

Setting the Wrong Price for the Right Reason: Consequences of Mispricing for Inflation and Monetary Policy*

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This paper studies how the nature of pricing frictions affects the propagation of shocks in the economy and the way monetary policy should respond to shocks. We consider models that are parameterized to match the same degree of aggregate monetary non-neutrality but differ in the source of the nominal rigidity. We find that nominal rigidity arising from frictions in reset prices operates through a fundamentally different mechanism from Calvo and menu cost models. This differentially affects the dynamics of the economy, generates differences in the degree of welfare-relevant price dispersion, and changes the central bank's stabilization problem. We furthermore document that in US data, the responses of the frequency and dispersion of price changes to exogenous monetary policy shocks match those generated by a model with mispricing but are at odds with models with perfect repricing.

*The title of this paper is inspired by [Hellwig & Venkateswaran \(2009\)](#), who showed that under some conditions, firms may set the right prices for the wrong reasons: even under uncertainty about the sources of shocks, they adjust in ways that preserve aggregate flexibility. Here, instead, we consider the opposite case, in which firms rationally trade off the benefit of more accurate pricing against the cost of achieving it. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of anyone else associated with the Federal Reserve System. We thank seminar participants at Bank of Canada, Bundesbank, ECB, Reserve bank of Australia, Kansas City Fed, and San Francisco Fed for valuable comments. Contact: camilo.moralesjimenez@frb.gov, stevens7@umd.edu, hw2688@umd.edu.

Everyone is struggling to figure out what to do, what's the right decision, where do we set prices.

—Clifford Thompson, President of Thompson Traders
The Wall Street Journal, August 30, 2025

1 Introduction

In August 2025, the Federal Reserve Bank of Richmond surveyed businesses about their pricing plans amid rapidly shifting trade policy. Nearly 40 percent of firms reported being not at all certain or only slightly certain about what prices they would charge for the remainder of the year. As the *Wall Street Journal* quote above illustrates, the challenge for these firms was not merely *whether* or *when* to change prices, but also *what price to set* conditional on deciding to adjust.

Although tariff volatility has brought this challenge into stark relief, it is not new. Survey evidence has long documented that firms find pricing decisions difficult and costly even in calm times. [Blinder, Canetti, Lebow & Rudd \(1998\)](#) documented that firms use crude pricing methods and in a detailed study of a large industrial manufacturer, [Zbaracki, Ritson, Levy, Dutta & Bergen \(2004\)](#) found that the managerial costs of determining the right price, such as information-gathering, decision-making, and internal communication, are six times larger than the physical costs of implementing the desired price changes.

However, the dominant approach to modeling price setting abstracts entirely from this margin. In virtually all quantitative models of inflation determination, firms that reprice are assumed to set the optimal price with perfect precision. In all of these frameworks, the source of nominal rigidity is delay (and possibly imprecision) in the decision to adjust or not, not a friction in the price level chosen upon adjustment.

In this paper we show that *how* the nominal friction is modeled – whether allowing or not for repricing frictions – affects aggregate dynamics and how monetary policy should respond to shocks. When firms that adjust can *misprice*, setting prices that deviate from the full

information optimum, the mechanism generating inefficient price dispersion is fundamentally different: The intensive margin of price gaps becomes a distinct and quantitatively important source of monetary non-neutrality. This frees the extensive margin to be strongly state-dependent, allowing the model to simultaneously match the large real effects of nominal shocks *and* the high sensitivity of the frequency of price changes to inflation – two features of the data that models with perfect repricing struggle to reconcile. [Blanco, Boar, Jones & Midrigan \(2025\)](#) also emphasize existing models’ inability to match the elasticity of frequency to inflation. However, they focus on a tension between the high standard deviation of price changes and this elasticity being high. In contrast, we demonstrate the tension with the degree of non-neutrality, which is a key object of interest in these models.

We then ask how monetary policy, operating under a Taylor rule, should respond to variations in output and inflation driven by different shocks. The optimal policy coefficients differ depending on whether non-neutrality arises from timing frictions or repricing frictions. This question has not been addressed in the menu cost literature, which has largely specified monetary policy as an exogenous process for nominal spending (e.g., [Blanco et al., 2025](#); [Golosov & Lucas Jr, 2007](#); [Midrigan, 2011](#)), precluding the study of optimal interest rate rules. An exception is [?](#), who characterize optimal policy in a menu cost model. Our analysis differs in that we compare optimal policy across pricing specifications that generate the same aggregate nonneutrality but through different microeconomic channels.

generalized pricing framework of [Morales-Jiménez & Stevens \(2025\)](#),

As shown by [?](#) (MJS henceforth), partial state-dependence in reset prices is a major driver of nominal rigidities in U.S. data in recent decades. To establish how the nature of pricing frictions affects the economy’s dynamic response to shocks, we parameterize the different models to match the same set of steady state price setting moments.

2 Model

We study an economy with a representative household, a continuum of retailers selling differentiated goods subject to pricing frictions, a fiscal authority setting taxes, transfers, and government spending, and a monetary authority responsible for setting the short term

nominal interest rate. We consider three types of pricing frictions: the Calvo model, a generalized Ss model microfounded with information frictions (Woodford, 2009), and the generalized pricing frictions of Morales-Jiménez & Stevens (2025), which feature information frictions and menu costs and allow for frictions in both the timing of price changes and the chosen reset prices.

Households

The representative household chooses consumption, bonds, and labor supply to maximize lifetime discounted utility,

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\frac{1}{\psi}} - 1}{1 - \frac{1}{\psi}} - \omega \frac{L_t^{1+\frac{1}{\nu}}}{1 + \frac{1}{\nu}} \right], \quad (1)$$

where β is the discount factor, ψ is the intertemporal elasticity of substitution, ν is the Frisch elasticity of labor supply, and ω is a labor disutility parameter. Maximization is subject to the sequence of flow budget constraints

$$C_t + B_t = (1 - \tau_t)w_t L_t + D_t - Z_t + \frac{B_{t-1}P_{t-1}(1 + i_{t-1})}{P_t}, \quad (2)$$

and a no-Ponzi condition. The household receives after-tax labor income $(1 - \tau_t)w_t L_t$, dividends D_t , pays lump-sum taxes net of transfers Z_t , and saves using one-period bonds that earn a nominal rate i_t between period t and period $t + 1$ and whose real value is B_t .

