# A Note on Temporary Supply Shocks with Aggregate Demand Inertia

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# The inflation debate

OPINION
PAUL KRUGMAN

**Wonking Out: I'm Still on Team Transitory**

**Summers Sees Dangerous Policy Parallels With High-Inflation Era**

- Summers sees 'very serious' danger of repeating mistakes
- Summers says being comfortable with faster inflation is a risk

**Fed's Powell says high inflation temporary, will 'wane'**

By CHRISTOPHER RUGABER June 22, 2021

ECONOMY

**Powell Says Supply-Side Constraints Have Worsened, Creating More Inflation Risk**

**Powell Vows to Cool Prices With Hikes That Risk Economy Pain**

- Fed chief sets aggressive path, stops short of drastic action

- Why did the Fed allow inflation in 2021? An EX ANTE "mistake"?
- If not a "mistake", then why did the Fed reverse course recently?

This paper: **Optimal** monetary policy with **temporary supply shocks**

# Temporary supply shocks alone don't imply inflation

Suppose supply is temporarily low but is expected to come back

Standard NK model: Supply shocks do NOT rationalize inflation or loose monetary policy

- Divine coincidence: CB can stabilize both output and inflation

Two realistic ingredients change that conclusion...

# Main ingredient: Aggregate demand inertia

1. **Aggregate demand inertia** (adjustment costs, habits...)

- Demand inertia is typically assumed in quantitative NK models
- Inertia explains the “long and variable” policy transmission lags

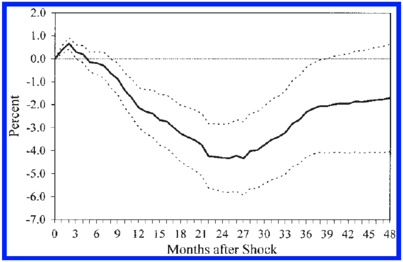



FIGURE 2. THE EFFECT OF MONETARY POLICY ON OUTPUT

Figure: Romer and Romer (2004), “A New Measure of Monetary Shocks...”

# Ingredients: AD inertia and expansionary policy constraints

1. Aggregate demand inertia
2. **Expansionary policy constraints:** Expanding AD takes time
    - AD inertia and a preference to adjust the interest rates gradually
    - Constraints on cutting the policy rate (e.g., the zero lower bound)

These ingredients imply that **preempting the expansion is valuable**...

# Main result: Overheating is optimal, but with caveats

**Main results:**

1. Optimal to run the economy HOT in the low-supply phase
   - Overheating accelerates **future** recovery once supply recovers
2. Policy does NOT keep rates low through entire low-supply phase
   - **Demand momentum** keeps output high without need for low rates
3. **Inertial inflation** $\Longrightarrow$ Policy gradually "undoes" some overheating
   - Inflation gradually builds up and makes overheating increasingly costly

# Roadmap

1. Overheating without inflation

2. Overheating with inflation

# Key ingredients: Demand inertia and policy constraints

- **Temporary supply shocks:** States $\{L, H\}$ with potential $y_L^* < y_H^*$
  - Start in $L$ and transition to $H$ (absorbing) with probability $\lambda$ at each $t$

- **IS curve with aggregate demand inertia ($\eta$)**:

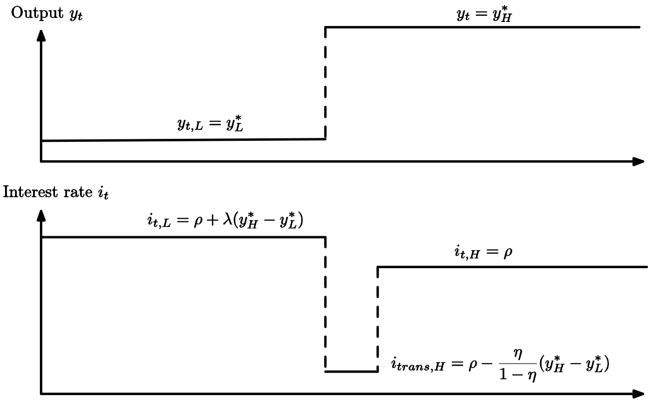
$$y_t = \eta y_{t-1} + (1-\eta)\left(-\left(i_t - \rho\right) + E_t\left[y_{t+1}\right]\right)$$

