Inflation Stabilization Under Experience Learning*

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Abstract

An empirical literature documents that having being exposed to episodes of high inflation in the past raises current concerns about inflation, an effect known as experience learning. This note embeds experience learning in a new-Keynesian model and characterizes the costs of inflation stabilization. It shows that if the economy experience an episode of high inflation in the past, achieving the inflation target is more costly in terms of lost output and requires a more hawkish monetary stance relative to rational expectations. It is also shown that although expectations are exclusively shaped by events occurring in the past, the cost of inflation stabilization depends not only on how agents discount the past but also on how they discount the future.

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1 Introduction

A young but growing empirical literature documents that past episodes of high inflation significantly affect current inflation expectations. This phenomenon is known as experience learning. Surprisingly, there is no theoretical work exploring the consequences of experience learning for inflation stabilization. Here, I make a first step toward filling this gap. I embed experience learning into a simple new-Keynesian model and characterize the cost in terms of lost output of achieving a given inflation target relative to the rational expectations bench mark.

Under rational expectations, due to the "divine coincidence" property of the new-Keynesian model, in the absence of cost-push shocks, inflation stabilization and output stabilization go in tandem. In other words, inflation targeting is costless. This ceases to be the case under experience learning. I model experience learning by postulating that agents' memory of past inflationary episodes decay slowly over time and affect current inflation expectations. The central result I derive in this paper is that relative to rational expectations, stabilizing inflation under experience learning in an economy that suffered an inflationary spike in the past entails a transition with negative output gaps and high interest rates. Thus, experience learning increases the cost of inflation targeting relative to rational expectations.

The reason why experience learning raises the cost of price stability for an economy that was subject to an inflationary episode in the past is simple. As is well known, in the new-Keynesian model current inflation equals the expected present discounted value of current and future marginal costs. If a bad past inflationary experience causes agents to expect high marginal costs in the future, then, in order to achieve its inflation target today, the policymaker must over cool the economy, that is,it must induce a sufficiently large negative output gap. In turn, to cool down the economy, the central bank must implement a sufficiently large increase in interest rates.

It is clear from this intuition that both the rate at which agents discount the past and the rate at which they discount the future are important determinants of the cost of achieving

inflation stability under experience learning. The rate at which agents forget past inflationary episodes is important because it governs people's current expectations of future marginal costs. And the standard subjective time discount is important because it is the rate agents use to calculate the present value of the stream of future marginal costs.

As mentioned at the top of this introduction, there is an empirical literature that provides substantial support for the role of past experiences in shaping current expectations, a concept central to experience-based learning. A broad strand of research demonstrates how historical exposure to economic events influences general attitudes and expectations. For instance, Malmendier and Nagel (2011) show that individuals who lived through the Great Depression exhibit lower stock market participation and more pessimistic expectations about future stock returns. Giuliano and Spilimbergo (2023) survey a wide range of studies documenting how macroeconomic shocks affect preferences and beliefs, including political preferences and risk attitudes, with the timing of these shocks being particularly critical. Das et al. (2020) find that individual characteristics such as income and education influence macroeconomic optimism, while D'Acunto, Malmendier, and Weber (2022) highlight demographic factors like gender and race as significant predictors of inflation expectations. Notably, they attribute some of these differences to direct exposure to price signals, such as grocery prices. A narrower subset of studies specifically examines the relationship between past inflationary experiences and current inflation expectations. Using U.S. consumer survey data, Malmendier and Nagel (2016) find that differences in inflation experiences across cohorts predict variations in inflation expectations, . Similarly, Binder and Makridis (2020) show that individuals who experienced the 1970s oil crises maintain a stronger association between rising energy prices and economic downturns. Braggion et al. (2023), using data from the German hyperinflation document how exposure to past inflation episodes results in higher current inflation expectations. Expanding this analysis to both advanced and emerging economies, Magud and Pienknagura (2024) confirm the long-term impact of inflationary episodes on expectations.

