Monetary Policy without an Anchor*

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Abstract

The risk of inflation expectations "de-anchoring" is often cited by policymakers as a key justification for aggressive responses to inflationary shocks. We develop a model to analyze the trade-offs central banks face in such situations, and to quantify the economic benefits of stable inflation expectations. We consider a New Keynesian economy in which households and firms are imperfectly informed about the central banker's objective function, and they learn about it from monetary policy decisions. Recognizing this interaction, the central bank has an incentive to raise interest rates more aggressively after adverse supply shocks, trading off short-run economic costs with more stable inflation expectations going forward. We show that the strength of this mechanism depends on how sensitive long-run inflation expectations are to interest rate changes, and we use high-frequency methods to estimate these elasticities for a group of emerging and advanced economies. When fit to Brazilian data, our model predicts that the swift response to the inflationary shocks of 2021 led to large reputation gains for the central bank and to a sizable improvement in its inflation-output trade-off.

Keywords: De-anchoring of inflation expectations, reputation, optimal policy

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1 Introduction

Large inflation spikes, such as those seen after the pandemic, can shape the private sector's perception of monetary policy institutions and their commitment to maintaining price stability. Doubts about this commitment can further exacerbate inflationary pressures, as elevated inflation expectations often lead firms to preemptively raise prices. The risk of long-run inflation expectations "de-anchoring" is frequently cited by policymakers as a key reason for decisive action against inflationary shocks. For instance, during the post-pandemic inflation surge, these concerns were central to the Brazilian central bank's decision to raise interest rates in March 2021—more than a year before similar moves in advanced economies like the U.S. and the euro area. To what extent did de-anchoring risk shape the monetary policy response of countries like Brazil? How much "reputation" did the central bank build by acting swiftly, and how does this accumulated reputation enhance inflation management in the future?

In this paper, we study these questions by analyzing monetary policy determination within a macroeconomic model that incorporates the risk of de-anchoring of inflation expectations. We consider a baseline New Keynesian economy in which households and firms are imperfectly informed about the central banker's objective function. In this setting, the central bank chooses its policy without commitment and the private sector infers the central banker's type based on its policy actions. The more the private sector perceives the central banker as a "Hawk"—i.e., one primarily focused on controlling inflation—the more stable long-run inflation expectations become. Understanding this dynamic, the central bank has an incentive to respond more aggressively to adverse supply shocks, using interest rate hikes to reinforce its hawkish reputation. While this strategy imposes short-run economic costs, including a deeper recession than would occur under perfect information, it improves the inflation-output trade-off over time by making inflation expectations more anchored and less sensitive to future shocks. To quantify these effects, we apply our model to Brazil, measuring the reputation gains accumulated during the post-pandemic recovery and assessing the macroeconomic benefits of improved credibility in monetary policy.

We consider a standard New Keynesian model of the business cycle. Firms' optimal pricing decisions follow a canonical Phillips curve, while households' consumption choices are governed by an Euler equation. The monetary authority sets nominal interest rates under discretion to minimize a loss function. The central banker can be one of two types: a *"Hawk"* and a *"Dove"* with the former placing greater emphasis on inflation stabilization and has a lower inflation target. Households and firms do not observe the exact parameters of the central bank's loss function and must infer the policymaker's type using all

available information, updating their beliefs through Bayes' rule. The economy is subject to three types of shocks: supply shocks (which shift the Phillips curve), demand shocks (which affect the Euler equation), and monetary shocks (transitory disturbances to the loss function).

To build intuition, we begin by analyzing a simplified, analytically tractable version of the model. Under perfect information about the policymaker's type, optimal monetary policy is governed by a static trade-off between inflation and output stabilization. This trade-off is relevant only in response to supply shocks, as demand shocks can be perfectly stabilized by adjusting interest rates to simultaneously set inflation and output at their targets. In the presence of a supply shock, the central bank raises interest rates to lower output, mitigating the inflationary effects of the shock. The strength of this policy response depends on the central bank's preferences—specifically, the weight it places on inflation relative to output stabilization in its loss function—and on the sensitivity of inflation to changes in the output gap, as determined by the slope of the Phillips curve.

Under imperfect information, the monetary authority must also account for how its interest rate decisions influence the private sector's inference process. When an inflationary supply shock occurs, a more aggressive interest rate hike signals a stronger commitment to inflation stabilization, leading the private sector to update its beliefs toward facing a hawkish policymaker. This belief revision reduces inflation expectations, which in turn helps stabilize current inflation through the Phillips curve. Due to this reputation channel, the optimal monetary policy response to an inflationary supply shock is more restrictive than in the perfect information case. The gap between the two policies—the *reputation wedge*—is larger when inflation expectations are highly responsive to changes in the policy rate. The sensitivity of inflation expectations, in turn, depends on key parameters governing the learning process and is highly state-dependent. For example, it is close to zero when the private sector holds dogmatic priors or when demand shocks dominate the economy.

This tight relationship between the strength of reputational forces and the sensitivity of inflation expectations also characterizes the optimal policy in the infinite horizon model. At the optimum, the central bank deviates from the optimal policy prescribed under perfect information only when its actions affect inflation expectations going forward. Following an inflationary supply shock, for example, the central bank will respond with a more restrictive monetary policy relative to what it would have done under perfect information as long as higher interest rates increase its reputation and reduce the present discounted value of future inflation expectations. This intuitive relationship provides a "sufficient statistic" for the importance of reputational considerations for monetary policy decisions, as they relate something inherently unobservable—the wedge in behavior *vis a vis* the perfect informa-

tion benchmark—to the sensitivity of *long-run* inflation expectations to changes in interest rates, which we can estimate.

We then estimate these elasticities for a group of emerging and advanced economies. We use yields on nominal and inflation-protected bonds to construct high frequency inflation expectations measures at different forward horizons. To validate our results, we also incorporate survey-based inflation expectations from professional forecasters, which are available for many countries at a monthly frequency. To quantify the sensitivity of long-run inflation expectations to monetary policy shocks, we regress innovations in the policy rate—measured around central bank meeting windows—on various indicators of inflation expectations. Our findings reveal substantial cross-country heterogeneity. In advanced economies like the U.S. and the Euro area, long-run inflation expectations are highly anchored, with estimated sensitivities that are not statistically different from zero when looking at forecasting horizons five years out. In contrast, in countries such as Brazil and Turkey, long-run inflation expectations are much more responsive to monetary policy surprises. For instance, in Brazil, an unexpected 100-basis-point increase in the Selic rate is associated with a 0.40 percentage point decline in the five years-5 years market-based expected inflation, and a 0.15 percentage point reduction in survey-based expectations.

Finally, we use the model to analyze the dynamics of central bank reputation in Brazil during the post-pandemic inflationary episode and its macroeconomic implications. We discipline the parameters that govern the learning process and the central bank's objective function by targeting the estimated elasticity of long-run inflation expectations to monetary policy shocks and we calibrate the remaining parameters by matching standard targets. We then use the calibrated model, along with data on inflation, output and nominal interest rates, to filter out the sequence of economic shocks affecting the country and to measure the model implied path of reputation—the private sector perception of the central banker being the Hawk—during this episode. To understand the importance of the reputation channel, we compare this path to counterfactual paths in which interest rates are set by a myopic monetary authority that doesn't internalize the reputational benefits of its actions. We find that the Brazilian central bank had a significantly more restrictive policy relative to this benchmark, with the output gap being on average 1.5% lower over the episode than in the counterfactual scenario. This increased reputation by 20%, and the implied reputation gains led to 1% lower inflation at peak, and to an improved inflation-output trade-off going forward—with the standard deviation of output gap and inflation declining, respectively, by 8% and 6%.

Related literature: [**Incomplete**] Our model contributes to a large literature that studies

reputation building and management of private sector expectations in monetary economies. We build on the work of Barro (1986), Backus and Driffill (1985), Lu, King, and Pasten (2016), Kostadinov and Roldán (2024), de Aguilar (2024). In all these policy games, as in the classic work by Rogoff (1985), having a reputation of being a Hawk is beneficial for the central bank because it can either reduce the *inflation bias* coming from the incentive to increase output above the equilibrium level as in Kydland and Prescott (1977) and Barro and Gordon (1983) or allow for a better trade-off between inflation and output in response to markup shocks, the *stabilization bias*.[1] Our model shares all these features.

The main contribution relative to this literature is to show how to use data to discipline the contribution of the reputation channel in shaping the conduct of monetary policy. In this sense, the closest paper to ours is King and Lu (2022) that uses data on inflation expectations to infer the reputation of the central bank using variation in the term structure of inflation expectations. The main departure from their work is that we use high frequency methods to study how inflation expectations at different horizons change in response to a surprise in interest rates.[2] We believe this is an important distinction: the time path of inflation expectations is endogenous to a given set of policy enacted by the central bank; our elasticity, instead, provides a local measure of how inflation expectations would change if the central bank adopted a different policy. As we show in our paper, this latter statistic is directly informative about the importance of the reputation channel and about the de-anchoring risk faced by policymakers faces when considering alternative policy choices.

Carvalho, Eusepi, Moench, and Preston (2023) and Gati (2023) embed adaptive learning about the long-run mean of inflation into a New Keynesian framework to capture anchored versus unanchored long-run inflation expectations and measure the strength of this channel from survey data. In contrast, we model the anchoring process through Bayesian learning about the central bank's type and use high frequency data to measure the size of the reputation channel.