- **Expansionary policy constraint**: Taylor rule **after** transition

$$i_t \geq \underline{i}_t\left(y_t\right) = \rho + \phi\left(y_t - y_H^*\right) \quad \text{if } s_t = H$$

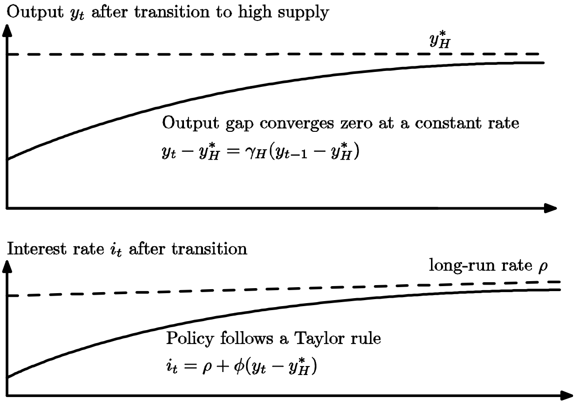
  - Appendix: Similar results with ZLB constraint $i_t \geq \underline{i}_t\left(y_t\right) = 0$

# Benchmark without policy constraints: Zero gaps




- No expansionary constraints $\Longrightarrow$ CB achieves zero gaps throughout
- But this requires a **large rate cut** after transition to high supply

# Policy constraints: Gradual recovery after transition




- **Inertia:** Raising $y_{t-1}$ **accelerates recovery and closes the gaps**

# Main result: CB overheats output in the supply shock

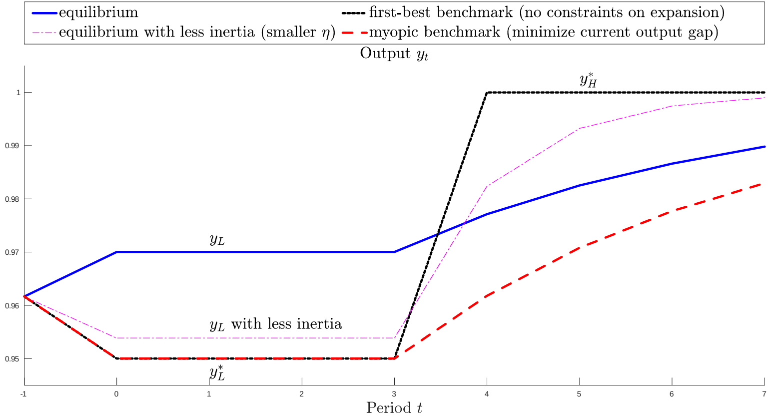
- **Result:** The CB implements the output $y_L \in (y_L^*, y_H^*)$ that solves:

$$\underbrace{y_L - y_L^*}_{\text{marginal cost of overheating}} = \overbrace{\beta\lambda}^{\text{discounted transition probability}} \underbrace{\theta_H \left(y_H^* - y_L\right)}_{\text{marginal benefit}}$$

- A sort of "**backward guidance**"

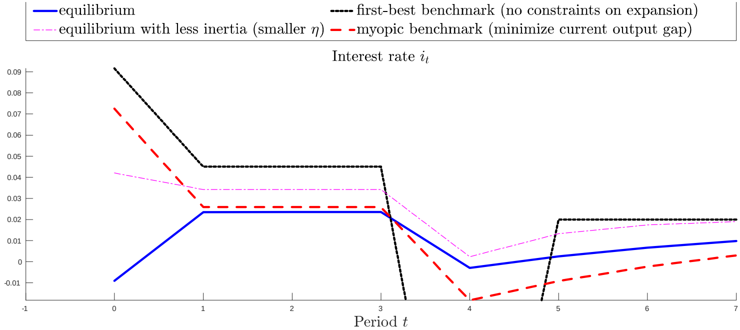
# Main result: CB overheats output in the supply shock

**Current overheating** $(y_L > y_L^*)$ vs **future demand gaps** $(y_L < y_H^*)$




(Result holds when CB is constrained by the ▸ ZLB instead of Taylor rule)