Final Goods

A homogeneous final good is used for consumption, government spending, and to pay for any adjustment costs related to the nominal price frictions,

$$Y_t = C_t + G_t + F_t. \quad (3)$$

This good is generated via costless aggregation of the retail varieties j with elasticity of substitution ε_t ,

$$Y_t = \left[\int y_{jt}^{\frac{\varepsilon_t-1}{\varepsilon_t}} dj \right]^{\frac{\varepsilon_t}{\varepsilon_t-1}}, \quad (4)$$

where the implied desired markup $\mu_t \equiv \varepsilon_t/(\varepsilon_t - 1)$ follows an AR(1) process in logs, independent of other shocks,

$$\ln \mu_t = (1 - \rho_\mu) \ln \bar{\mu} + \rho_\mu \ln \mu_{t-1} + \epsilon_{\mu,t}, \quad \epsilon_{\mu,t} \sim \mathcal{N}(0, \sigma_\mu^2), \quad (5)$$

and $\bar{\mu}$ is the steady-state desired markup. Demand for each differentiated variety is

$$y_{jt} = p_{jt}^{-\varepsilon_t} Y_t, \quad (6)$$

with $p_{jt} = P_{jt}/P_t$ denoting the good's relative price, and

$$\left(\int p_{jt}^{1-\varepsilon_t} dj \right)^{\frac{1}{1-\varepsilon_t}} = 1. \quad (7)$$

Retailers

A unit mass of retailers indexed by j sell a continuum of differentiated varieties in a monopolistically competitive market. The retailers' production function is

$$y_{jt} = e^{a_{jt}+a_t} L_{jt}, \quad (8)$$

with idiosyncratic and aggregate productivity following independent AR(1) processes in logs,

$$a_{jt} = \rho a_{j,t-1} + \epsilon_{j,t}, \quad \epsilon_{j,t} \sim \mathcal{N}(0, \sigma^2), \quad (9)$$

$$a_t = \rho_a a_{t-1} + \epsilon_{a,t}, \quad \epsilon_{a,t} \sim \mathcal{N}(0, \sigma_a^2), \quad (10)$$

L_{jt} is the labor input employed by retailer j and real operating profit per period is

$$\pi_{jt}^r = p_{jt} y_{jt} - w_t L_{jt}. \quad (11)$$

Generalized Pricing Frictions

Retailers set prices subject to a fixed adjustment cost κ , and unit information costs θ^a and θ^p that represent the costs of acquiring information in order to decide whether a price change is warranted, and if so, what reset price to choose conditional on adjustment. Firms acquire information and make pricing decisions to maximize

$$\mathcal{V}_0 = E_{j0} \sum_{t=0}^{\infty} M_{0,t} \left[\pi_{jt}^r - \theta^a \mathcal{I}_{jt}^a - \delta_{jt} (\kappa + \theta^p \mathcal{I}_{jt}^p) \right], \quad (12)$$

where $M_{0,t}$ is the stochastic discount factor used to discount real profit streams from date t to date 0,

$$M_{t,t+1} = \beta \frac{C_{t+1}^{-1/\psi}}{C_t^{-1/\psi}}, \quad (13)$$

δ_{jt} is an indicator equal to 1 if the firm picks a new price in period t and 0 otherwise, and \mathcal{I}_{jt}^a and \mathcal{I}_{jt}^p are the information quantities acquired in order to make the adjustment decision and the reset price decision, respectively.

Retailers are rationally inattentive (Sims, 2003; Woodford, 2009), which means that they acquire information optimally to make their decisions. We specify the adjustment decision using a probability Λ_{jt} that specifies the probability that firm j adjusts its price in period t as a function of the state, and the reset price using a distribution $f_{jt}(p)$ that specifies the probability that, conditional on adjustment, firm j sets price p in period t . The cost of making decisions contingent on the realized state is linear in the Kullback-Leibler divergence \mathcal{D} of these probabilities from a reference probability $\bar{\Lambda}$ and a reference distribution for reset prices \bar{f} , respectively. Firms are ex-ante homogeneous, so they all use the same reference distributions. With this specification of the firm's information frictions, we can restate the firm's problem as maximizing

$$\mathcal{V}_0 = E_{j0} \sum_{t=0}^{\infty} M_{0,t} \left[\pi_{jt}^r - \theta^a \mathcal{D}(\Lambda_{jt} \parallel \bar{\Lambda}) - \Lambda_{jt} (\kappa + \theta^p \mathcal{D}(f_{jt} \parallel \bar{f})) \right], \quad (14)$$

where

$$\mathcal{D}(f \parallel \bar{f}) = \int f(p) \ln \left(\frac{f(p)}{\bar{f}(p)} \right) dp, \quad (15)$$

and $\mathcal{D}(\Lambda_{jt} \parallel \bar{\Lambda})$ is analogously defined.

Optimal Pricing Decisions

Let $V_t(p, a)$ denote the expected present value of charging real price p for a firm with idiosyncratic productivity a in the aggregate state Γ_t . This value is given by

$$V_t(p, a) = \pi_t^r(p, a) + E_t \left\{ M_{t,t+1} V_{t+1}^*(pP_t/P_{t+1}, a') \right\}, \quad (16)$$

where the continuation value V_{t+1}^* is the maximum attainable value assuming optimal choices henceforth, and the continuation price is eroded by inflation.¹ A firm that enters the period with real price \tilde{p} faces a choice of an adjustment probability and, conditional on adjusting, a reset price distribution. The firm's choices solve

$$\begin{cases} V_t^*(\tilde{p}, a) = \max_{\Lambda} \left\{ (1 - \Lambda) \cdot V_t(\tilde{p}, a) + \Lambda \cdot \left[V_t^{adj}(a) - \kappa \right] - \theta^a \mathcal{D}(\Lambda \parallel \bar{\Lambda}) \right\} \\ V_t^{adj}(a) = \max_f \left\{ \int V_t(p, a) f(p|a) dp - \theta^p \mathcal{D}(f \parallel \bar{f}) \right\} \end{cases} \quad (17)$$

where aggregate state dependence is suppressed for brevity. This problem is separable: the inner problem determines the value of adjusting $V_t^{adj}(a)$, which the outer problem takes as given when choosing the adjustment probability.

The Optimal Adjustment Probability

The optimal adjustment policy is characterized by the logit rule

$$\ln \left(\frac{\Lambda_t(\tilde{p}, a)}{1 - \Lambda_t(\tilde{p}, a)} \right) = \ln \left(\frac{\bar{\Lambda}}{1 - \bar{\Lambda}} \right) + \frac{1}{\theta^a} \left[V_t^{adj}(a) - V_t(\tilde{p}, a) - \kappa \right], \quad (18)$$

where $\bar{\Lambda}$ is the reference probability of adjustment used when the firm acquires no real-time information for its adjustment decision. Whatever the repricing policy, it is embedded in $V_t^{adj}(a)$, so the adjustment probability depends on the repricing frictions only through V_t^{adj} .

¹We omit firm subscripts j henceforth and instead index firms by their existing price and idiosyncratic state.