Werning (2022) studies the effect of expected inflation on current inflation from a different angle. He notices that standard measures empirical measures fail at isolating the true pass-through of expected inflation on current inflation due to the equilibrium relationships between expected inflation and real marginal cost. Deviating from rational expectations—or any other mechanism of expectation formation—he isolates the role of inflation expectations in a wide class of pricing models. In our paper, the effect of reputation on current

[1] Afrouzi, Halac, Rogoff, and Yared (2023) study the Markov Perfect Equilibrium in a New Keynesian model with a dynamic Phillips curve and full information and show that it delivers an inflation bias because of the presence of markups that are not undue by wage subsidies (as typically assumed in the New-Keynesian literature).

[2] Morelli and Moretti (2023) also use a high-frequency identification strategy to quantify the contribution of reputation in the context of a sovereign default model.

inflation comes from how reputation changes expected future inflation and output.

Our empirical strategy is related to a large literature that uses high-frequency methods to estimate the expected impact of monetary policy shocks – and other macroeconomic news – on interest rates, expected inflation, and other variables (see Cook and Hahn (1989), Kuttner (2001) and Cochrane and Piazzesi (2002), among many others). The results for market-based measures of long-horizon inflation expectations, which we have a particular interest in, have been mixed. In early work, pre-dating the availability of TIPS and inflation compensation measures, Gürkaynak, Sack, and Swanson (2005) interprets a significant response of long-horizon nominal forward rates as evidence that monetary policy may have affected the steady state level of inflation (which should equal long-horizon inflation expectations). Another interpretation of the significant response of long-horizon nominal forward rates may also reflect changes in risk premiums (Hanson and Stein, 2015; Kekre, Lenel, and Mainardi, 2024). In work using early TIPS and inflation compensation data, Beechey and Wright (2009) report that monetary policy shocks significantly affect far-forward inflation compensation measures, while Gürkaynak, Levin, and Swanson (2010) find that they do not. Using a more recent sample, Nakamura and Steinsson (2018) report that far-forward inflation compensation measures do not respond significantly to monetary policy shocks. We confirm this result for the US in our analysis.

The results discussed above pertain to U.S. data, whereas our analysis extends to a broader set of economies, including emerging markets. The literature examining the response of far-forward inflation compensation to monetary policy shocks in emerging market economies is much more limited than that focused on advanced economies. De Pooter, Robitaille, Walker, and Zdinak (2014) study inflation anchoring in Brazil, Mexico, and Chile and find that inflation expectations in Brazil appear less well anchored than in Mexico and Chile. That study is relevant to ours because, like us, it uses inflation compensation and survey-based inflation expectations data; however, it draws conclusions about inflation anchoring based on different metrics. Robitaille, Zhang, and Weisberg (2024) update the analysis of De Pooter et al. (2014) with more recent data and reach broadly similar conclusions. Witheridge (2024) also investigates the response of market-based inflation expectations to monetary policy shocks in emerging market economies, but focuses on shorter- to medium-term horizons.[3] Bonomo, Carvalho, Eusepi, Perrupato, Abib, Ayres, and Matos (2024) use

[3]Unlike us, Witheridge (2024) finds that a surprise monetary tightening in Chile and Mexico leads to an increase in break-even inflation, and interprets this result through a model featuring fiscal-monetary interactions. A possible reason for the discrepancy lies in the identification of monetary policy surprises: while Witheridge (2024) relies on changes in the one-year ahead forward premium to measure monetary policy surprises, we use forecast revisions for three-months ahead nominal interest rates. We believe the latter are less contaminated by changes in the expectations of future inflation that may occur around a policy meeting.

the Focus survey for Brazil to show that monetary policy surprises associated with the abrupt policy shift in 2011 had significant effects on long-run inflation expectations.

Relative to these papers, our contribution is to show that these elasticities are directly linked to the monetary authority's incentives to build reputation within a benchmark model of optimal monetary policy. This connection allows us to use the elasticities to discipline the strength of reputation-building motives and to quantify the macroeconomic stabilization benefits of anchoring inflation expectations. This approach builds on our earlier work in Bocola, Dovis, Jørgensen, and Kirpalani (2024), where we combined high-frequency identification with a structural model to assess the macroeconomic implications of changes in the perceived reaction function of the Federal Reserve.

2 Model

2.1 Environment

We consider a standard log-linear New Keynesian economy. The economy is populated by a large number of competitive consumers, a continuum of producers, and a central bank.

The consumers behavior is summarized by an intertemporal Euler equation

$$y_t = -\frac{1}{\sigma}\left[i_t - \mathbb{E}_t \pi_{t+1}\right] + \mathbb{E}_t y_{t+1} + \gamma_t \tag{1}$$

where y_t is final output, i_t is the nominal interest rate, π_t is the inflation rate, $1/\sigma$ is the intertemporal elasticity of substitution and γ_t is a shock to the agent Euler equation, a *demand shock*.

The behavior of monopolistic competitive producers is summarized by the Phillips curve

$$\pi_t = \kappa(y_t + \mu_t) + \beta \mathbb{E}_t \pi_{t+1} \tag{2}$$

where μ_t is a shock to the markup applied by firms, a *supply shock*.

The central bank chooses nominal interest rates to maximize

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t R\left(\pi_t, y_t; \theta_t, \varepsilon_t\right) \tag{3}$$

where $R\left(\pi_t, y_t; \theta_t, \varepsilon_t\right)$ is the period utility function, which depends on inflation, output and the central bank preferences over these two. The central bank preferences depends on two components: a persistent preference shock θ_t and an i.i.d. disturbance ε_t. We will refer to

θ_t as the central bank *type* and assume that it can take on two values, $\theta_t \in \{\theta_D, \theta_H\}$ where θ_D stands for *Dove* and θ_H for *Hawk* with $\theta_H > \theta_D$. An hawkish central bank for example may care more about inflation stabilization relative to output stabilization than a dovish central bank.

In the analytical analysis that follows, we will consider the following specification of the R function,

$$R(\pi_t, y_t; \alpha_t) = -\frac{1}{2}\left[\alpha_t \pi_t^2 + (1-\alpha_t) y_t^2\right] \tag{4}$$

and the weight on inflation is

$$\alpha_t = \alpha(\theta_t, \varepsilon_t) \tag{5}$$

with α being a strictly increasing function with range $[0,1]$. Thus, for any realization of ε_t the weight on inflation stabilization is higher for the hawkish central bank than the dove, $\alpha(\theta_H, \varepsilon_t) > \alpha(\theta_D, \varepsilon)$ for all ε.

The type of the central bank is private information and private agents learn about the central bank's type over time by observing its action. The presence of the i.i.d. shock ε_t will ensure that actions do not fully reveal the central bank's type.[4] We denote by ρ_t the *reputation* of the central bank, which is defined as the probability that private agents assign to facing the hawkish central bank. The initial level of reputation common to all private agents is ρ_0.

2.2 Markov Perfect Equilibrium

Let $h^{t-1} = (s_0, x_0, s_1, x_1, ..., s_{t-1}, x_{t-1})$ be the public history of shocks that are public information, $s_t = (\gamma_t, \mu_t)$, and outcomes $x_t = (i_t, y_t, \pi_t)$. The timing is as follows: in each period t, the central bank acts first and chooses the interest rate i_t to maximize (3) given their private history $\left(h^{t-1}, s_t, \theta_t, \varepsilon_r\right)$, then private agents simultaneously choose y_t and π_t according to (1) and (2) given the public history $\left(h^{t-1}, s_t, i_t\right)$.

We focus on *Markov perfect equilibria* where the public history h^{t-1} is summarized by the prior of facing the Hawkish central bank ρ_t. We assume that s_t follows a Markov process $\Gamma(s_{t+1}|s_t)$, that θ_t follows a Markov chain with transition matrix P_θ, and that ε_t is normally distributed. The central bank strategy depends on s_t, its reputation ρ_t at the beginning of the period, and its private information $(\theta_t, \varepsilon_t)$. The equilibrium outcome from competitive agents are instead functions of the exogenous public state s_t, the initial reputation, and the observed nominal interest rate i_t.

[4]The shock ε_t functions similarly to an "implementation" shock, introducing noise that prevents private agents from perfectly observing the government's intended policy.

To minimize the notation, for any function $f(s', \theta', \varepsilon')$ we define the central bank's expectations as $\mathbb{E}^{cb} f(s', \theta', \varepsilon') = \int \int \sum_{\theta'} f(s', \theta', \varepsilon') P_{\theta'\theta} d\Gamma(s'|s) d\Phi(\varepsilon')$ and for the private agents as $\mathbb{E}^{\rho} f(s', \theta', \varepsilon') = \int \int [\rho f(s', \theta_H, \varepsilon') + (1-\rho) f(s', \theta_D, \varepsilon')] d\Gamma(s'|s) d\Phi(\varepsilon')$.