The remainder of the note is organized in three sections. Section 2 presents a simple new-Keynesian model and analyzes inflation stabilization under rational expectations. Section 3 introduces experience learning and characterizes the cost of inflation stabilization in this environment. Section 4 discusses policy implications and concludes.

2 The Rational Expectations Benchmark

Consider a three-equation linear new-Keynesian model. The Euler equation is of the form

$$y_t = E_t y_{t+1} - \frac{1}{\sigma}(i_t - E_t \pi_{t+1}), \tag{1}$$

where π_t is the deviation of inflation from the intended target, y_t is the output gap, i_t is the nominal interest rate expressed in deviation from its steady-state level, and E_t is the expectation operator conditional on relevant information in period t (which will depend on the expectation model being considered). The parameter $\sigma > 0$ is the intertemporal elasticity of consumption substitution. The Euler equation says that output growth is decreasing in the expected real interest rate.

The Phillips curve takes the form

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t, \tag{2}$$

where $\beta \in (0, 1)$ is the subjective discount factor and $\kappa > 0$ is a parameter that is decreasing in the degree of price stickiness. The fact that in the Phillips curve current inflation depends not only on the current output gap but also on people's expectations about future inflation will play a central role in determining the cost of inflation stabilization under alternative assumptions about how expectations are formed.

I assume that the central bank implements strict inflation targeting, so that

$$\pi_t = 0 \tag{3}$$

for all $t \geq 0$. I assume that the central bank can commit to maintaining this policy over time. The question I wish to address is how costly it to implement this policy in terms of the output gap y_t and what does it imply for the level of the policy rate i_t. This completes the presentation of the three-equation new-Keynesian model.

Under rational expectations, the fact that $\pi_t = 0$ for all t implies that the conditional expectation of inflation must also be zero, $E_t\pi_{t+1}$. Plugging $\pi_t = E_t\pi_{t+1} = 0$ in the Phillips curve (2) yields

$$y_t = 0$$

for all t. Thus, under rational expectations it is costless to fully stabilize inflation. This is a well known result sometimes referred to as the"divine coincidence:" in the absence of cost-push shocks, the rational expectations solution of the new-Keynesian model implies that inflation stabilization goes in tandem with output stabilization.

Consider now the equilibrium path of the nominal interest rate that supports this outcome. Using $y_t = E_t y_{t+1} = E_t\pi_{t+1} = 0$, we can solve the Euler equation (1) for the equilibrium interest rate, to get

$$i_t = 0,$$

for all t, which says that to achieve price and output stability, the government does not need to deviate the policy rate from its steady-state value. In other words, macroeconomic stabilization is not associated with a particularly dovish or hawkish monetary policy. As we will see next, this will cease to be the case under experience learning.

3 Stabilization Under Experience Learning

I model experience learning by assuming that if the economy suffered high inflation in the past, denoted $\pi^H > 0$, then inflationary expectations evolve over time according to the expression

$$E_t\pi_{t+1} = \pi^H\lambda^t. \tag{4}$$

Here, the inflationary episode occurs in period 0, and the parameter $\lambda \in (0, 1)$ denotes the rate of decay of the inflationary memory. The formulation with memory depreciation is in line with empirical studies that document "recency bias" in experience learning (Malmendier and Nagel, 2016; Magud and Penknagura, 2024).

Let's now address the same question we answered in the economy with rational expectations, namely, how costly is it to stabilize the rate of inflation and what is the path of the policy rate consistent with this goal. Using $\pi_t = 0$ and $E_t\pi_{t+1} = \pi^H\lambda^t$ to eliminate π_t and $E_t\pi_{t+1}$ from the Phillips curve (2), we see immediately that