This specification nests several canonical models of price rigidity: Woodford's (2009) information-constrained form of a generalized Ss model ($\theta^a > 0$, $\kappa > 0$, $\theta^p = 0$), the menu cost model ($\kappa > 0$, $\theta^a = \theta^p = 0$), and the Calvo model ($\theta^a \rightarrow \infty$, $\theta^p = 0$). Moreover, with $\theta^a > 0$, the adjustment probability is a smooth, logistic function of the net benefit of adjustment, making the timing decision of the model equivalent to a random menu cost model with a specific distribution of menu costs (Alvarez, Lippi & Oskolkov, 2022).

The Optimal Reset Price Distribution

Unlike the canonical models, firms in this environment must also acquire information in order to determine what price to set when adjusting their prices. The optimal distribution of reset prices is given by

$$f_t(p | a) = \frac{\bar{f}(p) \exp \left\{ \frac{1}{\theta^p} V_t(p, a) \right\}}{\int \bar{f}(\hat{p}) \exp \left\{ \frac{1}{\theta^p} V_t(\hat{p}, a) \right\} d\hat{p}}, \quad (19)$$

which is a distribution that tilts the reference distribution \bar{f} toward higher-value prices. As $\theta^p \rightarrow 0$, the distribution collapses to a degenerate mass at the full-information optimal price for each (a, Γ_t) , recovering perfect repricing. For $\theta^p > 0$, the distribution places positive probability on all prices in the support of \bar{f} , generating repricing frictions: firms that adjust do not fully close their price gaps.

The Distribution of Prices and the Resource Cost of Price Frictions

The resulting joint distribution of prices and idiosyncratic productivity levels, $\Omega_t(p, a)$, evolves according to

$$\Omega_t(p, a) = [1 - \Lambda_t(p, a)] \cdot \tilde{\Omega}_t(p, a) + \left[\int \Lambda_t(\hat{p}, a) \tilde{\Omega}_t(\hat{p}, a) d\hat{p} \right] \cdot f_t(p | a), \quad (20)$$

where $\tilde{\Omega}_t(p, a)$ is the joint distribution before pricing decisions have been made in the period, but after the realization of shocks, and it is given by

$$\tilde{\Omega}_t(p, a) = \int \Omega_{t-1}(pP_t/P_{t-1}, \hat{a}) \cdot \mathcal{T}(\hat{a}, a) d\hat{a}, \quad (21)$$

and $\mathcal{T}(\hat{a}, a)$ is the transition probability across idiosyncratic productivity levels.

The implied resource cost of the pricing frictions is

$$F_t = \int \left\{ \theta^a \mathcal{D}(\Lambda_t(\tilde{p}, a) \parallel \bar{\Lambda}) + \Lambda_t(\tilde{p}, a) \left[\kappa + \theta^p \mathcal{D}(f_t(\cdot | a) \parallel \bar{f}) \right] \right\} d\tilde{\Omega}_t(\tilde{p}, a), \quad (22)$$

where the first term represents the review costs and the second term represents the repricing costs in the period, conditional on adjustment.

The Reference Distributions

Let $\Omega_{ss}(p, a)$ and $\tilde{\Omega}_{ss}(p, a)$ denote the steady state joint distributions before and after pricing decisions are made. The steady state reference distributions for making review and reset pricing decisions are then given by

$$\bar{\Lambda} = \int \Lambda_{ss}(\tilde{p}, a) \tilde{\Omega}_{ss}(\tilde{p}, a) d\tilde{p} da, \quad (23)$$

$$\bar{f}(p) = \int \Omega_{ss}(p, a) da. \quad (24)$$

That is, $\bar{\Lambda}$ is the unconditional steady-state probability of adjustment and \bar{f} is the marginal distribution of prices post-adjustment in steady state.²

Wage Setting

To avoid overstating the flexibility of marginal costs and the severity of pricing frictions, we use a reduced-form specification that captures real wage stickiness parsimoniously. The equilibrium real wage is a combination of its steady-state value and the competitive real wage that would clear the labor market:

$$w_t = (1 - \delta^w) w_{ss} + \delta^w w_t^c, \quad (25)$$

²The steady-state equilibrium distributions are motivated by the idea that decision makers with prior experience find it “easy” or “intuitive” to use as a reference a distribution that is optimal on average. This is an approximation to the information-theoretically optimal reference distribution, which is the marginal distribution that minimizes the expected KL divergence from the conditional distribution, integrating over states the firm expects to encounter over the life of its policy. See [Morales-Jiménez & Stevens \(2025\)](#) for a discussion of this assumption and the distinction between “pure” and “approximate” rational inattention.

where w_{ss} is the steady-state wage, $\delta^w \in (0, 1]$ controls the degree of wage flexibility, and the competitive wage is

$$w_t^c = \frac{\omega L_t^{1/\nu}}{(1 - \tau_t) C_t^{\gamma-1/\psi}}. \quad (26)$$

Fiscal Authority

The government undertakes an exogenous stream of real spending G_t , governed by an AR(1) process,

$$\ln G_t = (1 - \rho_g) \ln \bar{G} + \rho_g \ln G_{t-1} + \epsilon_{g,t}, \quad \epsilon_{g,t} \sim \mathcal{N}(0, \sigma_g^2), \quad (27)$$

where \bar{G} is the steady-state level of government purchases. Expenditures are financed using time-varying proportional labor income taxes τ_t , which also follow an independent AR(1) process,³

$$\tau_t = (1 - \rho_\tau) \bar{\tau} + \rho_\tau \tau_{t-1} + \epsilon_{\tau,t}, \quad \epsilon_{\tau,t} \sim \mathcal{N}(0, \sigma_\tau^2), \quad (28)$$

and lump-sum taxes net of transfers Z_t . Government bonds are in zero net supply, $B_t = 0$, and lump-sum taxes adjust residually each period to balance the budget:

$$Z_t = G_t - \tau_t w_t L_t. \quad (29)$$

Monetary Authority

The model is closed with a monetary authority that sets the nominal interest rate according to a Taylor rule with interest rate smoothing. Each month t , the annualized policy rate responds with a one month lag to inflation and output gaps,

$$i_t^a = \rho_i i_{t-1}^a + (1 - \rho_i) [i_{ss}^a + \phi_\pi (\bar{\pi}_{t-1} - \pi^*) + \phi_x (x_{t-1}^q - \bar{x}^q) + m_t^a], \quad (30)$$

³For the shock sizes we consider, τ_t remains well within $(0, 1)$.

where $m_t^a \sim \mathcal{N}(0, \sigma_m^2)$ is an i.i.d. monetary policy shock, the inflation measure is the average of the three most recent annualized inflation rates:

$$\bar{\pi}_{t-1} = \frac{1}{3} \sum_{j=1}^3 \pi_{t-j}^a, \quad (31)$$

and π^* is the inflation target. The term $x_{t-1}^q - \bar{x}^q$ measures deviations of the GDP gap from its steady-state level, so that monetary policy responds to fluctuations in the gap but does not target the permanent distortion arising from pricing frictions. The output gap fluctuations are given by the deviation of trailing three-month cumulative GDP from its efficient level:

$$x_{t-1}^q = \ln(\text{GDP}_{t-1} + \text{GDP}_{t-2} + \text{GDP}_{t-3}) - \ln(\text{GDP}_{t-1}^* + \text{GDP}_{t-2}^* + \text{GDP}_{t-3}^*) \quad (32)$$

where $\text{GDP}_t = C_t + G_t$ excludes the resource cost of pricing frictions, and GDP_t^* is the GDP that would prevail under full information flexible prices, and with proportional taxes and markups fixed at their steady-state values ($\tau_t = \bar{\tau}$, $\varepsilon_t = \bar{\varepsilon}$). Since the flex-price economy has no pricing frictions, $\text{GDP}_t^* = Y_t^*$. The flex-price economy is identical across all pricing friction specifications, so Y_t^* and Y_{ss}^* are common across models.