Definition. A Markov perfect equilibrium is a set of strategies $i(s, \rho, \theta, \varepsilon)$, $y(s, \rho, i)$, $\pi(s, \rho, i)$, a value function for the central bank $V(s, \rho, \theta, \varepsilon)$, and a law of motion for reputation such that i) the government's strategy and value function solve

$$V(s, \rho, \theta, \varepsilon) = \max_{i} R(\pi(s, \rho, i), y(s, \rho, i); \alpha(\theta, \varepsilon)) + \beta \mathbb{E}^{cb} V(s', \rho'(s, \theta, i), \theta', \varepsilon') \tag{6}$$

ii) the equilibrium outcomes satisfy (1) and (2) i.e.

$$y(s, \rho, i) = -\frac{1}{\sigma} \left\{ i - \mathbb{E}^{\rho'} \left[\pi(s', \rho'(s, \rho, i), i') \right] \right\} + \mathbb{E}^{\rho'} \left[y(s', \rho'(s, \rho, i), i') \right] + \gamma \tag{7}$$

$$\pi(s, \rho, i) = \kappa [y(s, \rho, i) + \mu] + \beta \mathbb{E}^{\rho'} \pi(s', \rho'(s, \rho, i), i') \tag{8}$$

iii) the law of motion for reputation satisfies Bayes' rule whenever possible i.e. for all $i \in \text{range}(i(s, \rho, \theta, \cdot))$

$$\rho'(s, \rho, i) = \frac{\rho \Pr(i|\theta_H, s, \rho) P_{HH} + (1-\rho) \Pr(i|\theta_D, s, \rho) P_{DH}}{\rho \Pr(i|\theta_H, s, \rho) + (1-\rho) \Pr(i|\theta_D, s, \rho)} \tag{9}$$

Note that given private agents' strategies, the central bank is effectively choosing the current equilibrium outcome $x = (i, y, \pi)$ to maximize its value subject to the two conditions that characterize private behavior, (7) and (8), and the law of motion for reputation (9). Thus, abstracting from the zero-lower-bound on the nominal interest rate, we can characterize the equilibrium outcome by finding[5] the equilibrium outcomes $\pi(s, \rho, \theta, \varepsilon)$, $y(s, \rho, \theta, \varepsilon)$ and $V(s, \rho, \theta, \varepsilon)$ that solve

$$V(s, \rho, \theta, \varepsilon) = \max_{\pi, y} R(\pi, y; \alpha(\theta, \varepsilon)) + \beta \mathbb{E}^{cb} V(s', \rho', \theta', \varepsilon') \tag{10}$$

subject to

$$\pi = \kappa(y + \mu) + \beta \mathbb{E}^{\rho'} \pi'$$
$$\rho' = p(s, \rho, y)$$

taking as given the law of motion for the central bank's reputation, $p(s, \rho, y)$, and the

[5] If we consider a ZLB constraint, we simply have to add the additional restriction that $i = \mathbb{E}[-\sigma(y' - y) + \pi' | \rho', s] - \sigma\gamma \geq 0$.

evolution of private sector's expected inflation, $\mathbb{E}^{\rho'}\pi'$. In equilibrium, it must be that

$$\mathbb{E}^{\rho'}\pi' = \int\int \left[\rho'\pi\left(s',\rho',\theta_H,\varepsilon'\right) + \left(1-\rho'\right)\pi\left(s',\rho',\theta_D,\varepsilon'\right)\right]\Gamma\left(s'|s\right)d\Phi\left(\varepsilon'\right) \tag{11}$$

and

$$p\left(s,\rho,y\right) = \frac{\rho\phi\left(\varepsilon : y = y\left(s,\rho,\theta_H,\varepsilon\right)\right)P_{HH} + \left(1-\rho\right)\phi\left(\varepsilon : y = y\left(s,\rho,\theta_D,\varepsilon\right)\right)P_{DH}}{\rho\phi\left(\varepsilon : y = y\left(s,\rho,\theta_H,\varepsilon\right)\right) + \left(1-\rho\right)\phi\left(\varepsilon : y = y\left(s,\rho,\theta_D,\varepsilon\right)\right)}, \tag{12}$$

where ϕ is the density of a standard normal random variable. Finding an equilibrium outcome then boils down to finding a set of allocation rules $\{\pi\left(s,\rho,\theta,\varepsilon\right), y\left(s,\rho,\theta,\varepsilon\right)\}$ and a value function that solve (10) and satisfy (11) and (12).

3 The reputation channel

Section 3.1 studies optimal monetary policy in a simplified version of the model. We start by considering the perfect information case. An inflationary supply shock introduces a trade-off between output and inflation, and the monetary authority optimally raises real interest rates to dampen the effects of the shock on prices. This response is stronger the more the central bank prioritizes inflation stabilization and the more effectively it can influence inflation—for example, when the Phillips curve is steeper. In the model with imperfect information, there is an additional motive that governs the monetary policy stance: the private sector learns the central bank type from observed policy choices, which affects future inflation expectations. We show that this feature induces the central bank to take a more hawkish stance in response to supply shocks relative to the economy with perfect information: by earning a reputation of being a hawk, the central bank can keep future inflation expectations "anchored" and this leads to a more favorable trade-off between current output and inflation. We show that this effect is state dependent, and it is large when the private sector is currently uncertain about the central bank's type. In Section 3.2 we derive the optimality condition in the full model and discuss our empirical strategy to quantify the strength of the reputation channel.

3.1 Simplified economy

We consider a simplified version of the economy where uncertainty about the central bank type is resolved after the first period. We assume that s_t and the type of the central bank θ are perfectly persistent. In period 1, the type is unknown and private agents form expec-

tations according to their prior ρ and the observed policy choices of the central bank. We assume that the types are credibly revealed to the private agents in period 2, and that there are no shocks to the preferences of the policymaker from that point onward ($\varepsilon_t = 0$ for all $t \geq 2$).

We solve for the equilibrium allocation going backward in time, first deriving the equilibrium outcome from period 2 onward and then studying the optimal policy problem at date 1.

Long-run under full information The equilibrium outcome from period 2 onward is the equilibrium outcome in a Markov perfect equilibrium with public information and permanent exogenous state s. Abstracting from the ZLB, there exists a unique Markov equilibrium outcome.[6] This outcome solves

$$V_2(s,\theta) = \max_{\pi,y} R(\pi, y, \alpha(\theta,0)) + \beta V_2(s,\theta) \tag{13}$$

subject to the Phillips curve. Thus, the equilibrium (π, y) solves the static first order condition

$$R_\pi \kappa = -R_y \tag{14}$$

and the pricing condition that, using stationarity, can be written as $\pi(1-\beta) = \kappa(y+\mu)$. Using the definition of R in (4), we can solve these two equations that characterize the equilibrium outcome to obtain

$$y_2(s,\theta) = -\frac{\alpha(\theta,0)\kappa^2}{[1-\alpha(\theta,0)](1-\beta)+\alpha(\theta,0)\kappa^2}\mu$$
$$\pi_2(s,\theta) = \frac{[1-\alpha(\theta,0)]\kappa}{[1-\alpha(\theta,0)](1-\beta)+\alpha(\theta,0)\kappa^2}\mu.$$

After a positive markup shock, the monetary authority increases real interest rates and induces a fall in output, which mitigates the effect of the shock on inflation. This policy response is stronger the greater the weight the policy maker has on inflation stabilization (larger $\alpha(\theta,0)$) and the steeper the Phillips curve is (larger κ). It follows that, conditional on a positive markup shock μ, the economy with a hawkish central bank has lower inflation and more negative output than an economy with a dovish central bank.

[6] Armenter (2018) show that there can be multiple Markov equilibria when respecting the ZLB. Furthermore, even abstrating from the ZLB, there are also mutiple time-dependent equilibria that differs from the unique Markov perfect equilibrium and have the property that inflation converges to infinity.

Short-run under imperfect information We now consider the problem in period 1 given the publicly observable state, (s, ρ), the value function from period 2 onward, $V_2(s, \theta)$, and the equilibrium level of inflation that will prevail in the second period, $\pi_2(s, \theta)$. We define the private sector's expectations of inflation in the next period *after* the central bank acts as

$$\Pi_2(s, \rho, y) = p(s, \rho, y)\, \pi_2(s, \theta_H) + [1 - p(s, \rho, y)]\, \pi_2(s, \theta_D) \tag{15}$$

where $p(s, \rho, y)$ satisfies (12) given the central bank's policy function $y(s, \rho, \theta, \varepsilon)$.

We can then write the problem for the government in period 1 as

$$V_1(s, \rho, \theta, \varepsilon) = \max_{\pi, y} R(\pi, y; \alpha(\theta, \varepsilon)) + \beta V_2(s, \theta) \tag{16}$$

subject to

$$\pi = \kappa(y + \mu) + \beta \Pi_2(s, \rho, y) \tag{17}$$

taking the function $\Pi_2(\cdot)$ as given. Because the continuation value $V_2(s, \theta)$ does not depend on the equilibrium outcome in period 1, the optimal choice is obtained by maximizing R subject to the Phillips curve (17), or simply:

$$y(s, \rho, \theta, \varepsilon) = \arg\max_{y} R(\kappa(y + \mu) + \beta \Pi_2(s, \rho, y), y; \alpha). \tag{18}$$

Finding an equilibrium then boils down to find a policy $y(\cdot)$ and expectations $\Pi_2(\cdot)$ that are consistent with (15) and (18).

We focus on a *separating equilibrium* in which the central bank chooses a different policy for any $\alpha = \alpha(\theta, \varepsilon)$.[7] In fact, inspecting problem (18), the optimal y depends on θ and ε solely through their effect on $\alpha = \alpha(\theta, \varepsilon)$. We can thus write the equilibrium outcome as $y_1(s, \rho, \alpha)$ that is strictly monotone in α. Then, defining $a(y; s, \rho)$ to be the inverse function of $y_1(s, \rho, \cdot)$ given s and ρ, for all y on path we can then write (12) as

$$p(s, \rho, y) = P(\alpha = a(y; s, \rho); \rho) \equiv \frac{\rho \Pr(\alpha = a(y; s, \rho) | \theta_H)}{\rho \Pr(\alpha = a(y; s, \rho) | \theta_H) + (1 - \rho) \Pr(\alpha = a(y; s, \rho) | \theta_D)}.$$

Moreover, if y_1 is differentiable in α, we have

$$\frac{\partial p(s, \rho, y)}{\partial y} = \frac{P'(a(y; s, \rho))}{\partial y_1(s, \rho, \alpha) / \partial \alpha}.$$

[7] This economy could also admit pooling equilibria in which for all α the central bank chooses the same policy and there is no updates in the type of the central bank, $\rho' = \rho$. These pooling equilibria are supported by off-equilibrium path beliefs that assign a reputation lower than ρ for deviations that entail more tightening than along the equilibrium path. They then do not satisfy the intuitive criterion.

