A Monetary Policy Asset Pricing Model

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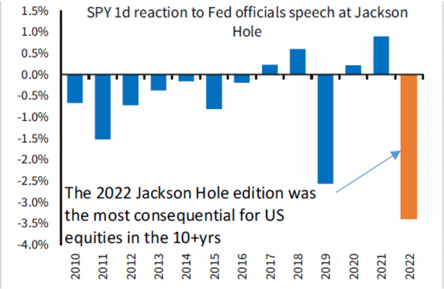
When does the Fed stabilize or destabilize the market?

- Central banks typically stabilize the stock markets ("the Fed put")
- Not so recently...



Source: Bloomberg

- Neel Kashkari (Pres. Minneapolis Fed): "I was actually happy to see how Chair Powell's Jackson Hole speech was received..."

What we do: Asset price implications of monetary policy

We assume the Fed **uses** asset prices to stabilize output gaps and inflation

We derive the aggregate asset price implied by optimal policy (**"pStar"**)

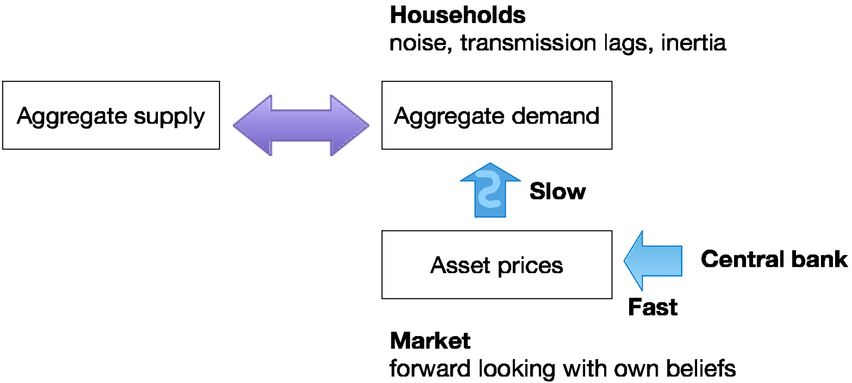
We account for **lags** and **inertia** that complicate the policy in practice

Powell, September 2022 FOMC press conference:

- "Monetary policy does, famously, work with long and variable lags..."
- "Our policy decisions affect financial conditions immediately..."
- "Then, it takes some time to see the full effects (on real activity)"

▸ Empirical evidence on lags

Asset price implications of the Fed in a two-speed economy



Supply side: Demand-driven output

- Potential output $Y_t^* \simeq A_t$. Subject to supply shocks (in logs):

$$y_{t+1}^* = y_t^* + z_{t+1}$$

- Nominal rigidities. Output is determined by **aggregate demand**
  - Fully sticky prices. In the paper, we introduce a Phillips curve
- Labor is supplied by hand-to-mouth agents. They induce multiplier
- Capital is held by asset-holding households. They drive demand...

Demand depends on P with noise, lags, inertia

Asset-holding households have standard time-separable log utility

But they do not **necessarily** make optimal decisions. Follow **rules**

- **Baseline:** Optimal consumption rule with log utility:

$$C_t^H = \underbrace{(1-\beta)}_{\text{MPC}} \times \underbrace{(\alpha Y_t + P_t)}_{\text{Wealth (Market portfolio)}}$$

- **Demand shocks:** Noisy deviation
- **Transmission lags:** React to **past** asset prices P_{t-1}
- **Aggregate demand inertia:** Partly react to **past spending** C_{t-1}^H

Market and central bank determine asset prices

- Log return on the market portfolio is $r_{t+1} = \log\left(\frac{\alpha Y_{t+1}+P_{t+1}}{P_t}\right)$
- Risk-free asset is in zero net supply. Central bank sets $i_t = \log R_t^f$

Market: Managers choose portfolio weight to maximize log **wealth** $\Longrightarrow$

$$\underbrace{E_t^M\left[r_{t+1}\right]}_{\text{discount rate}} = i_t + \frac{1}{2}\underbrace{var_t^M\left[r_{t+1}\right]}_{\text{risk premium}}$$

Central Bank: Sets i_t to close output gaps $\tilde{y}_t = y_t - y_t^*$ **under its belief**