# Result: CB doesn't keep rates low through the supply shock




- CB **frontloads** rate cuts **and then quickly normalizes the rates**
- **Momentum** (high $y_{t-1}$) keeps output high w/o need for low rates

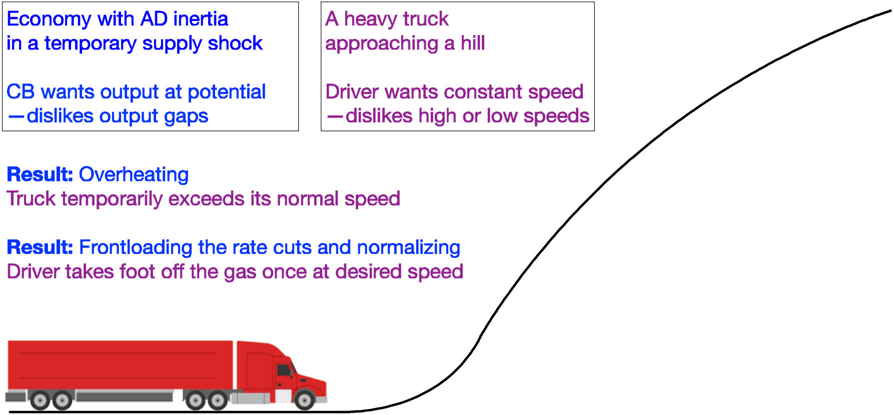
$$y_t = \eta y_{t-1} + (1-\eta)\left(-\left(i_t - \rho\right) + E_t\left[y_{t+1}\right]\right)$$

# A metaphor for the main results: Truck approaching a hill

| Economy with AD inertia in a temporary supply shock | A heavy truck approaching a hill |
| --- | --- |
| CB wants output at potential —dislikes output gaps | Driver wants constant speed —dislikes high or low speeds |

**Result:** Overheating
Truck temporarily exceeds its normal speed

**Result:** Frontloading the rate cuts and normalizing
Driver takes foot off the gas once at desired speed



# Roadmap

1. Overheating without inflation
2. Overheating with inflation

# Let us extend the model to incorporate inflation

- **IS curve** depends on the **real** interest rate $r_t = i_t - E_t[\pi_{t+1}]$
- **Taylor rule** in state $s = H$ can react to output **and inflation gaps**

$$i_t = \rho + \phi_y (y_t - y_H^*) + \phi_\pi \pi_t \qquad \text{if } s_t = H$$

- CB minimizes expected quadratic output **and inflation gaps**
- Inflation is determined by a Phillips Curve. Two cases...

# Consider a non-inertial and an inertial Phillips Curve

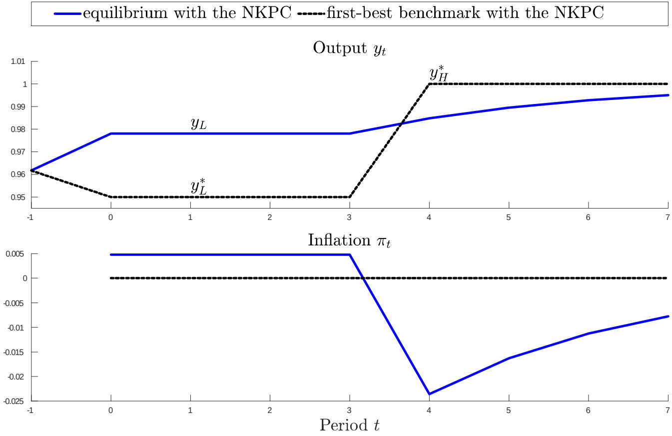
1. **New Keynesian Phillips Curve** (forward looking, **no inertia**):

$$\pi_t = \kappa \left( y_t - y^*_{s_t} \right) + \beta E_t \left[ \pi_{t+1} \right]$$

2. **Inertial Phillips Curve** (backward-looking expectations/indexation):