The sign of this derivative tells us in which direction private agents update their belief over the policymaker's type when they see a marginally higher output—with a negative value implying that a higher level of output induces the private sector to update their prior toward the dovish policymaker. As we will see, the sign of this derivative shapes how reputation affects the optimal policy at date 1. Because higher values of α are more likely when the monetary authority is of type θ_H, $P' \geq 0$, the sign of $\partial p\left(s,\rho,y\right)/\partial y$ depends solely on the sign of $\partial y_1\left(s,\rho,\alpha\right)/\partial\alpha$.

For $\mu > 0$, output strictly decreases in α because the central bank is more willing to sacrifice output to stabilize inflation when α is large. Thus, a higher realization of y signals that it is more likely that the central bank is a dove – $\partial p\left(s,\rho,y\right)/\partial y < 0$- and it increases expected inflation:

$$\frac{\partial \Pi_2\left(s,\rho,y\right)}{\partial y} \equiv -\left(\pi_2\left(s,\theta_D\right) - \pi_2\left(s,\theta_H\right)\right)\frac{\partial p\left(s,\rho,y\right)}{\partial y} \geq 0$$

since $\pi_2\left(s,\theta_D\right) - \pi_2\left(s,\theta_H\right) > 0$.[8]

We now solve for the optimal policy of the central bank and compare it to that in the Markov perfect equilibrium under full information. Toward this end, we can write the first order condition from the central bank problem (18)

$$R_\pi\left[\kappa + \beta\frac{\partial \Pi_2\left(s,\rho,y\right)}{\partial y}\right] = -R_y \tag{19}$$

Equation (19) is very similar to the optimality condition under full information, equation (14), with the exception that the monetary authority now takes also into account the effects of his policy actions at date 1 on expectations of future inflation—the term $\partial\Pi_2(s,\rho,y)/\partial y$. To understand how these considerations influence the optimal policy, consider a situation in which the economy faces an inflationary supply shock, $\mu > 0$. In this case, we argued that $\partial\Pi_2(s,\rho,y)/\partial y > 0$. That is, if the economy currently faces an inflationary shock and the private sector sees marginally higher output, it will assign more likelihood to the possibility that the policymaker is a dove, and this will raise expectations of future inflation because of the persistence of the markup shock. Due to this effect, the central bank induces a larger fall in output relative to the perfect information case, as the next proposition shows.

Proposition 1. *The central bank is more hawkish when its type is unknown. That is, if $\mu > 0$ ($\mu < 0$) then $y_1\left(s,\rho,\alpha\right)$ is more negative (positive) than in the Markov equilibrium under perfect*

[8]Symmetrically, if $\mu < 0$ the the equilibrium output is strictly increasing in α. So a higher realization of y increases the government reputation. Also in this case $\partial\Pi_2\left(s,\rho,y\right)/\partial y \geq 0$ since $\left(\pi_2\left(s,\theta_D\right) - \pi_2\left(s,\theta_H\right)\right) < 0$ when $\mu < 0$.

information under the Hawk, strictly so if $\rho \in (0,1)$.

Proof. Solving the optimality condition (19) using our functional form we have

$$y_1(s,\rho,\alpha) = -\frac{\alpha\left[\kappa+\beta\frac{\partial\Pi_2(s,\rho,y)}{\partial y}\right]}{(1-\alpha)+\alpha\kappa\left[\kappa+\beta\frac{\partial\Pi_2(s,\rho,y)}{\partial y}\right]}\left[\kappa\mu+\beta\Pi_2(s,\rho,y)\right]$$

If the central bank is a Hawk and there is full information then the Markov equilibrium outcome is given by

$$y_1^{full}(s,\alpha) = -\frac{\alpha\kappa}{(1-\alpha)+\alpha\kappa^2}\left[\kappa\mu+\beta\pi_2(s,\theta_H)\right]$$

Note that for any $\rho \in (0,1)$ and $\mu > 0$, we have that $\frac{\partial\Pi_2(s,\rho,y)}{\partial y} > 0$ as argued above in the text. Therefore,

$$\frac{\alpha\left[\kappa+\beta\frac{\partial\Pi_2(s,\rho,y)}{\partial y}\right]}{(1-\alpha)+\alpha\kappa\left[\kappa+\beta\frac{\partial\Pi_2(s,\rho,y)}{\partial y}\right]} = \frac{\alpha\kappa}{(1-\alpha)/\left[1+\beta\frac{\partial\Pi_2(s,\rho,y)}{\partial y}/\kappa\right]+\alpha\kappa^2} > \frac{\alpha\kappa}{(1-\alpha)+\alpha\kappa^2} > 0$$

If $\mu > 0$ we also know that

$$\Pi_2(s,\rho,y) = p(s,\rho,y)\,\pi_2(s,\theta_H) + (1-p(s,\rho,y))\,\pi_2(s,\theta_D) > \pi_2(s,\theta_H) > 0$$

Using these two observation in the expressions for $y_1(s,\rho,\alpha)$ and $y_1^{full}(s,\alpha)$ we have

$$y_1(s,\rho,\alpha) < y_1^{full}(s,\alpha)$$

as wanted. A specular argument holds for $\mu < 0$. *Q.E.D.*

With perfect information, the benefit of reducing output when the economy faces a positive markup shock is that, by doing so, the monetary authority can better stabilize inflation. This is because a lower output gap today directly reduces inflation by κ, the slope of the Phillips curve. With imperfect information, the same policy has an additional indirect effect on inflation today through expectations: lower output today increases the reputation of the central bank, reduces the expected impact of the markup shock on future inflation, and these lower inflation expectations have a stabilizing effect on current inflation via the forward looking component of the Phillips curve. This reputation channel induces the central bank to follow a tighter policy than in the perfect information case.

Interestingly, the reputation channel is state-dependent. First, it operates only when the

economy faces supply shocks. Conditional on demand shocks, there is no inflation/output trade-off in this model and, given the functional form used for R in this example, both types of policymakers will want to implement the same allocation $(y = 0, \pi = 0)$. Therefore, the private sector's beliefs about the central bank's type equal their prior irrespective of the observed policy choices ($\rho' = \rho$), and the monetary authority will not have an incentive to choose policy in order to change its reputation. In those cases, the equilibrium allocations with perfect and imperfect information coincide. Second, the reputation channel is present only when the private sector is uncertain about the policymaker's type. This can be seen by looking at the cases in which the prior is dogmatic—$\rho = 0$ or $\rho = 1$. In those cases, current policy choices will not have any effects on future inflation expectations, $\partial \Pi_2(s, \rho, y)/\partial y = 0$, and the reputation channel will be muted.

Numerical example We now illustrate the workings of the model using a numerical example. Figure 1 plots the equilibrium outcome in period 1 (solid line) as a function of the supply shock μ, and compares it to the equilibrium outcome of the economy with full information (circled lines). For this numerical experiment, we assume that the policymaker's type is the Hawk $(\theta = \theta_H)$, that the private sector holds initially a low level of reputation $\rho = 0.5$, and that $\varepsilon = 0$. The panels plot the equilibrium outcome as a function of the markup shock μ.

As discussed above, when private agents are uncertain about the central banker's type, the monetary authority responds to a positive markup shock by increasing interest rates more aggressively to avoid a dis-anchoring of inflation expectations. This can be seen in the figure from the fact that the nominal and the real interest rates are higher while the output gap is lower in the economy with imperfect information.

Despite the more restrictive policy stance, inflation outcomes are worse in the economy with imperfect information than in the one with perfect information. This happens because inflation expectations respond more strongly to markup shocks when reputation is low. To see that, let's rewrite the Phillips curve as

$$\pi_1 - \kappa y_1 = \kappa \mu + \beta \left\{ \pi_2 \left(s, \theta_D\right) - \rho'(s, \rho, y) \left[\pi_2 \left(s, \theta_D\right) - \pi_2 \left(s, \theta_H\right)\right] \right\}.$$

For fixed y_1, a lower ρ reduces $\rho'(s, \rho, y)$. Because $\pi_2 \left(s, \theta_D\right) > \pi_2 \left(s, \theta_H\right)$ when $\mu > 0$, a reduction in ρ increases inflation for any level of y. In other words, the central bank with a low reputation faces a worse inflation-output trade-off because private agents expects future inflation to react more to the supply shock μ. Given the worse inflation-output trade-off, the central bank in the incomplete information economy tends to achieve worse