$$y_t = -\frac{\beta\pi^H}{\kappa}\lambda^t \tag{5}$$

This expression reveals that experience learning imposes costs on inflation stabilization. Specifically, the output gap becomes negative for as long as the memory of a bad inflationary episode persists. The intuition behind this result is straightforward. In the New Keynesian framework, the current deviation of inflation from target equals the present discounted value of current and future marginal costs. If a prior inflationary experience leads people to believe that marginal costs will remain high in the future, the central bank must preemptively cool the economy to prevent inflation in the present. This requires inducing a negative output gap. The cost in terms of lost output depends on several factors: (a) The severity of the past inflationary exposure (π^H), with larger exposures amplifying the cost. (b) The recency of the exposure (smaller t), as more recent episodes weigh more heavily on expectations. (c) The degree of price stickiness (smaller κ), with stickier prices exacerbating the output

loss. (d) The persistence of the memory of the exposure (larger λ), which prolongs the economic effects of inflationary history. And (e) the subjective discount factor: Even though experience learning looks back, the magnitude of the cost of inflation the cost of stabilization depends not only on the rate at which people discount the past, λ, but also on the rate at which people discount the future, β. This is because the former determines the expected size of marginal costs in the future, while the latter deermines their present value.

How does experience learning affect monetary Policy? To calculate the path of the nominal interest rate i_t consistent with strict inflation targeting, substitute in the Euler equation (1) the values of of y_t, $E_t y_{t+1}$, and $E_t \pi_{t+1}$ implied by equations (4) and (5). This gives

$$i_t = \left[1 + \frac{\beta\sigma}{\kappa}(1-\lambda)\right] \pi^H \lambda^t.$$

The nominal interest rate is above its steady-state level throughout the transition. Thus, under experience learning, inflation stabilization requires a more hawkish monetary policy stance relative to rational expectations if inflation is to be stabilized. The required tightening is more severe the larger the inflation exposure, π^H, the stickier prices are (the smaller κ is), and the more risk averse agents are (the higher σ is).

4 Discussion and Conclusion

Experience learning has significant policy implications. Broadly speaking, it highlights the need for policymakers to recognize that an inflation spike can hinder future efforts to stabilize the economy.

Consider fiscal policy during the Covid-19 pandemic. Much of the policy debate surrounding the economic contraction caused by the pandemic centered on the fear of a double-dip recession. A guiding principle of fiscal policy during this crisis was, "When in doubt, keep stimulating." This rationale arguably underpinned the large stimulus packages implemented at the time (e.g., the American Rescue Plan [ARP] at $1.9 trillion and the Infrastructure Investment and Jobs A

trillion). Experience learning adds another dimension to this debate: the risk of an inflationary spike that could constrain the central banks ability to maintain price stability in the future. Viewed through this lens, it is legitimate to question whether the extent of economic stimulus went too far.

The key lesson for monetary policy derived from the possibility that people learn through experience is the necessity for the monetary authority to act swiftly during inflationary episodes. Again, the pandemic provides a telling example. At the time, the Federal Reserve introduced the concept of price averaging, which allowed for some quarters of above-target inflation because prior inflation had been below target. In essence, the Fed relied on inflation credit points accumulated in the past. This approach delayed monetary tightening until March 2022, despite clear signs by mid-2021–recognized by many in academic and policy circles–that inflation was becoming unmanageable. Experience learning provides an additional rationale to those who argue that the Fed waited too long to intervene, because it implies that the post-COVID inflation spike was not only harmful in the immediate term but also had long-lasting effects, as inflation memory raises the cost of achieving future price stability.

under experience learning, an inflationary spike can also have political-economic consequences. For instance, a plausible factor in the Democratic Partys loss of the White House, Congress, and Senate in the 2024 election was the lingering memory of the 2021 inflation spike, despite the fact that subsequently and before the end of the Biden administration inflation returned to near-target levels (2.7 percent) and the economy operated at full employment (unemployment rate of 3.7 percent). Experience learning provides a justification to those who wonder how many election losses the Democratic Party might need to endure before this inflation memory fades.

There are a number of extensions worth pursuing. The present analysis has focused on strict inflation targeting. Future research could explore optimal monetary and fiscal policies under experience learning within the framework presented here. Additionally, in the current

analysis, the inflation spike was treated as exogenous. In a stochastic environment, it would be valuable to endogenize this variable and examine its implications further.

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