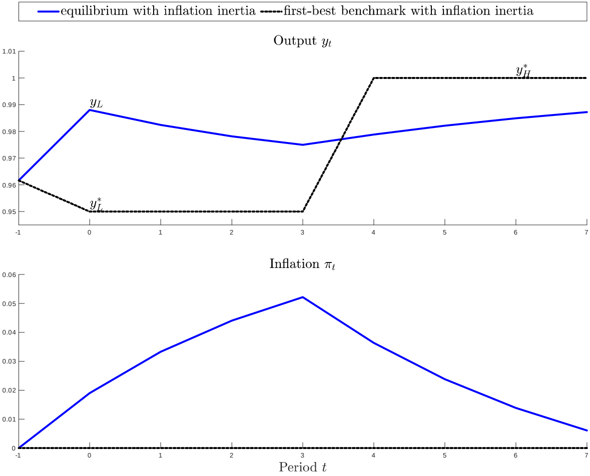
$$\pi_t = \kappa \left( y_t - y^*_{s_t} \right) + b \pi_{t-1}$$

# With NKPC (no inertia), our results are mostly the same

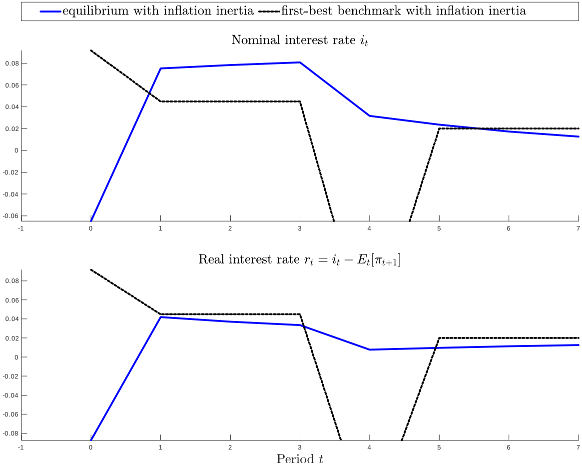



CB trades off current output **and inflation gaps** with future output gaps

# With inertial PC, the CB gradually "undoes" overheating



# The nominal rate can exceed its long-run level



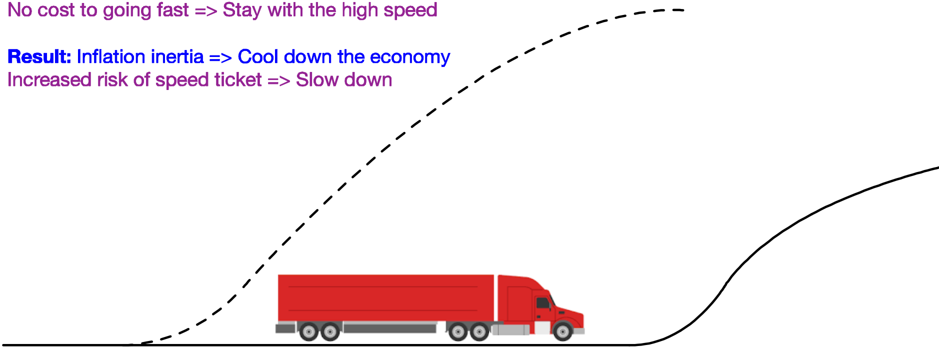

- Overheating increases inflation and expected inflation $E_t[\pi_{t+1}]$
- CB raises $i_t$ to prevent the **real** rate from rising $r_t = i_t - E_t[\pi_{t+1}]$

Supply recovery is delayed relative to CB's expectation

Uphill segment is farther than driver expected

**Result:** No inflation inertia => Stay with the ideal overheating
No cost to going fast => Stay with the high speed

**Result:** Inflation inertia => Cool down the economy
Increased risk of speed ticket => Slow down



# Taking stock: Temporary supply shocks with inertia

Under realistic ingredients, **demand inertia** and policy constraints:

1. Optimal to run the economy HOT in the low-supply phase
    - The Fed was arguably right to allow for *some* inflation in 2021
2. Policy does NOT keep rates low through entire low-supply phase
    - The Fed was arguably too slow to take its foot off the gas
3. With inertial inflation, policy gradually "undoes" some overheating
    - The Fed is arguably right to reverse course as inflation built up

# Thank you for your attention!

# Main result holds in an alternative setup with ZLB