The steady-state output gap is

$$\bar{x}^q = \ln \text{GDP}_{ss} - \ln Y_{ss}^*. \quad (33)$$

When comparing models with different pricing frictions, any differences in the GDP gap, and hence in the policy response, are driven entirely by how each model's pricing frictions propagate shocks through the economy.

3 Calibration and Steady State

We compare three specifications of the pricing friction: the full MJS model with repricing errors ($\theta^p > 0$), the Woodford (2009) generalized Ss model with perfect repricing ($\theta^p = 0$), and Calvo. All three share the same non-pricing block and the same idiosyncratic shock

process. They differ only in how the pricing friction is parameterized. Table I reports all parameter values. The models are calibrated at a monthly frequency.

Externally calibrated parameters

The discount factor $\beta = (1.03)^{-1/12}$ implies a 3% annual real interest rate. The intertemporal elasticity of substitution is $\psi = 0.75$ and the Frisch elasticity of labor supply is $\nu = 1$. The elasticity of substitution across varieties is $\varepsilon = 9$, implying a steady-state gross markup $\bar{\mu} = 1.125$. Trend inflation is 2% annually. The ratio of government spending to consumption in steady state is $g_c = \bar{G}/\bar{C} = 0.25$. The Taylor rule uses $\phi_\pi = 1.1$, $\phi_x = 0$, and quarterly interest rate smoothing $\rho_{i,q} = 0.75$ (monthly $\rho_i = 0.75^{1/3} \approx 0.91$). Wage flexibility is $\delta^w = 1/8$, corresponding to wages adjusting on average every 8 months.

Common internally calibrated parameters

The idiosyncratic productivity process has monthly persistence $\rho = 0.9707$, set at the midpoint of estimates from firm-level dynamics. Given ρ , the innovation standard deviation $\sigma = 0.048$ is chosen so that the Woodford model generates a standard deviation of price changes in the range of 12–12.5%, consistent with US CPI microdata.

The labor disutility parameter ω and the steady-state tax rate $\bar{\tau}$ are calibrated from the flex-price economy. We normalize flex-price output to unity ($Y^* = 1$) and set steady-state lump-sum transfers to zero ($Z^* = 0$), which pins down $\bar{\tau} = 0.225$. Then $\omega = 1.277$ is backed out from the intratemporal first-order condition. Both ω and $\bar{\tau}$ are held fixed across model specifications; in the frictional economy, the lump-sum transfer \bar{Z} adjusts to balance the government budget.

Pricing friction parameters

The pricing parameters θ^a , κ , and θ^p differ across models and are the key objects of the calibration. Our strategy is to parameterize all models to have the same frequency of price changes and the same degree of aggregate monetary non-neutrality, and then let the models' predictions for other moments and for shock propagation differ freely.

TABLE I: Parameter Values

<i>Externally calibrated (common across models)</i>			
Discount factor	β	$(1.03)^{-1/12}$	3% annual real rate
Intertemporal elast.	ψ	0.75	
Frisch elasticity	ν	1	
Elast. of substitution	ε	9	markup $\bar{\mu} = 1.125$
Annual inflation	π^*	2%	
Gov. spending / cons.	g_c	0.25	
Wage flexibility	δ^w	1/8	avg. wage duration 8 months
Taylor rule: inflation	ϕ_π	1.1	
Taylor rule: output gap	ϕ_x	0	
Taylor rule: smoothing	$\rho_{i,q}$	0.75	monthly $\rho_i \approx 0.91$
<i>Internally calibrated (common across models)</i>			
Idiosyncratic persistence	ρ	0.9707	firm dynamics midpoint est.
Idiosyncratic SD	σ	0.048	Woodford: SD $\Delta p = 12\text{--}12.5\%$
Labor disutility	ω	1.277	flex-price $Y^* = 1$
Steady-state tax rate	$\bar{\tau}$	0.225	flex-price $Z^* = 0$

Specifically, in each model we choose θ^a and κ to match: (i) a frequency of price changes of 10%, consistent with US CPI microdata, and (ii) a cumulative impulse response (CIR) of output to a monetary policy shock of 0.65%, based on [Smets & Wouters \(2007\)](#) adjusted for the absence of investment, and in the range of recent hybrid (HFI/VAR) estimates. In MJS, the repricing cost θ^p provides an additional degree of freedom. It is calibrated to match the semi-elasticity of the frequency of price changes with respect to inflation, $\Delta\text{freq}/\Delta\pi = 0.64$, estimated from US CPI microdata for the range $\Delta\pi$ from 2% to 8% (the post-Covid relevant US range).

In Calvo, the adjustment probability is exogenous ($\theta^a = \infty$) and there are no menu costs ($\kappa = 0$). Only one target can be matched: we report two Calvo calibrations, one matching frequency and one matching CIR.

Model-implied moments

Table [III](#) compares the pricing moments across model specifications. All three models match the targeted 10% frequency and the targeted 0.65% CIR (bold entries). The key difference

TABLE II: Pricing Parameters Across Models

		Mispricing	Woodford	Calvo	Target
Review cost	θ^a	0.51	1.21	∞	CIR Y_m in US = 0.65%
Menu cost	κ	0.017	0.212	∞ w.p. 0.1, 0	Freq Δp in US CPI = 10%
Repricing cost	θ^p	0.18	0	0	$\overline{\Delta \text{freq}/\Delta \pi}$ in US CPI = 0.64

TABLE III: Moments Across Models

	Mispricing	Woodford	Calvo - CIR	Calvo - freq
SD Δp	13.69%	12.35%	9.46%	10.96%
Freq Δp	10%	10%	19.6%	10%
CIR Y_m	0.65%	0.65%	0.65%	1.06%
$\Delta \text{freq}/\Delta \pi$	0.64	0.38	–	–

Targeted moments in bold.

is in the untargeted moments. MJS matches the semi-elasticity of frequency with respect to inflation (0.64), while Woodford, constrained to use $\theta^p = 0$, delivers only 0.38 at the same CIR. This is the core tension: in models with perfect repricing, achieving significant non-neutrality at low inflation requires timing frictions close to Calvo, which in turn makes the frequency of price changes nearly unresponsive to inflation. Repricing frictions break this tradeoff, as follows.

