price index or the CPI. Both inflation measures generate a convex-shaped scatter plot. The mean value of $\mu_{\pi,t}$ during the simulation is 0.57, with a standard deviation of 0.15. The minimum value of $\mu_{\pi,t}$ is 0.14 and the maximum value is 0.7, similar to the range of values for the U.S. anchoring measure plotted in Figure 1. In contrast, the model versions with constant μ_π (top panels) exhibit much smaller ranges of variation in the rolling inflation statistics.

In the simulation with endogenous indexation, the only time-varying parameter is $\mu_{\pi,t}$. But in U.S. data, the observation of time-varying inflation dynamics is likely due to multitude of factors. These include shifts in monetary policy, changing properties of demand and supply shocks, or other structural changes that influence firms' price-setting behavior.

5.1 Endogenous anchoring effects of model parameters

Endogenous indexation implies that shifts in the value of μ_π can result not only from sampling variation in the persistence of inflation, but also from shifts in any model parameter value that influences the value of the model-implied autocorrelation statistic $Corr(\pi_t, \pi_{t-1})$.

Figure 5 shows the endogenous anchoring effects of shifts in various model parameter values. Parameter values that reduce inflation persistence serve to increase the equilibrium anchoring measure. The top panels of Figure 5 show that a stronger policy response to either inflation or the output gap, as measured by g_π or g_y, each serves to increase the equilibrium anchoring measure. This is because a stronger policy response helps to bring inflation back to target more quickly in response to a shock, thereby reducing inflation persistence.

The bottom left panel of Figure 5 shows that a decrease in the NKPC slope parameter κ, i.e., a flatter Phillips curve, also serves to raise the equilibrium anchoring measure. This is because a flatter Phillips curve reduces the transmission of persistence from the output gap to inflation via the term κy_t in the NKPC (3).

The bottom left panel of Figure 5 shows that improved anchoring can also result from an increase in the value of μ_y which governs the relative weights on $E_t y_{t+1}$ and y_{t-1} in the Euler equation (2). Higher values of μ_y reduce the persistence of the output gap. A less persistent output gap transmits less persistence to inflation via the Phillips curve. In the bottom middle panel, an increase in the Euler equation interest rate parameter α (implying lower risk aversion) serves to reduce inflation persistence and thereby raise the equilibrium anchoring measure, similar to the intuition for an increase in either g_π or g_y.[26]

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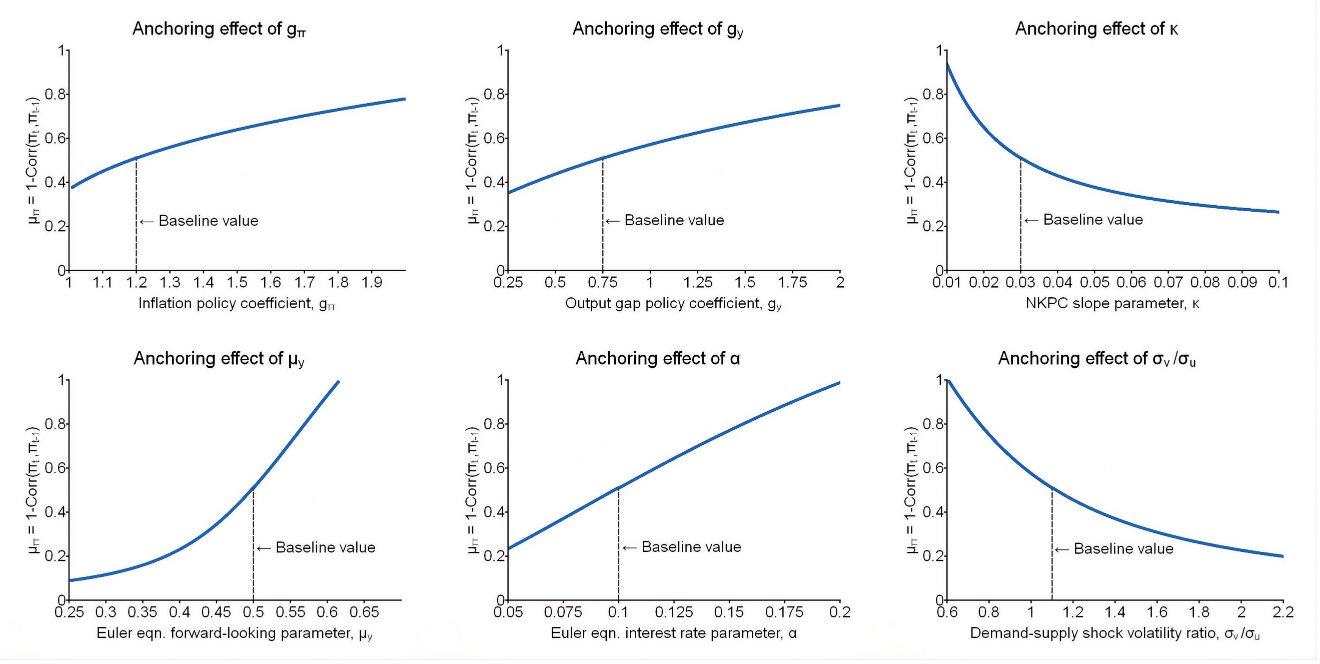
[26] For this exercise, we do not enforce the theoretical link between the value of α and the value of the NKPC slope coefficient κ, as shown in footnote 22. Enforcing this theoretical link would contribute to a higher anchoring measure as α increases.