CB effectively controls the aggregate asset price P_t, by adjusting i_t

Baseline model: Macro needs drive asset prices

$$
\begin{aligned}
C_t^H &= (1-\beta)(\alpha Y_t + P_t) \\
&\Longrightarrow \\
y_t &= m + p_t
\end{aligned}
$$

- The Fed sets $y_t = y_t^* \Longrightarrow$

$$p_t = y_t^* - m$$

- Aggregate asset price is driven by **macro needs—not finance**

Result (Fed put): RP/belief shocks don't affect p_t. Absorbed by i_t

Demand shocks: The Fed destabilizes asset prices

$$
\begin{aligned}
C_t^H &= (1-\beta)\left(\alpha Y_t + P_t \exp\left(\delta_t\right)\right) \\
&\Longrightarrow \\
y_t &= m + p_t + \delta_t
\end{aligned}
$$

- The Fed sets $y_t = y_t^* \Longrightarrow$

$$p_t = y_t^* - m - \delta_t$$

Result: AD shocks create "excess" asset volatility and risk premium

Transmission lags: The Fed's belief drives asset prices

$$
\begin{aligned}
C_t^H &= (1-\beta)\left(\alpha Y_t + P_{t-1}\exp(\delta_t)\right) \\
&\Longrightarrow \\
y_t &= m + p_{t-1} + \delta_t
\end{aligned}
$$

- The Fed can't set $y_t = y_t^*$. It targets $E_t^F[y_{t+1}] = E_t^F\left[y_{t+1}^*\right] \Longrightarrow$

$$
p_t = y_t^* - E_t^F\left[\tilde{\delta}_{t+1}\right] - m \text{ where } \tilde{\delta}_{t+1} \equiv \delta_{t+1} - z_{t+1}
$$

Result: The Fed's belief about **net AD shock** drives asset prices

Aggregate demand inertia: Policy-induced overshooting

$$
\begin{aligned}
C_t^H &\sim \left[\eta\beta C_{t-1}^H + (1-\eta)(1-\beta) P_{t-1}\right] \exp(\delta_t) \\
&\Longrightarrow \\
y_t &\sim \eta y_{t-1} + (1-\eta) p_{t-1} + \delta_t
\end{aligned}
$$

- The Fed targets $E_t^F [y_{t+1}] = E_t^F \left[y_{t+1}^*\right] \Longrightarrow$

$$
p_t = y_t^* - \underbrace{\frac{\eta}{1-\eta}\tilde{y}_t}_{\textbf{overshooting}} - \frac{E_t^F\left[\tilde{\delta}_{t+1}\right]}{1-\eta} - m
$$

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$$

CS (2022a): Overshooting and disconnect during Covid-19

Similar for **temporary supply shock:** y_t^* low but $E_t^F\left[y_{t+1}^*\right]$ high

Disagreements and inflation generate additional results

Fed market disagreements:

- The market perceives excess volatility $\Longrightarrow$ **Policy risk premium**
- The market learns the Fed's belief $\Longrightarrow$ **Endogenous MP shocks**
- The market thinks the Fed will reverse policy $\Longrightarrow$ **Behind the curve**

Inflation/Phillips curve:

- Demand and supply-driven inflation **both** reduce asset prices

Conclusion: A monetary policy asset pricing model

The Fed drives aggregate asset prices to achieve macro objectives

- The Fed controls **aggregate asset prices (FCI)**—i_t is the tool

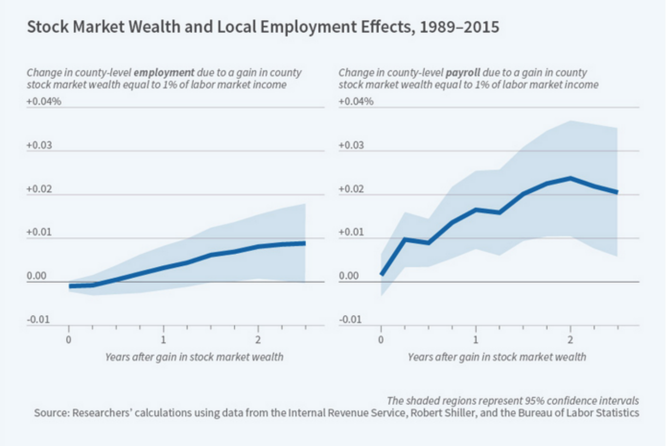
The Fed stabilizes financial shocks & uses asset prices to offset real shocks