Calvo cannot simultaneously match frequency and CIR: matching the CIR requires a frequency of nearly 20%, while matching the frequency delivers a CIR of over 1%.

How mispricing breaks the tradeoff

In models with perfect repricing ($\theta^p = 0$), all monetary non-neutrality comes from the extensive margin: which firms adjust. More state-dependent timing (θ^a smaller, κ smaller) makes frequency more responsive to inflation, but it also reduces the CIR because the “right” firms are adjusting and selection effects are strong. At matched CIR, Woodford requires relatively large θ^a and κ —timing closer to Calvo, larger menu costs—and delivers a semi-elasticity of only 0.38, versus 0.64 in the data.

With repricing frictions ($\theta^p > 0$), adjusters don’t fully close their price gaps, providing

an intensive-margin source of non-neutrality. This frees the extensive margin to be much more state-dependent: MJS achieves the same CIR with $\theta^a = 0.51$ (vs. 1.21 for Woodford) and $\kappa = 0.017$ (vs. 0.212). The result is a frequency that responds strongly to inflation ($\Delta f/\Delta\pi = 0.64$), matching the data.

Repricing mistakes are systematic—they do not wash out with aggregation. Firms that adjust in response to an inflationary shock draw new prices from a distribution that is tilted toward, but not concentrated at, the full-information optimum. The residual mispricing generates aggregate price dispersion and output effects over and above what the extensive margin produces.

Steady-state friction costs

Table IV reports the resource cost of pricing frictions in steady state, expressed as a share of output. Total friction costs are 2.3% of output in MJS and 3.1% in Woodford. In MJS, the largest component is the repricing cost (1.3%), reflecting the information expenditure required to choose reset prices. Menu costs are small (0.2%) because the highly state-dependent adjustment rule ($\theta^a = 0.51$, $\kappa = 0.017$) means that few firms pay the fixed cost in any given period. In Woodford, the composition is reversed: menu costs account for 2.2% of output, reflecting the large $\kappa = 0.212$ needed to generate sufficient non-neutrality with perfect repricing. Calvo has zero friction costs by construction.

Price dispersion in both MJS and Woodford is about 3% higher than in the flex-price economy. Calvo-freq, despite having zero friction costs, has the highest price dispersion (7.6% above flex) because the exogenous timing of adjustment prevents firms from correcting large price gaps.

4 Dynamics

Having established that MJS, Woodford, and Calvo can all be parameterized to deliver the same frequency of price changes and the same aggregate non-neutrality, we now ask: does the *source* of nominal rigidity matter for how the economy responds to shocks? If the three models are observationally equivalent at the calibration targets, do they make different

TABLE IV: Steady-State Friction Costs (Share of Output)

	MJS	Woodford	Calvo - freq	Calvo - CIR
Total friction cost F/Y	2.34%	3.07%	0	0
Review costs	0.83%	0.84%	0	0
Repricing costs	1.34%	0	0	0
Menu costs	0.18%	2.22%	0	0
Price dispersion / flex	1.033	1.028	1.076	1.035

predictions elsewhere?

4.1 Impulse Responses

We compute impulse responses to six shocks in all three models: a monetary expansion (50 basis point rate cut), a government spending increase (1%), a TFP increase (1%), a markup increase (1%), a review cost increase (10%), and a repricing cost increase (5%). The last two shocks—exogenous variation in θ^a and θ^p —are novel to the MJS framework and have no counterpart in standard models.

For each shock, we report the responses of macro aggregates (output, consumption, inflation, the nominal rate), the output gap, and several pricing moments (frequency of price changes, standard deviation, average price gap conditional on adjustment, and the shares of information acquisition devoted to review vs. repricing). These pricing moment responses are a distinctive feature of the model: they provide rich, testable implications that go beyond the aggregate dynamics.

Monetary expansion

Figure 1 reports the responses to a 50 basis point rate cut.

By construction, the cumulative output responses are equalized across models. The dynamic paths differ. In MJS, the output response is more front-loaded: the initial impact is larger, but the response dies out faster. This reflects the more state-dependent timing ($\theta^a = 0.51$): firms that are far from their optimal price adjust quickly, generating a rapid initial response, but this also means the shock is absorbed faster.

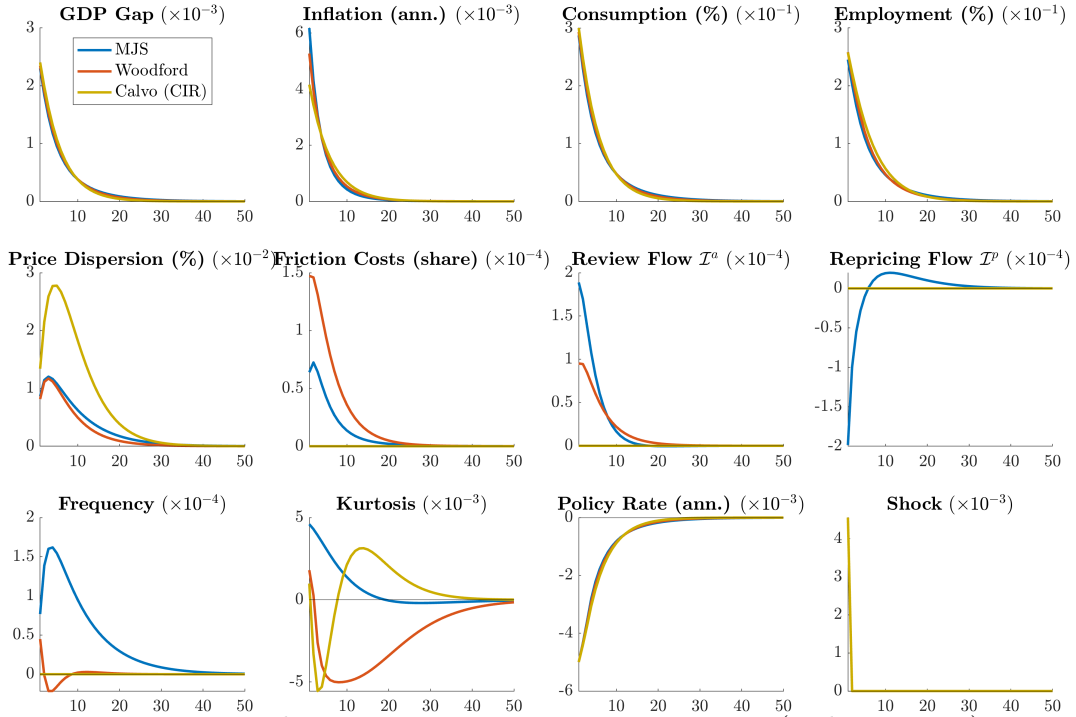


Figure 1: Impulse responses to a monetary expansion (50 bp rate cut).