Figure 5: Endogenous anchoring effects of model parameters



Notes: The figure shows the endogenous anchoring effects of shifts in model parameter values when indexing behavior depends on inflation persistence according to the relationship $\mu_\pi = 1 - Corr(\pi_t, \pi_{t-1})$. A shift in any model parameter value that affects inflation persistence will also influence the equilibrium anchoring measure.

Higher values of σ_v/σ_u imply increased importance of demand shocks which increase inflation persistence via the term κy_t in the NKPC (3). The increase in inflation persistence delivers a weaker anchoring measure (bottom right panel).

While not shown in Figure 5, higher values of the discount factor β have only tiny effects on the equilibrium anchoring measure. Shifts in the value of β influence the values of γ_f and γ_b which are the coefficients applied to $E_t\pi_{t+1}$ and π_{t-1} in the NKPC (3). All else equal, an increase in β serves to decrease γ_b and thereby reduce inflation persistence. But at the same time, the endogenous anchoring effect seeks to raise the value of μ_π, shrinking the term $\beta(1-\mu_\pi)$ that appears in the denominator of γ_b. These effects are approximately offsetting.

If endogenous indexation is indeed present in the U.S. economy, then empirical efforts to identify the source of improved anchoring become more difficult. This is because researchers must control for time variation in any parameter value that could influence firms' indexing behavior. Section 4.1 cites numerous studies that find evidence of time variation in the empirical estimates of most model parameter values. Based on this evidence, it seems likely that observed changes in U.S. inflation behavior have been driven by multiple forces which together have led to improved anchoring of short-run expected inflation.

5.2 Disinflation simulations with endogenous anchoring

In this section, we examine how different paths for the inflation target in disinflation scenarios can influence the equilibrium anchoring measure and economic outcomes when indexing behavior responds to observed inflation persistence.[27] Specifically, we perform a series of disinflation simulations where the model inflation target π_t^* declines to 2% at different speeds, starting from around 8% in 1980.Q1.

To perform the simulations, we first solve for the sequences of demand and cost-push shocks that allow the model to exactly replicate the observed time paths of the CBO output gap and quarterly PCE inflation under the Volcker disinflation. The time series for the model-implied shocks are contingent on the path of the "proxy federal funds rate" constructed by Choi et al. (2022) to summarize the broader stance of monetary policy.[28] In solving for the model-implied shock sequences, we assume that the inflation target π_t^* evolves along the path shown in Figure 1.[29] The model's neutral real rate of interest r_t^* evolves according to the median time series estimate from Lubik and Matthes (2023).[30] The model's time-varying anchoring measure evolves as 1 minus the 20-year rolling autocorrelation statistic for quarterly PCE inflation, as plotted in Figure 1.

Given the model parameter values from Table 1 together with the current values of π_t^* and r_t^*, we use the anchoring measure observed in period $t-1$ to solve the model in each period t. This procedure yields linear expressions for $E_t y_{t+1}$ and $E_t \pi_{t+1}$ in terms of y_t, π_t and $\pi_{av,t}$, as shown in Appendix A. We then substitute these expressions into equations (2) and (3) and solve for the two shock realizations v_t and u_t. For this exercise, i_t is given by the proxy federal funds rate, y_t is the CBO output gap, π_t is quarterly PCE inflation (annualized) and $\pi_{av,t}$ is constructed from U.S. data as $\pi_{av,t} = \omega \pi_t = (1-\omega)\pi_{av,t-1}$ with a starting value equal to

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[27] Wieland (2009) examines how different paths for the inflation target in Chile influence economic outcomes when indexing behavior responds to the observed mean of the inflation distribution.