Transmission lags make the Fed's belief determine aggregate asset prices

- Fed-market disagreements induce policy risk premium and MP shocks

Inertia makes the Fed overshoot asset prices and induce a disconnect

A key friction: Transmission delays from asset prices



- Chodorow-Reich et al. (2021): Long lags for stock wealth effect

A key friction: Transmission delays from asset prices

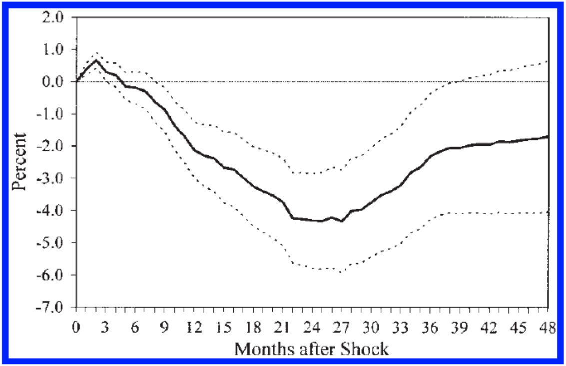
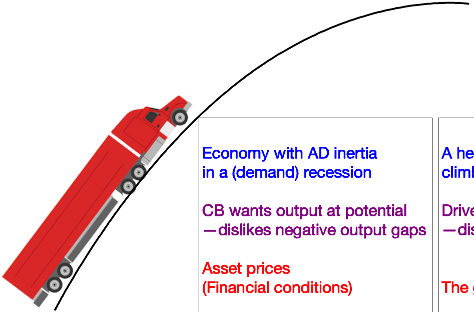


FIGURE 2. THE EFFECT OF MONETARY POLICY ON OUTPUT

- Romer-Romer (2004), "A New Measure of Monetary Shocks"

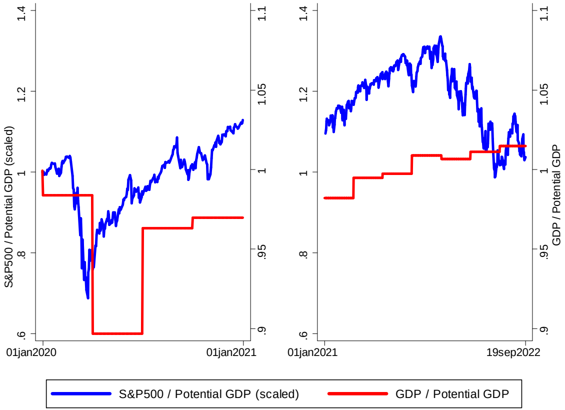
Fed overshoots prices and induces Wall/Main St disconnect



Economy with AD inertia in a (demand) recession	A heavy truck climbing a hill
CB wants output at potential —dislikes negative output gaps	Driver wants constant speed —dislikes slowing down
Asset prices (Financial conditions)	The gas pedal

$$y_{t+1} = \underbrace{\eta y_t}_{\text{output is low} \implies} + \underbrace{(1-\eta)\, p_t}_{\text{asset prices are high to offset}} + \delta_{t+1}$$

Wall/Main Street disconnect during Covid-19



- CS (2022a): Similar ingredients (inertia, no lags) $\Longrightarrow$ Overshooting
- Quantitative: Overshooting via rates can explain high prices in 2021...