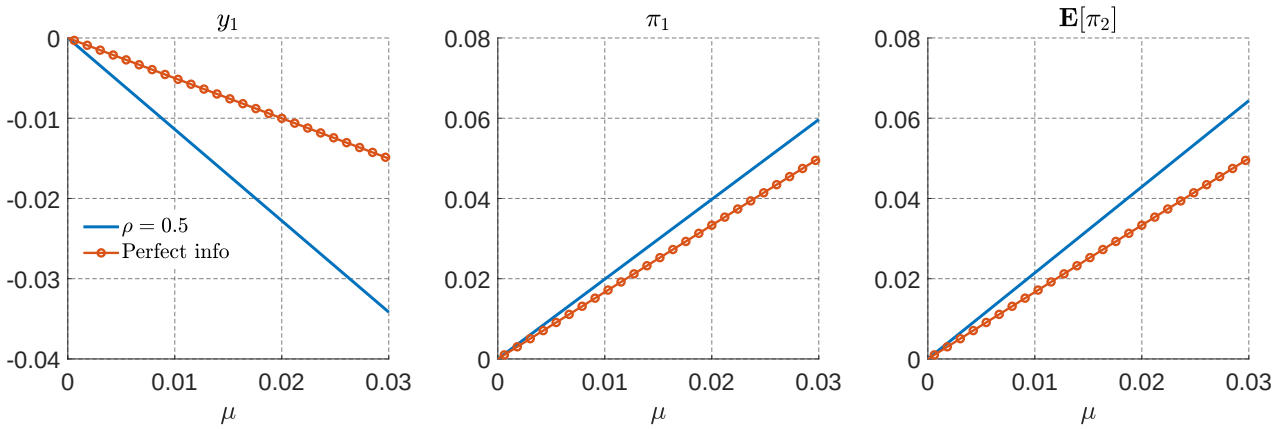


Figure 1: Equilibrium response to a markup shock

Notes: We set $\kappa = 0.2$, $\beta = 0.94$, $\theta_H = 0.6$, $\theta_D = 0.2$, $\sigma_\mu = 0.02$, $\sigma_\varepsilon = 2$. The policy functions are constructed setting $\theta = \theta_H$and $\varepsilon = 0$. The solid line reports the policy function for $\rho = 0.5$, while the circled line for $\rho = 1$.

inflation outcomes than the economy with perfect information.

To further understand the role of reputation in shaping equilibrium outcomes, we plot in Figure 2 the policy function for output, inflation and expected inflation as a function of ρ, when the economy is currently facing an inflationary supply shock, $\mu > 0$. Consistent with the discussion above, higher reputation reduces the effects of the supply shock on expected inflation, with $\mathbb{E}[\pi_2]$ unambiguously declining toward $\pi_2(\mu, \theta_H)$ as ρ increases. This implies that the central bank can achieve better inflation output outcomes today, as both $y_1$and π_1 get closer to their targets as ρ increases toward 1.[9] Therefore, the value for the central bank increases in ρ, as the bottom-right quadrant of the figure shows: that is, reputation is valuable because it allows a better inflation/output trade-off when the economy is hit by a supply shock.

3.2 Quantifying the reputation channel

Thus far, we have analyzed a simplified environment and shown that reputational considerations lead the central bank to respond more aggressively to inflationary supply shocks by tightening interest rates. In doing so, the central bank accepts a larger decline in output

[9]From the graph we can see a non-monotonicity of $y_1$in ρ. Specifically, $y_1$is decreasing when ρ is close to zero, and then increasing. At $\rho = 0$, the central bank's actions do not affect its reputation, and so the optimal choice of (y_1, π_1) follows the static rule of equation (13). As ρ increases, the central bank has an incentive to act more hawkishly to build reputation, this explaining why output initially decreases in ρ. Eventually, higher ρ means that inflation expectations are more anchored toward zero, which allows the central bank to stabilize inflation without needing to reduce output too much—this explaining why y_1 eventually increases in ρ.

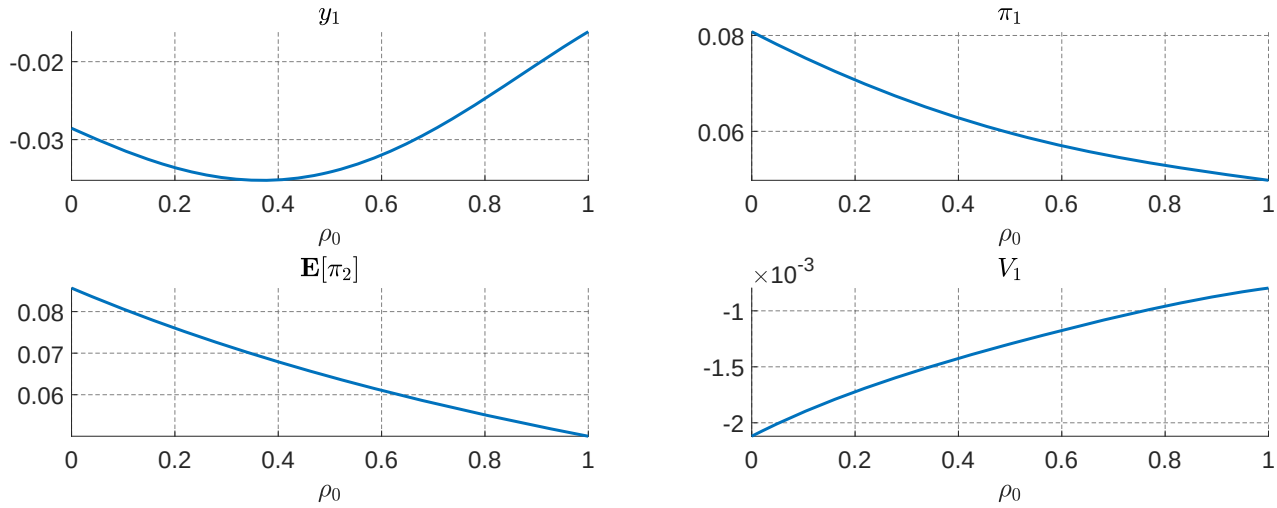


Figure 2: Equilibrium response to reputation

Notes: We set $\kappa = 0.2$, $\beta = 0.94$, $\theta_H = 0.6$, $\theta_D = 0.2$, $\sigma_\mu = 0.02$, $\sigma_\varepsilon = 2$. The policy functions are constructed setting $\theta = \theta_H$, $\varepsilon = 0$ and $\mu = 0.03$.

in exchange for more stable inflation expectations. This trade-off also characterizes optimal monetary policy in the full model described in Section 2. As for the simplified economy, we focus on separating equilibria in which the central bank chooses a different policy for any private state (θ, ε). In the full model, $\alpha = h(\theta, \varepsilon)$ is not longer a sufficient statistic for the central bank's problem because only the persistent type affects the continuation value. We restrict to equilibria in which it is not possible to perfectly learn the central bank's type by observing its choices.[10]

Consider the problem in (10). Substituting the Phillips curve in the objective function and maximizing with respect to y, a necessary condition for the optimum is

$$-\left(R_\pi \kappa - R_y\right) = \beta \left\{ R_\pi \frac{\partial \mathbb{E}^{\rho'}\left[\pi(s', \rho', i')\right]}{\partial \rho'} + \mathbb{E}^{cb}\left[\frac{\partial V(s', \rho', \theta', \varepsilon')}{\partial \rho'}\right] \right\} \frac{\partial p(s, \rho, y)}{\partial y}. \quad (20)$$

If we were in the economy with perfect information, the optimal choice of inflation and output would be such that $R_\pi \kappa = -R_y$, see equation (14). With imperfect information, instead, the central bank introduces a "wedge" between these two terms and it trades off this distortion—the left hand side in equation (20)—with an increase in reputation, whose benefits are represented by the right hand side of the equation. Higher reputation increases the objective function of the central bank in two ways. First, it moderates the impact of supply shocks on current inflation through their effects on inflation expectation, the term

[10] That is, when numerically solving the model we check that the range of $y(s, \rho, \theta_H, \cdot)$ is the same as $y(s, \rho, \theta_L, \cdot)$.

$\partial \mathbb{E}^{\rho'}[\pi'] / \partial \rho'$. This is the core mechanism discussed in simplified model we studied earlier. Second, higher reputation improves the inflation-output trade-off in the future, an effect summarized by the term $\mathbb{E}^{cb}[\partial V' / \partial \rho']$. This second term did not appear in the simplified model because in that example the Central Bank type was revealed in period 2, so the reputation had no value from that point on.

Applying the envelope theorem to (10), we can then rewrite equation (20) as

$$-\left(R_{\pi,t}\kappa + R_{y,t}\right)\frac{\partial y_t}{\partial i_t} = \sum_{k=1}^{\infty}\beta^k \mathbb{E}_t^{cb}\left[R_{\pi,t+k-1}\frac{\partial \mathbb{E}^{\rho_{t+k}}\pi_{t+k}}{\partial \rho_{t+k}}\frac{\partial \rho_{t+k}}{\partial \rho_t}\right]\frac{\partial \rho_t}{\partial y_t}\frac{\partial y_t}{\partial i_t} \tag{21}$$

where $k \geq 1$ indexes decisions k-periods ahead, $\partial \rho_k / \partial \rho_1 = \partial \rho_k / \partial \rho_{k-1} \times \partial \rho_{k-1} / \partial \rho_1$ for all $k \geq 1$, and $\partial y_t / \partial i_t$ is obtained by the Euler equation.

Equation (21) relates the strength of the reputation mechanism—measured as a wedge in the optimality condition of the economy with perfect information—to the present discounted value of the elasticity of inflation expectations to interest rate changes. The logic of this relationship is straightforward. Suppose that the economy is currently facing an inflationary supply shock. The monetary authority will then deviate from the decision rule prescribed by the perfect information model in the direction of being more hawkish ($-R_{y,t} < R_{\pi,t}\kappa$) as long as higher interest rates increase its reputation and reduce the present discounted value of future inflation expectations.

Aside from highlighting the trade-off faced by the central bank, equation (21) serves as a "sufficient statistic" for the role of reputational considerations in monetary policy. It links an inherently unobservable object—the behavioral wedge relative to the perfect information benchmark—to a potentially observable one: the sensitivity of inflation expectations to interest rate changes.