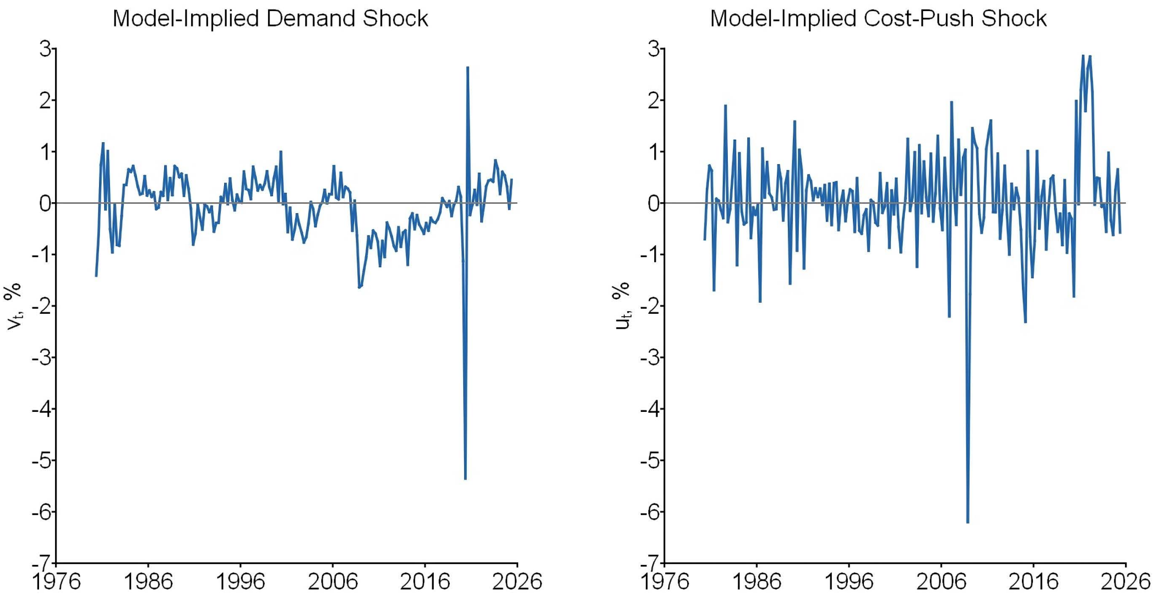
[28] Data for the proxy rate starts in 1976.Q3. Prior to this date, we use the actual federal funds rate.

[29] When the inflation trend is allowed to shift over time, the NKPC derived by Cogley and Sbordonne (2008) includes an additional term involving $E_t \Delta\pi_{t+1}^* - \Delta\pi_t^*$, where π_t^* defines the trend. For this exercise, we neglect the additional term because π_t^* is shifting slowly such that $E_t \Delta\pi_{t+1}^* \simeq \Delta\pi_t^* \simeq 0$.

[30] Data for the Lubik-Matthes r_t^* starts in 1967.Q1. Prior to this date, we assume that r_t^* is equal to the 1967.Q1 value.

4-quarter PCE inflation in 1960.Q1.

Figure 6: Model-implied shock sequences



Notes: We solve for the sequences of demand and cost-push shocks that allow the model to exactly replicate the quarterly time paths of U.S. data, assuming that i_t is given by the proxy federal funds rate from Choi, et al. (2022) and the model's time-varying anchoring parameter $\mu_{\pi,t}$ evolves as 1 minus 20-year rolling autocorrelation statistic for quarterly PCE inflation, as plotted in Figure 1. For this exercise the model inflation target π_t^* evolves according to the path plotted in Figure 1 and the model value of r_t^* evolves according to the updated median time series estimate from Lubik and Matthes (2023).

Figure 6 plots the model-implied sequences for the demand shock v_t and the cost-push shock u_t. The shock sequences begin in 1980.Q2 because the model solution in period t makes use of the U.S. anchoring measure that is computed using the trailing 20-year autocorrelation statistic for quarterly PCE inflation based on data ending in period $t-1$. The first value of the autocorrelation statistic becomes available in 1980.Q1. In solving for the shock sequences, we assume that the response coefficients g_π and g_y in the policy rule (4) remain unchanged from 1980.Q2 onward. This assumption is consistent with the findings of Coibion and Gorodnichenko (2011) who estimate a forecast-based Fed policy rule that allows for time-varying response coefficients and time varying values of π_t^* and r_t^*.

For the sample period from 1980.Q2 to 2025.Q2, the mean values of v_t and u_t are -0.08%

and 0.08%. The autocorrelation statistics for v_t and u_t are 0.27 and 0.08, with $Corr(v_t, u_t) = 0.18$. Similar shock statistics are obtained for the sample period starting in 1988.Q1. These results approximate the model's assumptions that the shocks are white noise and uncorrelated with each other. The reason that the model can replicate the U.S. data without the need for persistent shocks is because the model's endogenous variables derive persistence not only from the state variables y_{t-1}, π_{t-1}, and $\pi_{av,t-1}$, but also from the time-varying parameters π_t^*, r_t^* and $\mu_{\pi,t}$.

In the Volcker disinflation, the model inflation target $\pi_{\mathrm{v},t}^*$ follows the path shown in Figure 1. From 1960.Q1 to 1980.Q1, $\pi_{\mathrm{v},t}^*$ is the low frequency trend defined by the Hodrick-Prescott filter with $\lambda = 1600$. From 1980.Q2 onward, $\pi_{\mathrm{v},t}^*$ converges to 2% according to the law of motion $\pi_{\mathrm{v},t}^* = \lambda_{\mathrm{v}}\pi_{\mathrm{v}.t-1}^* + (1 - \lambda_{\mathrm{v}})2\%$ with $\lambda_{\mathrm{v}} = 0.94$. The value of $\pi_{\mathrm{v},t}^*$ reaches 2% in 1999.Q3. As noted in the introduction, the late 1990s is when the anchoring process for *long-run* expected inflation appears to have been completed. To achieve a slower disinflation, the inflation target from 1980.Q2 onward is given by $\pi_{\mathrm{s},t}^* = \pi_{\mathrm{v},t}^* + 0.94(\pi_{\mathrm{s},t-1}^* - \pi_{\mathrm{v},t}^*)$. The value of $\pi_{\mathrm{s},t}^*$ reaches 2% in 2007.Q4. To achieve a faster disinflation, the inflation target from 1980.Q2 onward is given by $\pi_{\mathrm{f},t}^* = \lambda_{\mathrm{f}}\pi_{\mathrm{f}.t-1}^* + (1 - \lambda_{\mathrm{f}})2\%$ with $\lambda_{\mathrm{f}} = 0.88$. The value of $\pi_{\mathrm{f},t}^*$ reaches 2% in 1989.Q3. The three disinflation paths are plotted in the top left panel of Figure 7.

