When does the Fed stabilize or destabilize the market?

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

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

Households
noise, transmission lags, inertia

Aggregate supply

Aggregate demand

Slow

Asset prices

Central bank

Fast

Market
forward looking with own beliefs
Supply side: Demand-driven output

- Potential output $Y_t^* \approx A_t$. 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:

  $$C_t^H = (1 - \beta) \times \left(\alpha Y_t + P_t\right)$$

  - **MPC**
  - **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** \( \implies \)

\[
E_t^M [r_{t+1}] = i_t + \frac{1}{2} var_t^M [r_{t+1}]
\]

- discount rate
- 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

\[ C_t^H = (1 - \beta)(\alpha Y_t + P_t) \]

\[ y_t = m + p_t \]

- The Fed sets \( y_t = y_t^* \)

\[ p_t = y_t^* - m \]

- 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

\[ C_t^H = (1 - \beta) (\alpha Y_t + P_t \exp(\delta_t)) \]
\[ \implies \]
\[ y_t = m + p_t + \delta_t \]

- The Fed sets \( y_t = y_t^* \)

\[ p_t = y_t^* - m - \delta_t \]

Result: AD shocks create “excess” asset volatility and risk premium
Transmission lags: The Fed’s belief drives asset prices

\[ C_t^H = (1 - \beta) (\alpha Y_t + P_{t-1} \exp(\delta_t)) \]

\[ \Rightarrow \]

\[ y_t = m + p_{t-1} + \delta_t \]

- The Fed can’t set \( y_t = y_t^* \). It targets \( E_t^F [y_{t+1}] = E_t^F [y_{t+1}^*] \rightarrow \)

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

Result: The Fed’s belief about net AD shock drives asset prices
Aggregate demand inertia: Policy-induced overshooting

\[ C_t^H \sim \left[ \eta \beta C_{t-1}^H + (1 - \eta)(1 - \beta) P_{t-1} \right] \exp(\delta_t) \]

\[ y_t \sim \eta y_{t-1} + (1 - \eta) p_{t-1} + \delta_t \]

- The Fed targets \( E_t^F [y_{t+1}] = E_t^F [y_{t+1}^*] \)

\[ \begin{align*}
p_t &= y_t^* - \frac{\eta}{1 - \eta} \tilde{y}_t - \frac{E_t^F [\tilde{\delta}_{t+1}]}{1 - \eta} - m \\
\text{overshooting} &\end{align*} \]
Aggregate demand inertia: Policy-induced overshooting

\[ C_t^H \sim \left[ \eta \beta C_{t-1}^H + (1 - \eta)(1 - \beta) P_{t-1} \right] \exp(\delta_t) \]

\[ y_t \sim \eta y_{t-1} + (1 - \eta) P_{t-1} + \delta_t \]

The Fed targets \( E_t^F [y_{t+1}] = E_t^F [y_{t+1}^*] \rightarrow \)

\[ p_t = y_{t}^* - \eta \frac{\ddot{y}_t}{1 - \eta} - \frac{E_t^F [\ddot{\delta}_{t+1}]}{1 - \eta} - m \]

overshooting

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

Similar for temporary supply shock: \( y_{t}^* \) low but \( E_t^F [y_{t+1}^*] \) high
Disagreements and inflation generate additional results

**Fed market disagreements:**
- The market perceives excess volatility $\implies$ **Policy risk premium**
- The market learns the Fed’s belief $\implies$ **Endogenous MP shocks**
- The market thinks the Fed will reverse policy $\implies$ **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

![Graph showing the effect of monetary policy on output over time.](image)

**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

\[ y_{t+1} = \eta y_t + (1 - \eta) p_t + \delta_{t+1} \]

- Output is low (\(\eta y_t\))
- Asset prices are high to offset (\((1 - \eta) p_t\))

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
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

\[ p(t) = p^{MB}(t) + p^{O}(t) \]

forward interest rates cash flows/other

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

\[ \dot{p}^{MB}(t) = -\int_{0}^{\infty} \mathcal{W}_{\mu} \frac{\partial f(t, \mu)}{\partial t} d\mu. \]

- 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

The uphill segment turned out to be farther than expected. The supply recovery is delayed relative to the CB's expectation.