4 Empirical analysis

In this section, we present estimates of the sensitivity of inflation expectations to monetary policy changes, which—as shown in the previous section—are directly tied to the strength of the reputation channel in our model. Section 4.1 discusses conceptual issues in recovering these elasticities and describes our empirical strategy, which consists of estimating the response of *long-run* inflation expectations to monetary policy surprises identified via high-frequency methods. Section 4.2 discusses the data, while Section 4.3 reports the estimates of these elasticities for a group of advanced and emerging markets economies. Our main finding is that in Brazil and Turkey, long-term inflation expectations are highly sensitive

to unexpected changes in monetary policy, whereas in the other countries in our sample, these expectations do not exhibit a systematic response to monetary policy surprises.

4.1 Monetary policy and inflation expectations

There are two main empirical challenges in estimating $\left\{ \frac{\partial \mathbb{E}_t[\pi_{t+k}]}{\partial \rho_t} \frac{\partial \rho_t}{\partial i_t} \right\}_k$. First, there is an endogeneity problem: monetary policy responds to shocks—such as supply shocks—that also directly influence inflation expectations, making it inappropriate to infer causal effects by simply regressing expectations on interest rates. Second, whereas in our model changes in interest rates affect future inflation expectations solely through their impact on reputation, in reality, there are multiple other channels that can impart persistent effects on inflation, thereby acting as confounding forces.[11]

In order to address the first challenge, we follow Cook and Hahn (1989), Kuttner (2001) and Cochrane and Piazzesi (2002), among many others and estimate the response of inflation expectations to monetary policy surprises—identified as variation in short term nominal interest rates in a window around a monetary policy meeting. To address the second challenge, we focus on estimating the effects of monetary policy surprises on inflation expectations five to ten years ahead. The implicit assumption underlying this approach is that reputational effects are more persistent than other transmission channels. By examining expectations at longer horizons, we aim to filter out short-lived effects and isolate the influence of reputation.

We identify plausibly exogenous variation in monetary policy by focusing on changes in money market rates—typically overnight index swap (OIS) rates linked to the key interbank rate—around monetary policy meetings. The timing of these meetings is based on Bloomberg's economic calendar. We use a two-day window surrounding each policy announcement, which we view as a suitable compromise: narrow enough to minimize the influence of confounding factors, yet broad enough to allow markets sufficient time to absorb and react to the policy news.

We use financial market data on inflation compensation as a proxy for inflation expectations—that is, the difference between the yields on nominal and inflation-linked bonds, or rates from inflation-linked swaps. The advantage of these financial market measures is that they are available at a daily frequency and reflect the views of investors who have strong incentives to be accurate, as they are effectively placing bets on their inflation outlooks. In addition, the term structure of these instruments allows us to examine how monetary pol-

[11] For example, in a model with capital, current interest rate changes will affect capital accumulation and, by changing productive capacity, will have an impact on inflation expectations in the future.

icy surprises affect inflation expectations across different horizons—enabling us to focus on the long end, consistent with our earlier discussion on isolating reputational effects. The disadvantage is that the financial market measures reflect both inflation expectations as well as compensation for holding inflation risk. These inflation risk premia can be large and volatile, especially for countries where inflation expectations are not well anchored. To guard against the possibility that inflation risk premia are driving our results, we also incorporate survey-based measures of long-horizon inflation expectations. These survey-based measures are generally considered free from inflation risk premia. However, their lower frequency—typically monthly or quarterly—reduces the statistical power of our event study approach, as revisions to expectations may reflect a wide range of other shocks. Moreover, unlike financial market participants, survey respondents often lack strong incentives to invest in forecast accuracy.

We collect these variables for a range of advanced and emerging market economies. A key data limitation is that relatively few countries have well-developed markets for inflation-protected bonds, which restricts the availability of high-frequency market-based measures. Among advanced economies, we include the Euro Area (EA), the United Kingdom (UK), and the United States (US); among emerging markets, we focus on Brazil, Chile, Mexico, and Turkey.[12] For each country, the baseline specification that we estimate is

$$\Delta \mathbb{E}_t[\pi_{t+k,t+k+s}] = a + b_{(k,s)} \Delta i_t + \eta_t, \tag{22}$$

where $\Delta \mathbb{E}_t[\pi_{k,k+s}]$ is the revision in expected average inflation between k and $k+s$ periods around the monetary policy meeting and Δi_t is the monetary policy surprise. The coefficient $b_{(k,s)}$ is a measure of the elasticity of inflation expectations to monetary policy shocks.

We now provide a detailed discussion of the data definitions and sources used for each country in our sample, followed by the presentation of our estimates of $b_{(k,s)}$.

4.2 Data

Monetary policy shocks. As noted earlier, we primarily rely on overnight index swap (OIS) rates to construct monetary policy shocks. In particular, we use OIS rates for Chile, the EA, the UK, and the US. In the cases of Brazil and Mexico, where OIS rates are not

[12] We include Turkey in the analysis even though it does not issue inflation-protected bonds in local currency. We do so because this country experienced large swings in monetary policy in recent years, and this makes it a good laboratory to study the impact of these changes on long term inflation expectations—which we measure using a survey administered by the Turkish central bank.

available, we follow the approach of Bolhuis, Das, and Yao (2024) and use alternative interest rate swaps with the shortest available tenor. For Brazil, this is the BRZ PRE-DI swap, which references the overnight interbank rate (DI), and for Mexico, it is the MXN MTH swap, which is based on the 28-day repo rate (TIIE). For emerging economies, the money market rates have a maturity of three months. For the EA, UK, and US, we use twelve-month OIS rates, as these countries faced effective lower bound (ELB) constraints on their policy rates for a significant portion of our sample period. Shorter-term rates—such as three-month OIS rates—were similarly constrained by the ELB and therefore provided limited information about monetary policy surprises during those episodes. The twelve-month rates display more promising variation around policy meetings in those cases. In all cases, the data source is Bloomberg. Turkey is the exception in our sample, as—based on our knowledge—there is no reliable source of swap rates with a sufficiently long time series to support meaningful analysis. Instead, we construct monetary policy surprises as the difference between the realized policy rate announced after each central bank meeting and the expected rate, measured by the median economist forecast in the Bloomberg survey conducted prior to the meeting.[13] In the case of Turkey, these monetary policy surprises can be quite large—occasionally reaching up to five percentage points—reflecting the significant policy shifts that have occurred in recent years.

Inflation compensation. As our focus is on long-horizon inflation expectations, we use a 5-year, 5-year (5y5y) forward inflation compensation. Setting aside inflation risk premia, this measure should reflect investors' average inflation expectations over the five-year period beginning five years from now. The EA and the UK inflation compensation is based on inflation-linked swap rates tied to the HICP and RPI indices, respectively. These are downloaded from Bloomberg. For Brazil, Chile, Mexico, and the US, we obtain inflation compensation measures as the difference between nominal and inflation-linked bond yields. The US measures are the estimates in Gürkaynak, Sack, and Wright (2007), the Brazilian measures are computed by ANBIMA (the Brazilian Financial and Capital Markets Association) and downloaded via Bloomberg, while Jens Christensen kindly provided us with his estimates for Chile and Mexico (see Beauregard, Christensen, Fischer, and Zhu (2024) and Ceballos, Christensen, and Romero (2025)). Turkey does not have inflation compensation data.

Survey-based inflation expectations. Ideally, we would like to have survey-based expectations that cover a 5y5y horizon similar to the inflation compensation measures. This

[13] Our results for the other emerging market economies are robust to using this alternative measure of monetary policy surprises instead of the changes in the three months OIS rates around the policy meetings.

measure is not available for all countries, but we use responses to the survey questions that elicit inflation expectations at the longest available horizon for each country. For Chile, Mexico, and Turkey, we use surveys conducted by or on behalf of the countries' central banks. These surveys are conducted monthly and report average inflation expectations over different future horizons: one year starting three years from now for Chile,[14] between five and eight years from now for Mexico, and the year ending five years from now for Turkey.[15] We use the Survey of Professional Forecasters for both the EA and the US, which asks for inflation expectations covering horizons five years ahead and the five years starting in five years respectively. Those surveys are only conducted quarterly.[16] For the UK, we use the survey conducted by Consensus Economics, which asks for inflation expectations covering the five years that start five years from now. That survey was only conducted bi-annually until 2014 and quarterly after that. For all of the surveys, we date the surveys based on the last day to respond to the particular survey. We then aggregate all monetary policy surprises occurring between two consecutive editions of the surveys to implement our regression analysis. For monthly surveys, this typically involves a single policy surprise, while for quarterly surveys, multiple surprises often fall within the interval.

The central bank of Brazil conducts an interesting survey for our event study analysis; the "Focus survey". All participants—which are mostly banks and asset managers, consistent with the notion of a "professional forecaster" survey as we have been using for the other countries—can update their forecasts at any time and the central bank publishes the results on a daily basis. There is no requirement to update on a particular frequency, but the central bank encourages regular updating by running frequent forecast accuracy contests with a published ranking of the best forecasters. In addition, if a participant makes no update to their expectations in a six month period, the participant automatically drops out of the panel. This should also help make the responses representative at any point in time. In our analysis, we will use the longest forecast horizon available, the fourth fiscal year forward. For additional details on the survey see Gaglianone, Giacomini, Issler, and

[14] Until November 2019, the longest horizon available in the Chilean survey was the year ending two years from now, which we use until the longer horizon becomes available.

[15] The timing of the Turkish survey responses is not immediately clear. The survey results are typically published early to mid-month, and are hence likely taken a couple of weeks earlier around the end of the preceding month. In our sample, most monetary policy decisions by the Turkish central bank occured around the end of the month, so it is unclear if the survey responses reflect that information. We assume that it does not, and we line up the forecasts updates from the survey with the monetary policy surprises of the month before.