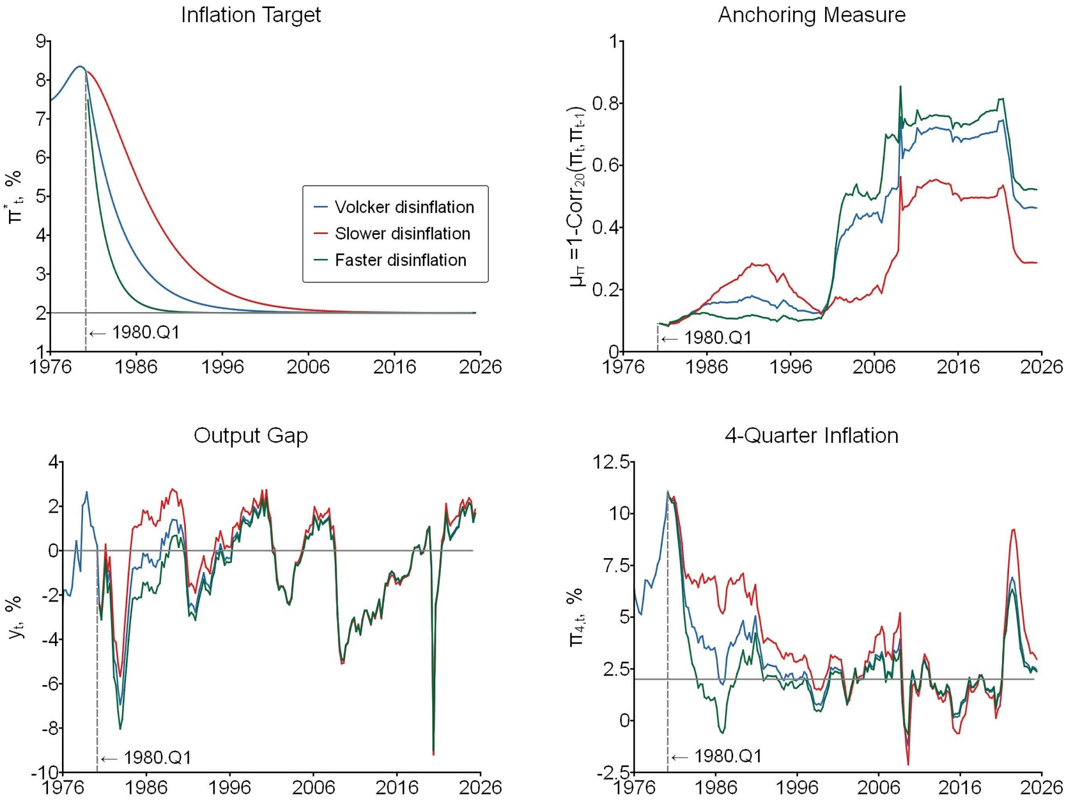
For all three disinflation paths, the starting value of the inflation target in 1980.Q1 is 8.23%, together with $r_t^* = 1.59\%$, and $\mu_{\pi,t} = 0.09$. From 1980.Q2 onward, the value of $\mu_{\pi,t}$ evolves endogenously as given by $\mu_{\pi,t} = 1 - Corr_{20}(\pi_t, \pi_{t-1})$, where $Corr_{20}(\pi_t, \pi_{t-1})$ is the trailing 20-year rolling autocorrelation statistic generated by the model using simulated data ending in period $t-1$. For the Volcker disinflation, this procedure exactly replicates the path of the U.S. anchoring measure plotted in Figure 1 and the paths of the CBO output gap and quarterly PCE inflation. For the other two disinflations, the paths of the model variables diverge from U.S. data. Each simulation ends in 2025.Q2, representing a 46 year counterfactual exercise.

We use a simple loss function to quantify the effects of each disinflation scenario on economic welfare. The loss function takes the form

$$Loss \;=\; \sqrt{E[(\pi_{4,t} - \pi_t^*)^2 \;+\; y_t^2]}, \tag{11}$$

where π_t^* is either $\pi_{\mathrm{v},t}^*$, $\pi_{\mathrm{s},t}^*$, or $\pi_{\mathrm{f},t}^*$ and $\pi_{4,t} = [\Pi_{j=0}^{3}(1+\pi_{t-j})]^{0.25} - 1$. The unconditional mean operator E is computed using simulated data from 1980.Q2 through 2025.Q2. The results of the disinflation simulations are shown in Figure 7 and Table 4.