The pricing moment responses reveal the mechanism. In MJS, the frequency of price changes rises on impact—firms find it worthwhile to pay the review cost more often when the monetary shock shifts their environment. At the same time, the average price gap conditional on adjustment increases: even firms that do adjust set prices that are further from the full-information optimum, because the repricing friction prevents full optimization. In Woodford, frequency barely moves (timing is closer to Calvo), and the average price gap is zero by construction.

Government spending and TFP

Figures 2 and 3 report responses to a government spending increase and a TFP increase, respectively.

The pattern across models is qualitatively similar to the monetary shock. In response to inflationary shocks, the mispricing model generates a substitution of information acquisition: repricing flows fall while review flows rise, and the frequency of adjustment increases. The average price gap conditional on adjustment also rises, reflecting that repricing accuracy deteriorates when the environment shifts. Price dispersion increases in all three models, but

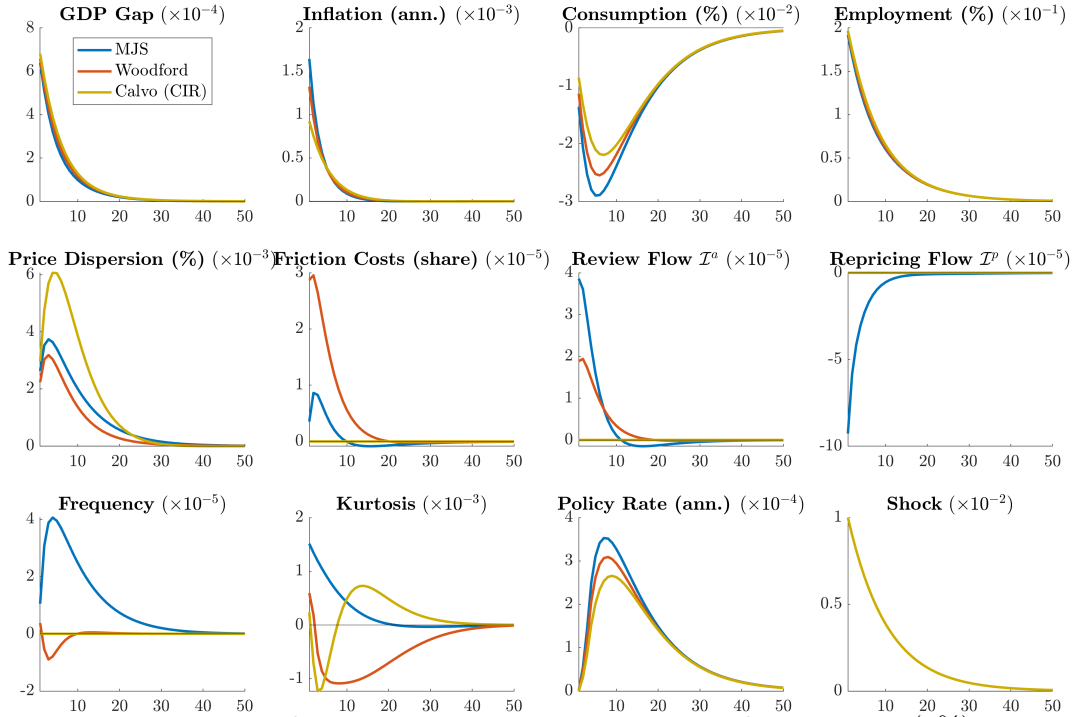


Figure 2: Impulse responses to a government spending increase (1%).

the ranking is Woodford < MJS < Calvo: the endogenous increase in information acquisition in MJS and Woodford partially offsets the shock’s impact on dispersion, while Calvo provides no such adjustment.

Markup shocks

Figure 4 reports the response to a 1% markup increase.

Mispricing makes markup shocks worse. The MJS model generates both a larger output gap and a larger inflation response than Woodford, which in turn generates larger responses than Calvo. The result is a more persistent deviation of actual prices from their new desired levels, amplifying the real effects of the shock.

Friction shocks

Figures 5 and 6 report responses to increases in the review cost θ^a and the repricing cost θ^p , respectively. These are novel shocks with no counterpart in Calvo (where adjustment is exogenous and repricing is frictionless) or in standard menu cost models.

Both shocks act as cost-push disturbances: they increase inflation, lower output, and

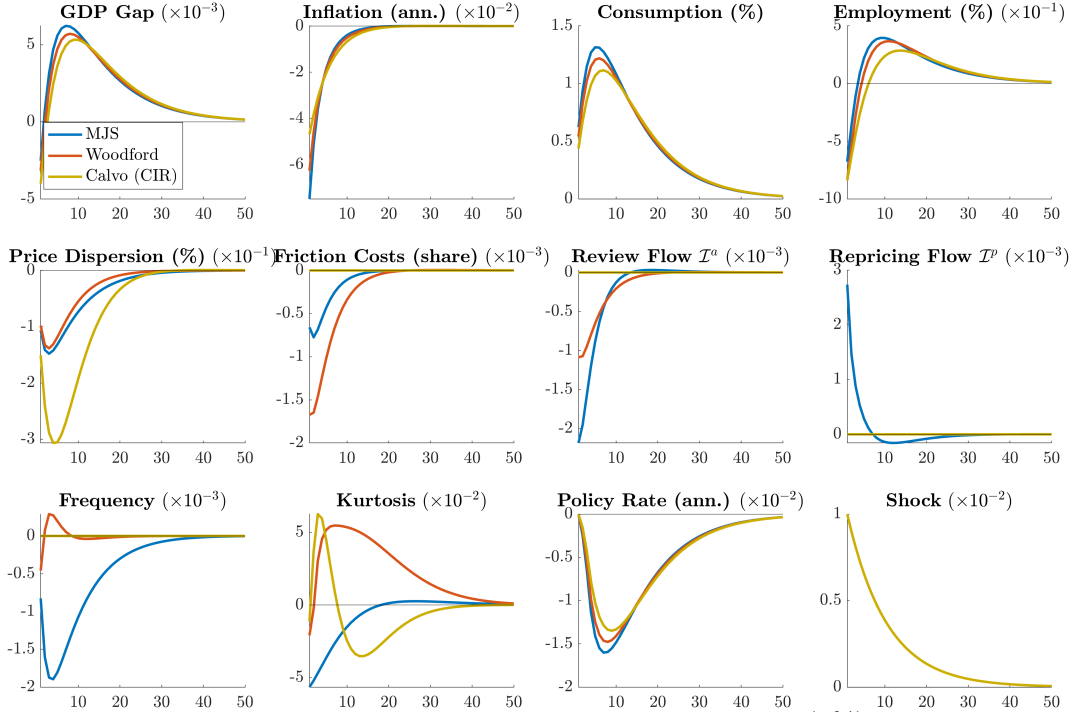


Figure 3: Impulse responses to a TFP increase (1%).

increase price dispersion. But they have different effects on the pricing moments. An increase in θ^a reduces the frequency of adjustment (reviewing becomes more expensive, so fewer firms choose to adjust) while an increase in θ^p increases the average price gap conditional on adjustment (repricing becomes noisier). These distinct signatures provide a basis for separately identifying the two friction parameters from pricing microdata.