[16] We could have used the responses to the Survey of Monetary Analysts and the "Desk survey" conducted by the ECB and the New York Fed, respectively. Those are both conducted eight times a year, just before policy meetings, but there is no, or almost no, variation in the long-horizon inflation expectations reported in those surveys. That indicates that inflation expectations are seen as well anchored, and that we should expect regression coefficients close to zero for those countries, if those surveys are representative.

Skreta (2022)and Bonomo et al. (2024).

4.3 Results

Table 1 reports of equation (22) for the different countries. Panel A reports the information when using inflation compensation as a measure of long-run inflation expectations, while Panel B reports the results when using surveys.

Table 1: Estimates of equation (22)

Panel A: Market-based results

	Brazil	Chile	Mexico	Turkey	Euro area	UK	US
$b_{(5y5y)}$	-0.48^{***}	-0.05	0.02	N/A	0.03	-0.05	-0.09
	(0.18)	(0.05)	(0.07)		(0.06)	(0.07)	(0.09)
R^2	0.08	0.03	0.00	N/A	0.00	0.01	0.00
Sample	2010-2024	2010-2023	2010-2024	N/A	2010-2024	2010-2024	2010-2024
# obs.	92	104	109	N/A	134	143	114

Panel B: Survey-based results

	Brazil	Chile	Mexico	Turkey	Euro area	UK	US
b	-0.16^{**}		0.03	-0.09^{***}	0.11		-0.04
	(0.09)		(0.06)	(0.03)	(0.08)		(0.06)
R^2	0.11		0.00	0.26	0.05		0.00
Sample	2010-2024		2010-2024	2017-2024	2010-2024		2010-2024
# obs.	92		106	23	57		54

Notes: The table reports regression coefficients from regressions of long-horizon inflation expectations onto monetary policy shocks, equation (22). Panel A reports results for market-based measures of inflation expectations based on either the difference between nominal and real bond yields or based on inflation-linked swap rates. The market-based inflation expectations are 5yr-5yr forward rates. Panel B reports results for survey-based measures of inflation expectations. See the text for details about the exact horizons of the survey-based inflation expectations for the different countries.

We can see that long-run inflation expectations are very sensitive to monetary policy surprises for certain countries, specifically Brazil and Turkey. In these countries, interest rate hikes are associated, on average, to significant reductions in expectations about expected inflation in the long-run. These effects are statistically significant at conventional level, and they are economically sizable. In the case of Brazil, we can see that a 100 basis points surprise in the three month OIS rate causes, on average, a reduction in the long-run inflation rate of roughly 50 basis points when using inflation compensation and approxi-

mately 20 basis points when using surveys.[17] For the case of Turkey, we find an elasticity of approximately ten basis points.

For the other countries, instead, we do not find evidence that long-run inflation expectations respond to monetary policy changes. Indeed, the coefficient b is not significantly different from zero for these countries and the R^2 of these regressions are very close to zero in almost all cases. These results hold regardless of the measure of long-run inflation expectations used in the analysis—whether based on financial markets or survey data.

The main result can be illustrated further by plotting the estimates for $b_{(k,s)}$ at different horizons for Brazil and the US. This experiment is reported in Figure 3. Following a 100 basis point surprise in the OIS rate in the US, we observe a canonical "hump" shaped response for inflation expectations: they are roughly insensitive in the near term ([0,2] years), they are significantly negative in the medium term, declining by 20 basis points over the [2,5] years horizon, and not being significantly different from zero at conventional levels [5,10] years out. In the case of Brazil, instead, a surprise tightening is associated on average to a very persistent and sizable drop in inflation expectations, with little evidence of mean reversion.

Why do inflation expectations in Brazil and Turkey respond differently to a monetary shock relative to other countries? Through the lens of our model, one plausible interpretation is that bond market investors and professional forecasters are less certain about the monetary policy framework of Brazil and Turkey than they are for the other countries in our analysis—something that would make their long-run inflation expectations more sensitive to monetary policy surprises.[18] This interpretation is consistent with the fact that Brazil and Turkey have undergone major shifts in monetary policy in recent years—developments that would naturally heighten uncertainty about the central bank's "type" and, in turn, make reputation more salient in shaping expectations.

Another possible interpretation is that Brazil and Turkey are on average more exposed to supply shocks than the other countries reported in Table 1, making their reputation more sensitive to monetary policy choices.[19] To assess whether this is driving the cross-country

[17] The difference in the point estimates when using different measures of inflation expectations could be due different factors. First, market-based measure of inflation expectations contain a risk-premium component that may itself be sensitive to monetary policy surprises, and this could drive a wedge between the market-based measures and the surveys. Second, it is worth pointing out that not all participants in the Focus survey update their forecasts immediately after a monetary policy meeting. This unresponsiveness bias downward the sensitivity of inflation expectations to monetary policy shocks.

[18] As we have seen in Section x, the elasticity of inflation expectations to changes in interest rates depend on the underlying level of reputation ρ. Countries with very high levels of reputation $\rho \approx 1$will have more anchored inflation expectations relative to a country with intermediate levels of reputation.

[19] As we have seen earlier, both types of policymakers want to implement the same allocation conditional on demand shocks. Hence, monetary policy choices when demand shocks are sizable have little effects on

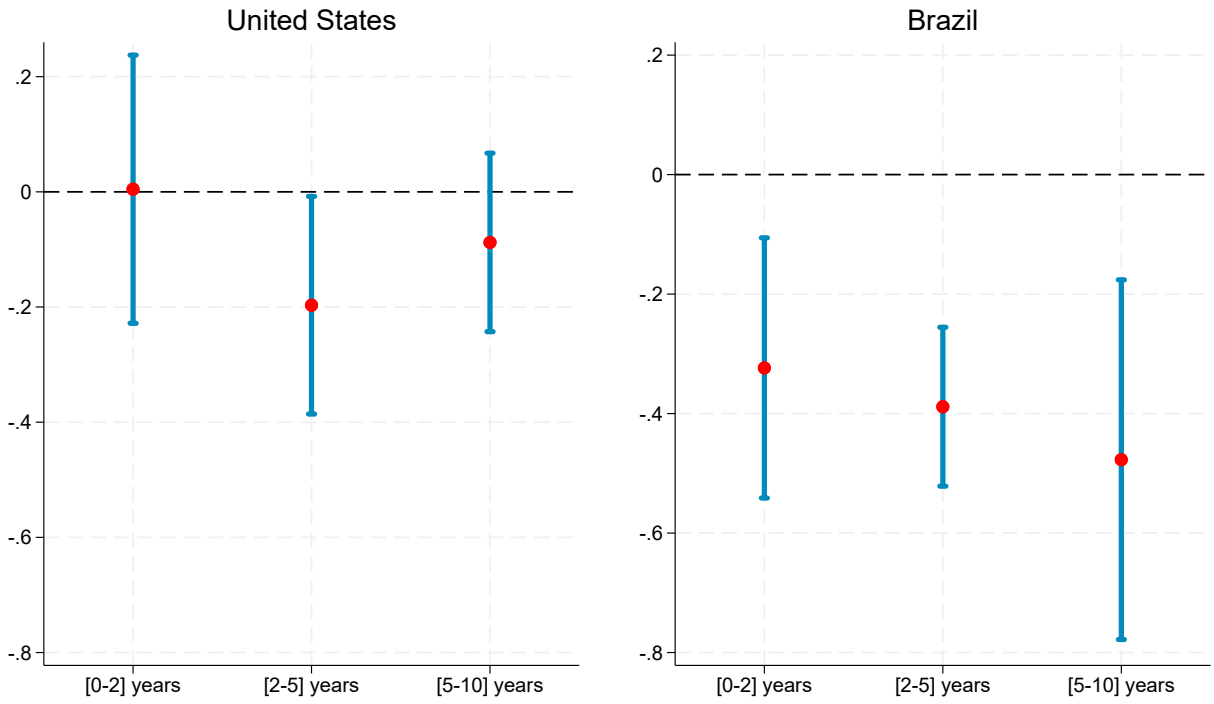


Figure 3: Monetary shocks and inflation expectations: US vs. Brazil

Notes: The figure reports estimates of $b_{(k,s)}$(point estimates and 95% confidence intervals) in (22) for various horizons for the US and Brazil. The confidence intervals are constructed using robust standard errors. Inflation expectations are market-based and calculated from the difference between nominal and real bond yields. The sample covers 2010 through 2024.

heterogeneity we find, we estimate equation (22) using only observations during the recovery from the pandemic (2020-2022), a period during which global supply disturbances were particularly severe for all countries in our analysis. Table x reports the result of this experiment using market-based inflation expectations. We can see that $b_{(5y5y)}$ is not significantly different from zero for Mexico, Chile, the EA, the US and the UK. That is, for these countries, long-run inflation expectations appear to be well anchored—in the sense that monetary policy surprises do not lead to meaningful changes in long-run inflation expectations even when the economy faces supply disturbances. For Brazil, instead, the coefficient is significantly negative, as in the main specification.

5 Quantitative analysis

[**Preliminary and incomplete**] We now apply our framework to quantify the role of rep-

beliefs about the policymaker's type.

utation in shaping monetary policy decisions during the post-pandemic recovery, and to assess the extent to which reputational gains have enhanced the inflation-output trade-off. We focus our analysis on the Brazilian economy. As noted in the introduction, Brazil was among the first countries to raise interest rates following the pandemic, with policymakers explicitly citing the risk of de-anchoring inflation expectations as a key motivation. Moreover, our empirical analysis in the previous section revealed a strong sensitivity of inflation expectations to monetary policy surprises in Brazil. Through the lens of our model, this points to a prominent role for reputational considerations in the conduct of monetary policy in Brazil.