Figure 7: Disinflation simulations with endogenous anchoring



Notes: The figure shows the history dependence of the model's equilibrium anchoring measure $\mu_{\pi,t}$ under three disinflation simulations. In the Volcker disinflation, the model inflation target π_t^* declines along the path shown in Figure 1. Conditional on the same shocks and the same policy rate path, a slower disinflation (red line) mitigates output losses in 1982 but delivers a weaker anchoring measure over subsequent decades (top right panel). A faster disinflation (blue or green lines) produces a more severe recession trough in 1982, but leads to a stronger anchoring measure in subsequent decades, rendering inflation more resilient to subsequent shocks, such as those that arrive during the Great Recession and the pandemic era.

The top right panel of Figure 7 illustrates the history dependence of the equilibrium anchoring measure $\mu_{\pi,t}$. Specifically, the speed of disinflation influences the equilibrium value of $\mu_{\pi,t}$ in subsequent decades. The slower disinflation yields $\mu_{\pi,t} = 0.27$ at the start of the Great Recession in 2007.Q4 and $\mu_{\pi,t} = 0.50$ at the start of the pandemic recession in 2019.Q4. On these same dates, the Volcker disinflation yields the higher values of $\mu_{\pi,t} = 0.51$ and $\mu_{\pi,t} = 0.71$, respectively. The higher values of $\mu_{\pi,t}$ render inflation more resilient to shocks that arrive during the subsequent recessions. At the end of the simulation in 2025.Q2, the anchoring measure under the Volcker disinflation is 0.46. This value is about 60% higher than the corresponding measure of 0.28 under the slower disinflation.

Table 4 shows that the slower disinflation mitigates output losses but delivers a higher loss function value over the full sample. In the slower disinflation, the trough output gap in 1982.Q4 is -5.7% versus -6.9% in the Volcker disinflation. The average value of y_t is -0.26% in the slower disinflation versus -0.76% in the Volcker disinflation. With a slower disinflation, expected inflation remains higher for longer, which serves to lower the path of the model real interest rate, as given by $i_t - E_t\pi_{t+1}$. A lower real interest rate provides support for aggregate demand, yielding a more favorable path for y_t.

Table 4. Model Disinflation Simulations, 1980.Q2 to 2025.Q2

Simulation	Slower disinflation	Volcker disinflation	Faster disinflation
Date of $\pi_t^* = 2\%$	2007.Q4	1999.Q3	1989.Q3
$\mu_{\pi,t}$, 1980.Q2	0.09	0.09	0.09
$\mu_{\pi,t}$, 2007.Q4	0.27	0.51	0.69
$\mu_{\pi,t}$, 2019.Q4	0.50	0.71	0.78
$\mu_{\pi,t}$, 2025.Q2	0.29	0.46	0.52
$\mu_{\pi,t}$, Average	0.28	0.35	0.37
y_t, 1982.Q4	-5.67%	-6.94%	-8.04%
y_t, Average	-0.26%	-0.76%	-1.03%
$\pi_{4,t}$, 2009.Q3	-2.12%	-1.20%	-0.66%
$\pi_{4,t}$, 2022.Q2	9.22%	6.91%	6.33%
$\pi_{4,t}$, 2025.Q2	2.97%	2.44%	2.37%
$\pi_{4,t}$, Average	3.71%	2.81%	2.31%
Loss value	4.99	4.02	3.75
Δ *Loss* value	+24.2%	0%	-6.66%

Notes: *Loss* is computed using equation (11) with π_t^* given by the paths shown in the top left panel of Figure 7. Δ *Loss* is the percent deviation from the *Loss* value in the Volcker disinflation.

As the simulations proceed into the Great Recession, the trough inflation rate in 2009.Q3 is -2.1% in the slower inflation versus -1.2% in the Volcker disinflation. During the pandemic era, the peak inflation rate in 2022.Q2 is 9.2% in the slower disinflation versus 6.9% in the Volcker disinflation. Under the fastest disinflation scenario, the peak inflation rate in 2022.Q2 is 6.3%. The same sequence of pandemic era shocks produces a higher peak inflation rate under the slower disinflation because of the weaker anchoring measure $\mu_{\pi,t}$ in 2019.Q4. The anchoring measure then becomes even weaker as inflation rises persistently above 2%.[31]

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[31] Along similar lines, Erceg, Lindé, and Trabandt (2024) show that endogenous indexation serves to magnify the impact of inflationary shocks in a model with a nonlinear Phillips curve.

Going from left to right in Table 4, as the speed of disinflation increases, both the average value of $\pi_{4,t}$ and the ending value of $\pi_{4,t}$ in 2025.Q2 become closer to 2%, while the full sample loss value declines. In the slower disinflation, the loss value is 24% higher than the loss in the Volcker disinflation.

The disinflation simulations yield two important takeaways: First, due to the history dependence of the equilibrium anchoring measure, the relatively rapid disinflation that occurred under Volcker delivered long-lasting economic benefits. Second, endogenous indexation raises the perils of allowing inflation to depart persistently from the inflation target because it can open the door to equilibria with weaker anchoring of short-run expected inflation, making inflation less resilient to subsequent shocks.