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:

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

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

- Posterior beliefs are not the same:

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

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

\[
    Var^M (\text{Fed’s belief}) = Var^M (\text{Own belief}) + \gamma^2 D \sigma_\mu^2
\]
Disagreements induce “mistakes” and policy risk premium

- The Fed will stabilize future asset prices under its belief

\[
pt+1 = y_{t+1} - \frac{\eta}{1-\eta} \tilde{y}_{t+1} - \frac{\gamma (s_{t+1} + \mu^{F}_{t+1})}{1-\eta} - m
\]

- Market perceives “mistake”: Price “should” depend on \( \mu^{M}_{t+1} \)

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

**Result:** Market demands a policy “mistakes” risk premium

\[
rp_{t} = rp_{t}^{\text{common}} + \beta^2 \frac{\gamma^2 D\sigma^{2}_{\mu}}{(1-\eta)^2}
\]
Disagreements induce a “behind-the-curve” phenomenon

- A demand-optimistic market expects a positive gap/demand boom:
  \[ E_t^M [\bar{y}_{t+1}] = \gamma (\mu_t^M - \mu_t^F) \]

- It also expects policy reversal and lower future asset price:
  \[ E_t^M [p_{t+1}] = y_t^* - \frac{\eta (\mu_t^M - \mu_t^F)}{1 - \eta} - m \]

**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 \( i_t \)
Suppose the market learns $\mu_t^F$ later in the period. Initially thinks:

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

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

$$E_t^M [p_t] \sim -\frac{\gamma}{1 - \eta} \tilde{\beta} \mu_t^M$$

$$p_t \sim -\frac{\gamma}{1 - \eta} \mu_t^F$$

**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 $\mu_t^F$

- Market’s expected future short rate is **decreasing** in Fed’s belief $\mu_t^F$:

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

Fed’s belief $\mu_t^F$ (given $\mu_t^M$) has **opposite** effect on $i_t$ and $f_t \sim E_{t+1}^M [i_{t+1}]$
Behind-the-curve in the data? (preliminary)

- 10-year forward rate minus the 1-quarter rate
- Fed Greenbook forecast for the FFR (%), 4 quarters-ahead
- BlueChip Consensus forecast for the FFR (%), 4 quarters-ahead
Behind-the-curve in the data? (preliminary)

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

<table>
<thead>
<tr>
<th></th>
<th>f1y</th>
<th>f5y</th>
<th>f10y</th>
<th>f10minus1</th>
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<tr>
<td>BlueChip FFR</td>
<td>0.544**</td>
<td>1.040**</td>
<td>1.166**</td>
<td>0.916**</td>
</tr>
<tr>
<td>prediction</td>
<td>(0.096)</td>
<td>(0.200)</td>
<td>(0.210)</td>
<td>(0.233)</td>
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<td>Greenbook FFR</td>
<td>0.464**</td>
<td>-0.296</td>
<td>-0.542**</td>
<td>-1.224**</td>
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<tr>
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<td>(0.086)</td>
<td>(0.177)</td>
<td>(0.187)</td>
<td>(0.213)</td>
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<tr>
<td>Observations</td>
<td>116</td>
<td>116</td>
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<tr>
<td>R² (adjusted)</td>
<td>0.946</td>
<td>0.738</td>
<td>0.635</td>
<td>0.587</td>
</tr>
</tbody>
</table>

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
  \[ \pi_t = \kappa \tilde{y}_t + \beta E^P_t [\pi_{t+1}] \]
- The Fed now minimizes \( E^F_t \left[ \sum \beta^h (\tilde{y}_{t+h}^2 + \psi \pi_{t+h}^2) \right] \)
- With common 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:
  \[ \pi_t = \kappa \tilde{y}_t \]  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

\[ \text{cov}_{t-1}(\pi_t, p_t) = -\kappa \frac{1}{1 - \eta} \sigma_z^2 - \kappa \frac{\eta}{1 - \eta} \sigma_{\tilde{y}}^2 < 0 \]

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)