A price decomposition based on the market-bond portfolio

Market-Bond: Bond portfolio that matches **duration** of stock market

- Captures **the policy support** to asset prices **via risk-free rates**

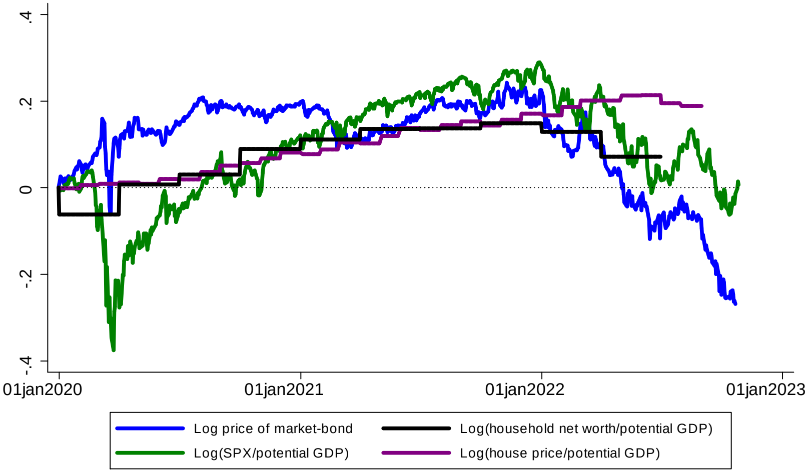
$$p(t) = \underbrace{p^{MB}(t)}_{\text{forward interest rates}} + \underbrace{p^{O}(t)}_{\text{cash flows/other}}$$

- Can be measured from **inflation-adjusted (TIPS) forward rates**

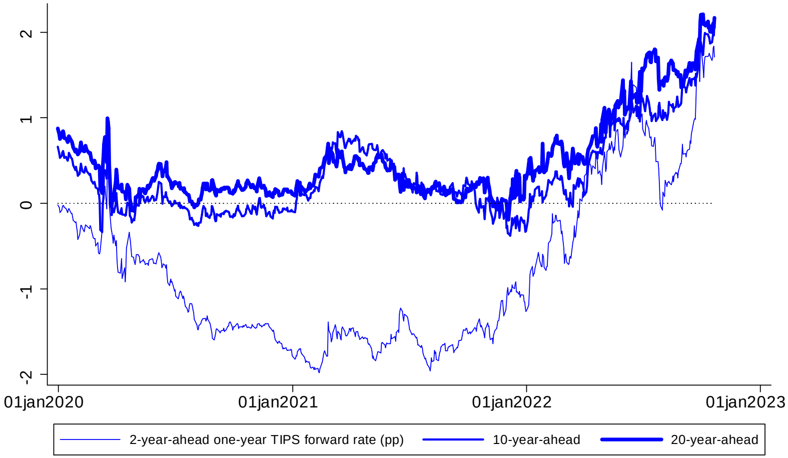
$$\dot{p}^{MB}(t) = -\int_0^\infty W_\mu \frac{\partial f(t,\mu)}{\partial t} d\mu.$$

- We implement this with weights from Van Binsbergen (2020)...

Policy-induced overshooting via risk-free rates was large



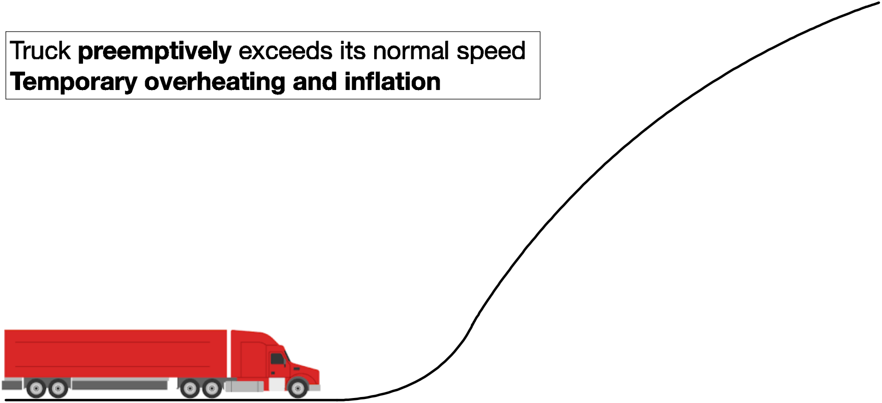
Overshooting was partly due to long-term rate declines