Finally, Figure 8 plots the model predicted path for 4-quarter ahead expected average inflation $E_t \pi_{av,t+4}$ under the Volcker disinflation versus two survey-based measures of expected inflation. Recall that average inflation $\pi_{av,t}$ from equation (5) approximates the 4-quarter inflation rate, so $E_t \pi_{av,t+4} \simeq E_t \pi_{4,t+4}$ corresponds to the 1-year ahead forecast for the central bank's goal variable. This forecast is less sensitive to movements in model inflation than the 1-quarter ahead forecast for quarterly inflation $E_t \pi_{t+1}$ which is linked to the model's anchoring measure via equation (1). From 1980 to 1990, the model path for $E_t \pi_{av,t+4}$ closely tracks 1-year ahead expected inflation from the University of Michigan Survey. From the late 1990s onward, the model path closely tracks 1-year ahead expected inflation from the Survey of Professional Forecasters (SPF).[32] In between, the model path lies below both survey measures, suggesting that survey respondents had imperfect knowledge of π^*. Indeed, Jørgensen and Lansing (2025b) employ an imperfect information model to show that full knowledge of π^* appears to have been established in the late 1990s.

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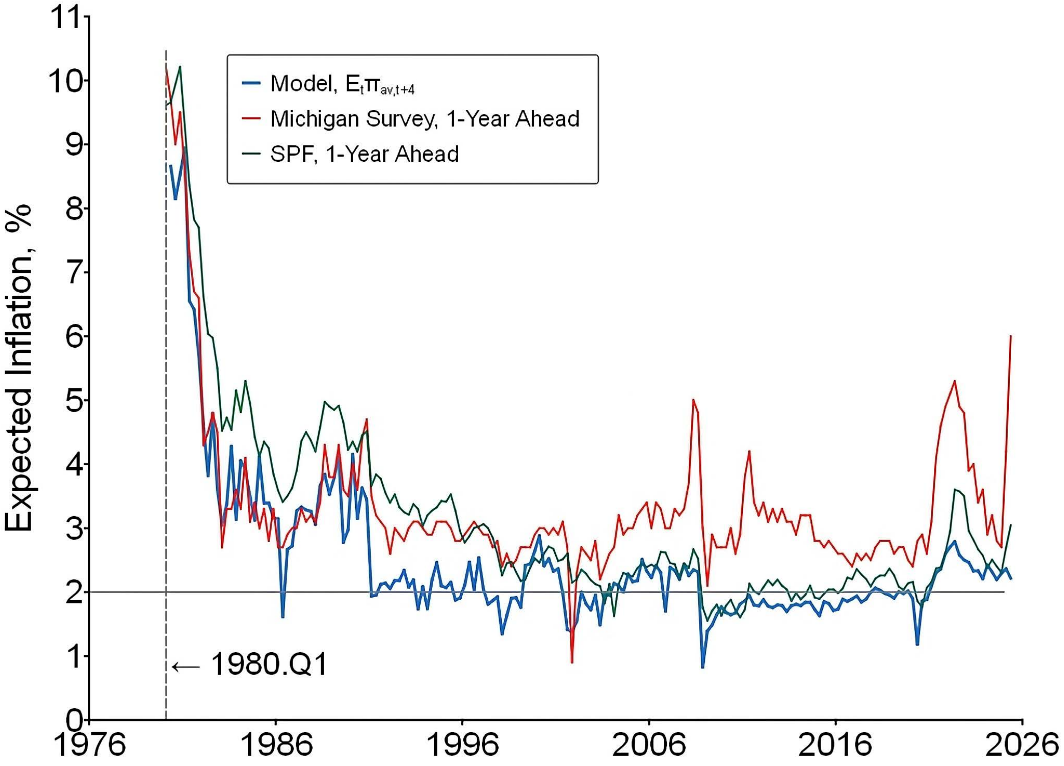
[32] The end-of-sample upward spikes in the survey measures appear to be driven by tariff-related price uncertainty that is concentrated in a subset of survey respondents. See Andrade and Wicklein (2025) and Cline and Rich (2026).

Figure 8: Expected inflation: Model versus survey data



Notes: The figure plots the model predicted path for $E_t\pi_{av,t+4} \simeq E_t\pi_{4,t+4}$ under the Volcker disinflation versus two survey-based measures of expected inflation. From 1980 to 1990, the model path closely tracks 1-year ahead expected inflation from the University of Michigan Survey. From the late 1990s onward, the model path closely tracks 1-year ahead expected inflation from the Survey of Professional Forecasters (SPF). In between, the model path lies below both survey measures, suggesting that survey respondents had imperfect knowledge of π^*.

6 Conclusion

The post-pandemic surge in U.S. inflation that peaked in mid-2022 has since receded back towards 2%. Ten consecutive Federal Open Market Committee (FOMC) statements from September 2020 through November 2021 stated that "longer-term inflation expectations remain well anchored at 2 percent." These statements appear to reflect a lesson taken from the Great Inflation. At the peak of the Great Inflation, Fed Chair Paul Volcker (1979) emphasized the importance of inflation expectations as a driving force for inflation. He stated (pp.