Section 5.1 calibrates the model to the Brazilian economy by fitting, among other targets, the measured response of long-run inflation expectations to monetary policy shocks. Section 5.2 uses the model to measure the reputational gains during the post-pandemic recovery and quantify how these reputational gains affected the inflation-output trade-off for the Brazilian economy.

5.1 Calibration

Let $\Theta = [\kappa, \sigma, \beta, \bar{\pi}, \theta_H, \theta_D, P, \sigma_\varepsilon, \rho_\mu, \sigma_\mu, \rho_\gamma, \sigma_\gamma]$ denote the vector of model parameters. We assume that the Markov chain for θ is symmetric, with $P = P_{HH} = P_{DD}$. Table 2 reports the numerical values of the parameters chosen for this numerical exploration of the model.

Table 2: Model parameters

Parameter	Value	Notes
κ	0.10	Slope of the Phillips curve
σ	1.00	Inverse IES
β	0.99	Discount rate
$\bar{\pi}$	0.01	Inflation target
θ_H	0.60	Weight on inflation, Hawk
θ_D	0.20	Weight on inflation, Dove
P	0.995	$Pr\left(\theta_{t+1} = \theta \middle\| \theta_t = \theta\right)$
σ_ε	3.00	St. dev., monetary shocks
ρ_μ	0.97	Persistence, supply shocks
σ_μ	0.01	St. dev., supply shocks
ρ_γ	0.95	Persistence, demand shocks
σ_γ	0.005	St. dev., demand shocks

Notes here.

We set $\kappa = 0.1$ consistent with estimates of the slope of the NK Phillips curve in Brazil over the 2010-2019 period. We let $\sigma = 1$ and $\beta = 0.99$, consistent with an annualized real

interest rate of approximately 4%. We set $\bar{\pi}$ to match an annualized inflation target of 4%, and we let $\theta_H = 0.6$ and $\theta_D = 0.2$.

The parameter P and σ_ε are chosen to match the sensitivity of inflation expectations to monetary policy surprises that we estimated in the previous section. Specifically, we target the coefficient in panel B of Table 1, which in the case of Brazil reports the response of inflation expectations for the fourth fiscal year forward to a 100 bp monetary surprise. We simulate a monetary surprise and study the effects on inflation expectations in the model as follows. For each (μ, ρ, θ), we consider a two standard deviation increase in ε, which in the model corresponds to a shift in monetary policy that is orthogonal to other structural shocks. We then compute the model-implied response to this monetary shock: the change in current nominal interest rates, $\Delta i(\mu, \rho, \theta)$, which captures the monetary policy surprise, and the change in expected inflation four years ahead, $\Delta \mathbb{E}[\pi_{16}](\mu, \rho, \theta)$. We then compute

$$b(\mu, \rho, \theta) = \frac{\Delta \mathbb{E}[\pi_{16}](\mu, \rho, \theta)}{\Delta i(\mu, \rho, \theta)}.$$

and average $b(\mu, \rho, \theta)$ over the ergodic distribution of (μ, ρ, θ) to obtain a model counterpart to b in Table 1.

The model requires highly persistent policymaker types ($P = 0.995$) and large monetary shocks ($\sigma = 3$) to replicate the persistent effects of monetary policy surprises on inflation expectations that we observe in the data. These parameter values imply that updates in beliefs dissipate slowly over time, allowing changes in beliefs today to influence expectations far into the future. Despite these parameter choices, the model still falls short of replicating the observed sensitivity of inflation expectations to monetary shocks. As shown in Table 3, the model-implied value of b is -0.04, only one-quarter of the magnitude estimated from the data. This result is partly due to the transitory nature of supply shocks in the model: even though belief updates decay slowly, their impact on long-term inflation expectations may still be limited because both policymaker types implement the same allocation once μ returns to its steady state.

The Table also reports selected moments for output, inflation and nominal interest rates in model simulations and in the data. The data moments are computed over the 2016:Q1-2023:Q4 period. Output is defined as the deviations of log real GDP from a linear trend estimated using data on 2016:Q1-2019:Q4. Inflation is the percentage change in the Brazilian consumer price index, while the nominal interest rates is the Selic rate. While the model does a reasonable job in matching the volatility of these three variables, it produces a strong negative correlation between output and inflation and output and nominal interest rates, which is far from what is observed in the data. This is because, in this version of

Table 3: Model fit

	Data	Model
b	-0.16	-0.04
$\sigma(y_t)$	2.58	2.18
$\sigma(\pi_t)$	0.67	0.84
$\sigma(i_t)$	1.02	2.19
$\text{corr}(y_t, \pi_t)$	0.07	-0.47
$\text{corr}(y_t, i_t)$	0.52	-0.56
$\text{corr}(\pi_t, i_t)$	0.30	-0.09

Notes here.

the model, demand shocks are perfectly stabilized by the central bank, so the correlation pattern between output and inflation is only driven by supply shocks.

5.2 Measuring the value of reputation

We now use the model to study the inflation dynamics in Brazil during the post-pandemic recovery. Specifically, we address two questions: First, how much reputation did the central bank gain by responding promptly to the inflationary pressures that emerged in early 2021? Second, what are the macroeconomic benefits associated with these reputational gains?

In order to answer the first question, we proceed in two steps. First, we use the calibrated model, along with data on output, inflation and nominal interest rates, to back out the implied dynamics of reputation during the recovery from the pandemic. Second, we use the model to compute counterfactual paths for the endogenous variables under an alternative scenario in which the central bank implemented a myopic policy that ignored the reputation gains—that is, a policy which would set $R_{\pi,t}\kappa = -R_{y,t}$ for all t. The difference between these two paths captures the macroeconomic impact of the reputation channel in our model.

To carry out the first step, we apply a particle filter to observed data on output, inflation, and nominal interest rates, allowing us to recover the time-series paths of both the exogenous shocks and the central bank's reputation, $\{\mu_{t,}\gamma_t, \varepsilon_t, \rho_t\}$. Figure 4 reports the results of this experiment.

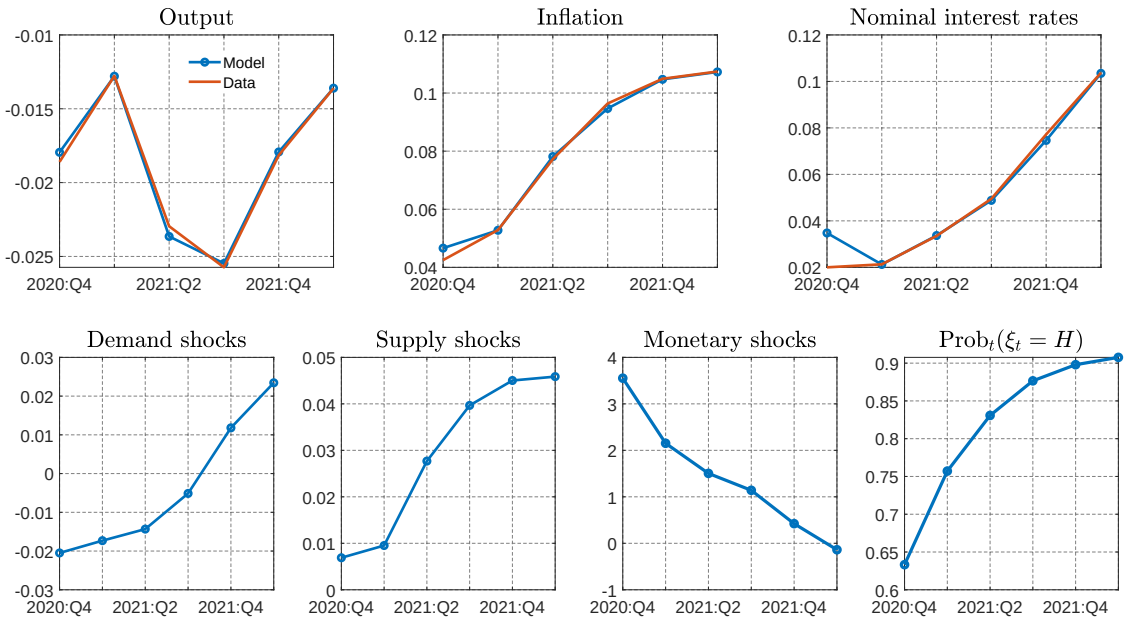


Figure 4: Output, inflation and interest rates in Brazil: 2020:Q4-2022:Q1

Notes here.

6 Conclusion

This paper studies monetary policy in environments where inflation expectations are imperfectly anchored and influenced by the central bank's reputation. We show that when agents are uncertain about the central bank's objectives, policymakers face stronger incentives to respond aggressively to inflationary supply shocks in order to signal their commitment to price stability. This process of reputation-building helps stabilize long-run inflation expectations and improves the inflation-output trade-off over time.

We show that the strength of the reputation channel in the model is closely linked to the sensitivity of long-run inflation expectations to changes in interest rates. Empirically, we find that in countries such as Brazil and Turkey, inflation expectations react strongly to monetary policy surprises—consistent with the model's predictions. Calibrating the model to Brazilian data, we demonstrate that the central bank's early interest rate hikes following the pandemic generated meaningful gains in reputation and helped anchor expectations. These findings underscore the critical role of credibility in ensuring effective monetary policy, particularly in settings characterized by elevated uncertainty.

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