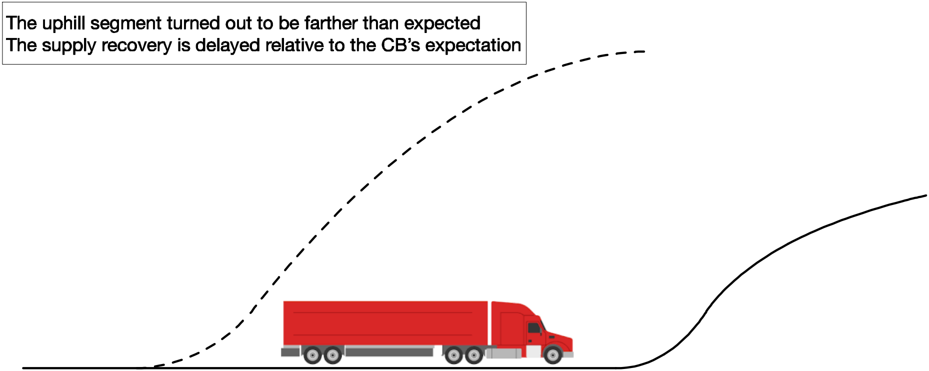
- LSAPs/QE might have substituted for large short-rate cuts

Temporary supply shock: Preemptive overshooting

Truck **preemptively** exceeds its normal speed
Temporary overheating and inflation



Current situation: Supply recovery delayed => overheating



CS (2022c), "A Note on Temporary Supply Shocks with AD Inertia"

- If inflation also has inertia, CB gradually cools down the economy

What if the markets disagree with the Fed's belief?

- Suppose agent $j \in \{F, M\}$ thinks:

$$s_t + \mu_t^j =^j \delta_{t+1} + e_t$$

  - Heterogeneous interpretations μ_t^F, μ_t^M with $corr\left(\mu_t^F, \mu_t^M\right) = 1 - \frac{D}{2}$
  - $D \geq 0$ captures the scope for **new disagreements**

- **Posterior beliefs are not the same:**

$$E_t^j\left[\delta_{t+1}\right] = \gamma\left(s_t + \mu_t^j\right)$$

- Agents think **other agent's belief** is a noisy version of own belief:

$$Var^M\left(\text{Fed's belief}\right) = Var^M\left(\text{Own belief}\right) + \gamma^2 D \sigma_\mu^2$$

Disagreements induce "mistakes" and policy risk premium

- The Fed will stabilize future asset prices under its belief

$$p_{t+1} = y^*_{t+1} - \frac{\eta}{1-\eta}\tilde{y}_{t+1} - \frac{\gamma\left(s_{t+1} + \mu^F_{t+1}\right)}{1-\eta} - m$$

- Market perceives "mistake": Price "should" depend on μ^M_{t+1}

- Market perceives excess price volatility $var^M_t\left(p_{t+1}\right) \sim \frac{\gamma^2 D\sigma^2_\mu}{(1-\eta)^2}$

- **Result:** Market demands a **policy "mistakes" risk premium**

$$rp_t = rp^{common}_t + \beta^2 \frac{\gamma^2 D\sigma^2_\mu}{(1-\eta)^2}$$

Disagreements induce a “behind-the-curve” phenomenon

- A demand-optimistic market expects a positive gap/**demand boom**:

$$E_t^M [\tilde{y}_{t+1}] = \gamma \left(\mu_t^M - \mu_t^F \right)$$

- It also expects **policy reversal** and **lower future asset price:**

$$E_t^M [p_{t+1}] = y_t^* - \frac{\eta \left(\mu_t^M - \mu_t^F \right)}{1 - \eta} - m$$

Behind-the-curve: Dovish Fed will reverse and tighten to undo “mistake”

“Mistakes” / “behind-the-curve” also affect $E_t^M [r_{t+1}]$ and the policy rate i_t

Disagreements microfound monetary policy shocks

- Suppose the market learns μ_t^F later in the period. Initially thinks:

$$\mu_t^F \simeq \tilde{\beta}\mu_t^M + \tilde{\varepsilon}_t^F$$

- Asset price before and after the market observes Fed's belief:

$$\begin{aligned} E_t^M [p_t] &\sim -\frac{\gamma}{1-\eta}\tilde{\beta}\mu_t^M \\ p_t &\sim -\frac{\gamma}{1-\eta}\mu_t^F \end{aligned}$$

Result: Fed belief surprises drive asset prices & **microfound MP shocks:**

$$\Delta p_t = -\frac{\gamma\tilde{\varepsilon}_t^F}{1-\eta} \text{ and } \Delta i_t = \frac{\beta+\eta}{1-\eta}\gamma\tilde{\varepsilon}_t^F$$