888–889): “Inflation feeds in part on itself, so part of the job of returning to a more stable and more productive economy must be to break the grip of inflationary expectations.” It is worth noting, however, that Volcker’s statement does not distinguish between short-run versus long-run inflation expectations.

The fact that long-run expected inflation remained well anchored through November 2021 attests to the credibility that the Federal Reserve had built up over the previous four decades. After November 2021, the FOMC stopped describing inflation developments as “largely reflecting transitory factors” or “factors that are expected to be transitory.” And indeed, both short-run and long-run inflation expectations began drifting up thereafter, but more so at shorter forecast horizons (Guerrieri, et al. 2023, Bernanke and Blanchard 2025).

It is widely acknowledged that maintaining well-anchored long-run inflation expectations is crucial for the success of an inflation targeting central bank. But according to the standard New Keynesian Phillips curve, it is *short-run* expected inflation that influences movements in inflation. If the structural slope of the NKPC is relatively flat as suggested by many empirical studies, then short-run expected inflation can become the primary driver of inflation.

Following Jørgensen and Lansing (2025a), we employ a simple anchoring measure for short-run expected inflation using a standard New Keynesian model with full-information rational expectations. The anchoring measure is the fraction of non-reoptimizing firms that index prices to the inflation target, rather than lagged inflation. Numerous empirical studies show that economic agents adjust their behavior or forecasts in response to recent observations about inflation. Based on this idea, we extend the model of Jørgensen and Lansing (2025a) to endogenize the anchoring measure in a manner suggested by the model itself. Specifically, the endogenous anchoring measure is given by 1 minus the model-implied autocorrelation statistic for quarterly inflation. The model-implied autocorrelation statistic $Corr(\pi_t, \pi_{t-1})$ is exactly equal to the slope coefficient obtained by regressing the one-quarter-ahead inflation forecast on actual inflation, as given by $Cov(E_t\pi_{t+1}, \pi_t)/Var(\pi_t)$.

With endogenous indexation, the model exhibits a unique rational expectations equilibrium but there is also a continuum of near-rational equilibria with anchoring measures that lie above or below the equilibrium value. These near-rational equilibria are close to self-fulfilling when the NKPC is very flat. The model’s equilibrium anchoring measure exhibits history dependence as it responds to sampling variation in the autocorrelation statistic for quarterly inflation. We show that the model can generate a scatter plot of 20-year rolling persistence and volatility measures that approximates the convex pattern observed in quarterly U.S. data.

To further illustrate the idea of history dependence, we perform a series of disinflation simulations where the model inflation target declines to 2% at different speeds, starting from around 8% in 1980.Q1. The relatively rapid disinflation that occurred under Volcker delivers a stronger anchoring measure in subsequent decades relative to a counterfactual simulation where the inflation target declines more slowly. According to the model, Volcker's rapid disinflation bestowed future policymakers with a valuable asset: An economy with more resilience to future shocks that can affect inflation. But the same model contains a cautionary lesson. Episodes that cause inflation to depart persistently from the inflation target can open the door to equilibria with a weaker anchoring measure, making inflation less resilient to shocks and requiring a stronger and longer-lasting policy response to bring inflation back to target.

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A Appendix: Model solution with constant π_t^*, r_t^*, and $\mu_{\pi,t}$.

This appendix provides details of the model solution when π_t^*, r_t^*, and $\mu_{\pi,t}$ are constants, denoted by the parameters π^*, r^*, and μ_π, respectively. Given the linearity of the model, the rational decision rules for y_t, π_t, and $\pi_{av,t}$ are unique linear functions of the state variables y_{t-1}, π_{t-1}, $\pi_{av,t-1}$, ν_t, u_t, and ε_t.

Starting from the definition of average inflation $\pi_{av,t} \equiv \omega\pi_t + (1-\omega)\,\pi_{av,t-1}$ we have

$$E_t\pi_{av,t+1} - \pi^* = \omega\left(E_t\pi_{t+1} - \pi^*\right) + \omega\left(1-\omega\right)\left(\pi_t - \pi^*\right) + \left(1-\omega\right)^2\left(\pi_{av,t-1} - \pi^*\right), \tag{A.1}$$

which can be substituted into the policy rule (4) to yield the following expression:

$$\begin{aligned} i_t - E_t\,\pi_{t+1} - r^* \quad &= \quad \left(g_\pi\omega - 1\right)\left(E_t\pi_{t+1} - \pi^*\right) + g_\pi\omega\left(1-\omega\right)\left(\pi_t - \pi^*\right) \\ &\quad +g_\pi\left(1-\omega\right)^2\left(\pi_{av,t-1} - \pi^*\right) + g_y E_t y_{t+1} + \varepsilon_t, \end{aligned} \tag{A.2}$$