4.2 Summary

Two broad conclusions emerge from the impulse response analysis.

First, the mechanism generating nominal rigidities matters for the propagation of standard macroeconomic shocks. Even though all three models are calibrated to the same non-neutrality, mispricing generates qualitatively different dynamics: more front-loaded output responses, endogenous variation in pricing accuracy, and a systematic ranking of inflation and output gap responses (MJS > Woodford > Calvo for cost-push shocks).

Second, information costs θ^a and θ^p provide a new source of cost-push shocks. Both increase inflation and lower output, but they operate through different channels—the extensive margin (θ^a) vs. the intensive margin (θ^p)—and leave different fingerprints in pricing

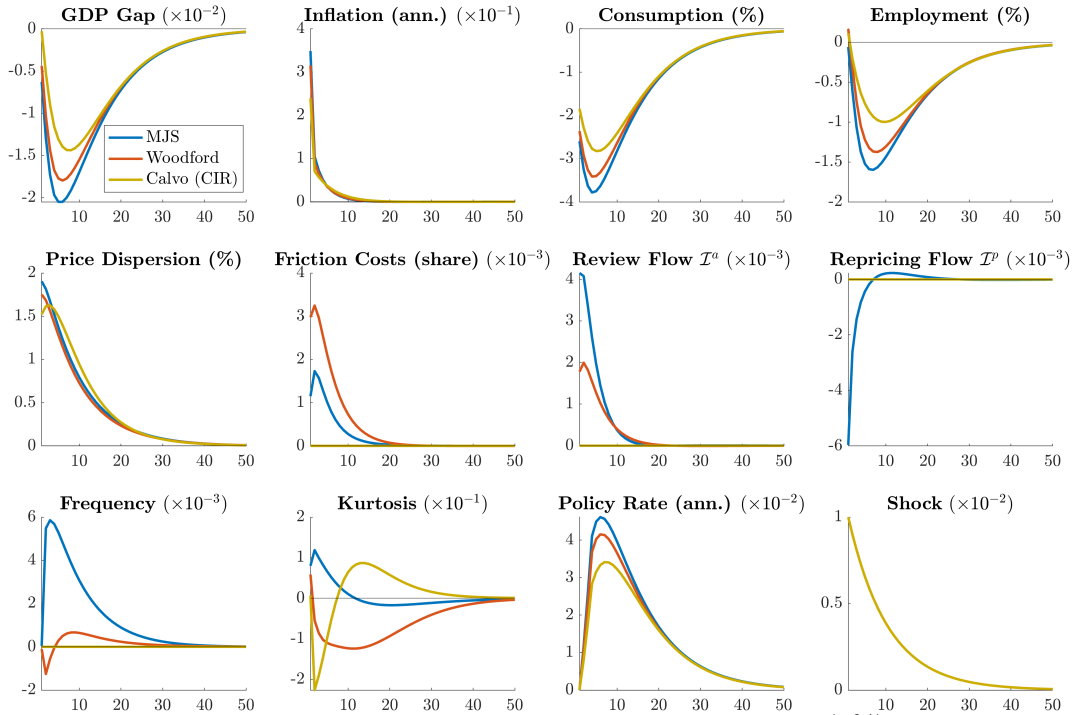


Figure 4: Impulse responses to a markup increase (1%).

moments. This opens the door to using microdata on pricing behavior to discipline the friction parameters and test the model’s predictions.

5 Optimal Simple Rules

The IRFs raise three distinct policy questions:

1. Do optimal Taylor rule coefficients differ across models? Does the source of nominal rigidity change what the central bank should do?
2. Does the resulting welfare loss differ across models, even under the same rule? Does the central bank face a harder stabilization problem in some models than others?
3. Is the standard loss function even the right tool to evaluate policy here? Does inflation capture all the welfare-relevant price dispersion—or does mispricing break that link?

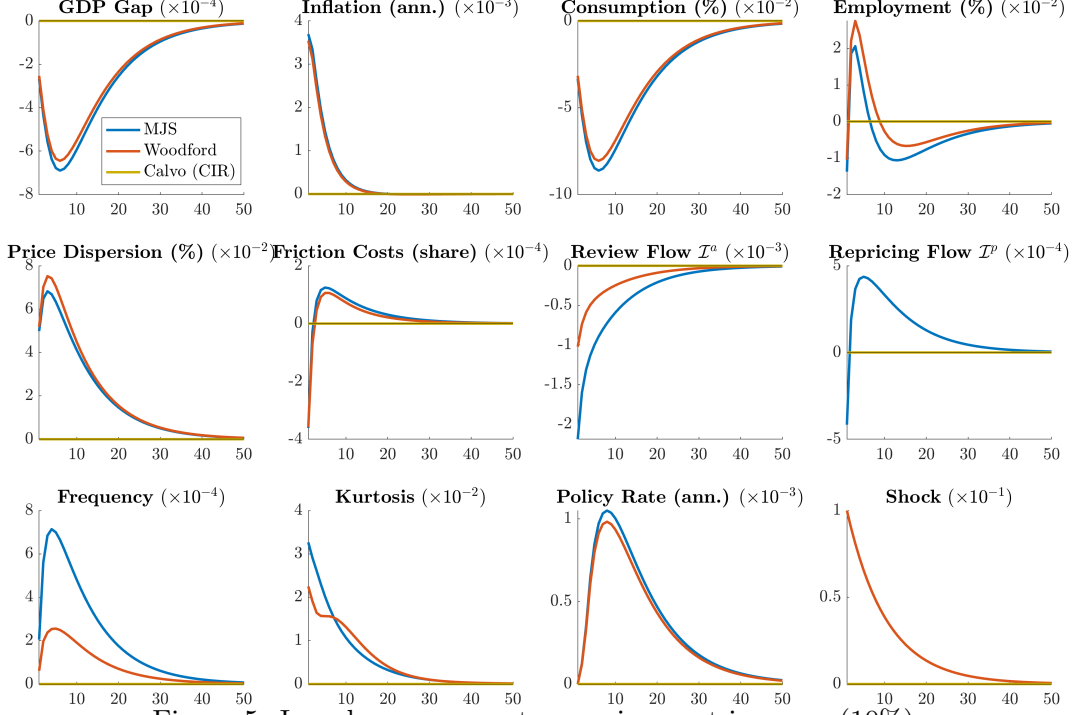


Figure 5: Impulse responses to a review cost increase (10%).