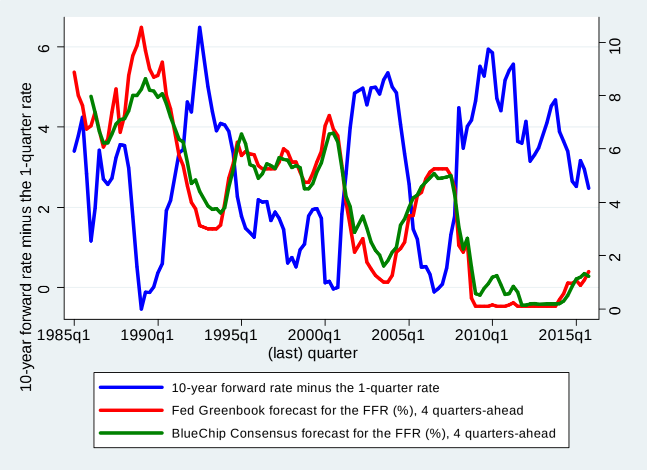
"Behind-the-curve": MP shocks from Fed beliefs will flip

- The current short rate i_t is **increasing** in the Fed's belief μ_t^F
- Market's expected future short rate is **decreasing** in Fed's belief μ_t^F:

$$E_{t+1}^M \left[i_{t+1}\right] \sim \rho + \frac{\eta\gamma\left(\mu_t^M - \mu_t^F\right)}{1-\eta}$$

Fed's belief μ_t^F (given μ_t^M) has **opposite** effect on i_t and $f_t \simeq E_{t+1}^M \left[i_{t+1}\right]$

Behind-the-curve in the data? (preliminary)



Behind-the-curve in the data? (preliminary)

Table: Forward rates as a function of the Market's and the Fed's beliefs (for FFR)

	f1y	f5y	f10y	f10minus1
BlueChip FFR	0.544**	1.040**	1.166**	0.916**
prediction	(0.096)	(0.200)	(0.210)	(0.233)
Greenbook FFR	0.464**	-0.296	-0.542**	-1.224**
prediction	(0.086)	(0.177)	(0.187)	(0.213)
Observations	116	116	116	116
R^2 (adjusted)	0.946	0.738	0.635	0.587

Quarterly time series of Greenbook and BlueChip forecasts from 1986-2015

How do inflation surprises affect asset prices?

- Let us introduce inflation via **the standard NKPC**

$$\pi_t = \kappa \tilde{y}_t + \beta E_t^P [\pi_{t+1}]$$

- The Fed now minimizes $E_t^F \left[\sum \beta^h \left(\tilde{y}_{t+h}^2 + \psi \pi_{t+h}^2 \right) \right]$
- With common beliefs beliefs, both gaps are zero *on average:*

$$E_t [\tilde{y}_{t+1}] = E_t [\pi_{t+1}] = 0$$

- "Divine coincidence" *in expectation*

Inflation is bad news for aggregate asset prices

- Inflation is driven by current demand and supply shocks:

$$\pi_t = \kappa \tilde{y}_t \text{ where } \tilde{y}_t = (\delta_t - z_t) - E_{t-1}[\delta_t - z_t]$$

- Asset prices are also driven by supply and demand shocks:

$$p_t \sim y^*_{t-1} + z_t - \frac{\eta}{1-\eta}\tilde{y}_t$$

Result: Inflation surprises are **bad news** for asset prices

$$cov_{t-1}(\pi_t, p_t) = -\kappa \frac{1}{1-\eta}\sigma_z^2 - \kappa \frac{\eta}{1-\eta}\sigma_\delta^2 < 0$$

Negative covariance for **both demand or (persistent) supply shocks**

Related literature

Risk-centric macroeconomics (e.g., CS (2020), Pflueger et al. (2020)

- We focus on **the spillback** effects from macroeconomy to asset prices
- Similar to Lucas (1978), but with nominal rigidities and other frictions
- Similar to Bianchi et al. (2022), but with asset prices driving demand

Excess volatility: Time-varying risk premia/beliefs/supply-demand...

- We highlight **AD shocks** (& policy) as a source of "excess" volatility

Excess volatility in bonds and **stock-bond market covariance**

- We explain bond volatility. Covariance with stocks depends on shocks

Monetary policy works through markets (large empirical literature)