which shows that i_t inherits persistence from four different endogenous variables. Equation (A.2) can be substituted into the Euler equation (2) to eliminate i_t. The resulting expression together with the Phillips curve (3) and the law of motion for $\pi_{av,t}$ form a linear system of three equations in the three unknown decision rules for y_t, π_t, and $\pi_{av,t}$. The state variables are y_{t-1}, π_{t-1}, $\pi_{av,t-1}$, v_t, u_t, and ε_t. Standard techniques yield a set of linear decision rules of the form

$$\begin{bmatrix} y_t \\ \pi_t - \pi^* \\ \pi_{av,t} - \pi^* \end{bmatrix} = \mathbf{A}\begin{bmatrix} y_{t-1} \\ \pi_{t-1} - \pi^* \\ \pi_{av,t-1} - \pi^* \end{bmatrix} + \mathbf{B}\begin{bmatrix} v_t \\ u_t \\ \varepsilon_t \end{bmatrix}, \tag{A.3}$$

where $\mathbf{A}$ and $\mathbf{B}$ are 3×3 matrices of decision rule coefficients. The variance-covariance matrix $\mathbf{V}$ of the left-side variables in equation (A.3) can be computed analytically using the formula:

$$vec\left(\mathbf{V}\right) = \left[\mathbf{I} - \mathbf{A} \otimes \mathbf{A}\right]^{-1} vec\left(\mathbf{B\Omega B}^{'}\right), \tag{A.4}$$

where $\mathbf{\Omega}$ is the variance-covariance matrix of the three fundamental shocks v_t, u_t, and ε_t. We use $\mathbf{V}$ and the other model equations to compute the analytical moments of model variables for different values of μ_π, as shown in Table 2 and Figures 2 and 3.

For the parameter values shown in Table 1, the matrices $\mathbf{A}$ and $\mathbf{B}$ are

$$\mathbf{A} = \begin{bmatrix} 0.720 & -0.023 & -0.074 \\ 0.104 & 0.474 & -0.022 \\ 0.048 & 0.220 & 0.526 \end{bmatrix}, \qquad \mathbf{B} = \begin{bmatrix} 1.441 & -0.070 & -0.143 \\ 0.208 & 1.440 & -0.021 \\ 0.096 & 0.668 & -0.010 \end{bmatrix}. \tag{A.5}$$

Iterating the linear decision rules in equation (A.3) ahead one period and then taking the conditional expectation of both sides yields the following rational forecast rules:

$$E_t y_{t+1} = \mathbf{A}_{11} y_t + \mathbf{A}_{12} \left(\pi_t - \pi^*\right) + \mathbf{A}_{13} \left(\pi_{av,t} - \pi^*\right), \tag{A.6}$$

$$E_t \pi_{t+1} - \pi^* = \mathbf{A}_{21} y_t + \mathbf{A}_{22} \left(\pi_t - \pi^*\right) + \mathbf{A}_{23} \left(\pi_{av,t} - \pi^*\right), \tag{A.7}$$

$$E_t \pi_{av,t+1} - \pi^* = \mathbf{A}_{31} y_t + \mathbf{A}_{32} \left(\pi_t - \pi^*\right) + \mathbf{A}_{33} \left(\pi_{av,t} - \pi^*\right), \tag{A.8}$$

where $\mathbf{A}_{i\,j}$ represents the corresponding element of the matrix $\mathbf{A}$.

From equation (A.3), we have

$$\pi_t - \pi^* = \mathbf{A}_{21} y_{t-1} + \mathbf{A}_{22} \left(\pi_{t-1} - \pi^*\right) + \mathbf{A}_{23} \left(\pi_{av,t-1} - \pi^*\right) + \mathbf{B}_{21} v_t + \mathbf{B}_{22} u_t + \mathbf{B}_{23} \varepsilon_t. \tag{A.9}$$

We can now demonstrate a direct theoretical link between our autocorrelation-based anchoring measure and an alternative anchoring measure that is based on a regression of expected inflation on actual inflation, along the lines of numerous empirical anchoring measures, as noted in the introduction. Equation (A.9) implies

$$Cov(\pi_t, \pi_{t-1}) = \mathbf{A}_{21} Cov(\pi_t, y_t) + \mathbf{A}_{22} Var\left(\pi_t\right) + \mathbf{A}_{23} Cov\left(\pi_t, \pi_{av,t}\right). \tag{A.10}$$

Similarly, from equation (A.7) we have

$$Cov(E_t \pi_{t+1}, \pi_t) = \mathbf{A}_{21} Cov(\pi_t, y_t) + \mathbf{A}_{22} Var\left(\pi_t\right) + \mathbf{A}_{23} Cov\left(\pi_t, \pi_{av,t}\right). \tag{A.11}$$

Comparing equations (A.10) and (A.11) yields the result

$$Corr(\pi_t, \pi_{t-1}) \equiv \frac{Cov(\pi_t, \pi_{t-1})}{Var(\pi_t)} = \frac{Cov(E_t \pi_{t+1}, \pi_t)}{Var(\pi_t)}, \tag{A.12}$$

which shows that $Corr(\pi_t, \pi_{t-1})$ is equal to the slope coefficient obtained by regressing the rational inflation forecast on a constant and π_t.