Policy loss function

The central bank minimizes the expected discounted loss

$$\mathcal{L} = E \sum_{t=0}^{\infty} \beta^t \left[(\bar{\pi}_t^q)^2 + \lambda (x_t^q - \bar{x}^q)^2 + \lambda_i (\Delta i_t^a)^2 \right], \quad (34)$$

where $\bar{\pi}_t^q = \frac{1}{3} \sum_{j=1}^3 \pi_{t-j}^a$ is average annualized inflation over the last quarter, $x_t^q - \bar{x}^q$ is the quarterly output gap (same definition as in the Taylor rule), $\Delta i_t^a = i_t^a - i_{t-1}^a$ is the change in the annualized policy rate, $\lambda = 0.25$, and $\lambda_i = 0.10$.

Welfare losses at the baseline rule

Table V reports the welfare loss at the baseline rule ($\phi_\pi = 1.1$, $\phi_x = 0$, $\rho_{i,q} = 0.75$), relative to Calvo.

Losses of MJS > Woodford > Calvo for every shock. Repricing frictions generate additional price dispersion that the baseline rule cannot stabilize.

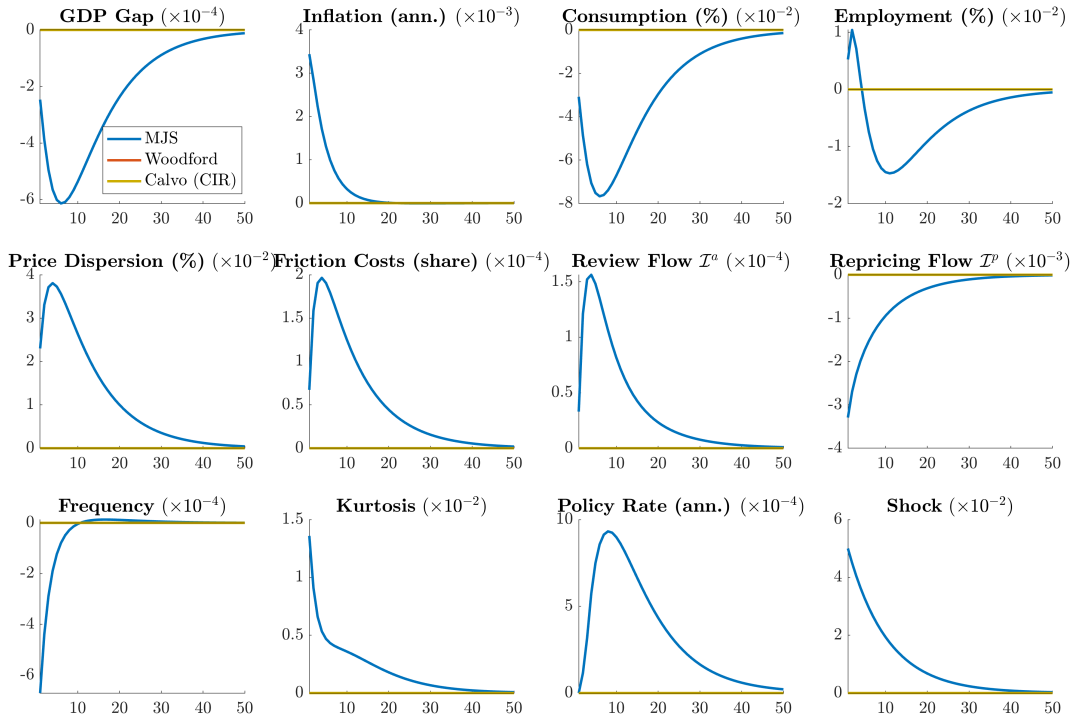


Figure 6: Impulse responses to a repricing cost increase (5%).

TABLE V: Welfare Loss at Baseline Rule (Relative to Calvo)

	Mispricing	Woodford	Calvo
Mon. pol.	1.27	1.13	1
Gov. spending	1.76	1.36	1
TFP	1.53	1.27	1
Markup	1.89	1.54	1

Optimal policy

We search over $(\phi_\pi, \phi_x, \rho_i)$ for each shock and each model. All models: divine coincidence holds for demand shocks. All models: respond aggressively to gaps. The key cross-model difference is interest rate smoothing. Table VI reports the optimal quarterly smoothing coefficient $\rho_{i,q}^*$.

MJS wants less smoothing than Woodford and Calvo for every real shock. Repricing frictions attenuate the effect of each rate change, so the central bank must act more decisively.

TABLE VI: Optimal Interest Rate Smoothing $\rho_{i,q}^*$

	Mispricing	Woodford	Calvo
Mon. pol.	0.83	0.86	0.85
Gov. spending	0.46	0.49	0.55
TFP	0.42	0.51	0.73
Markup	0.47	0.55	0.73
θ^p	0.49	—	—

Baseline rule: $\rho_{i,q} = 0.75$.

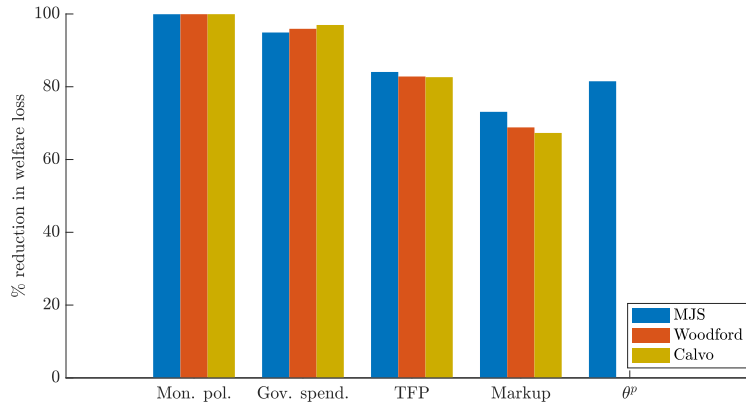


Figure 7: Percent reduction in welfare loss: optimal rule vs. baseline rule.

Welfare gains from optimization

Figure 7 reports the percent reduction in welfare loss from moving to the optimal rule, relative to the baseline ($\phi_\pi = 1.1$, $\phi_x = 0$, $\rho_{i,q} = 0.75$).

MJS benefits most from optimization, especially for cost-push shocks. Under mispricing, the central bank faces larger losses under a naive rule but can recover more of them by optimizing.

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