Monetary Policy as Insurance

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Optimal Monetary Policy as Insurance

Large shocks: financial crisis + pandemic

- Monetary policy constrained by the zero lower bound (ZLB)
- Uncertainty about crisis duration

Optimal monetary policy response: forward guidance (FG) (Eggertsson and Woodford, 2003)

- Commitment to future zero interest rate policy at times when policy is no longer constrained

Optimal Monetary Policy as Insurance

Large shocks: financial crisis + pandemic

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Rational Expectations Full Information (standard)

- State-contingent forward guidance policy: additional ZLB rises with shock duration
- Large general equilibrium (GE) effects

$\Longrightarrow$ Near-complete stabilization of the economy

Optimal Monetary Policy as Insurance

Large shocks: financial crisis + pandemic

- Monetary policy constrained by the zero lower bound (ZLB)
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Incomplete knowledge (this paper): agents learn macro impact of FG policy $\Rightarrow$ delayed GE effects

– State-contingent forward guidance policy: additional ZLB falls with shock duration

– Large(r) front-loaded stimulus at beginning of the crisis (*before duration uncertainty is resolved*)

Costs: inflationary boom if shock is short-lived

Benefits: prevent large welfare costs in case of long lasting crisis

$\Longrightarrow$ Policy ex-post too stimulatory: insurance against a persistent shock

Simple New Keynesian Model

Optimal households' consumption and firms' price decisions

$$
\begin{aligned}
c_t(i) &= (1-\beta)\,x_t + \beta \hat{E}_t \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta)\,x_{T+1} - \sigma\beta\,(R_T - \pi_{T+1} - r_T^n)\right] \\
p_t(j) &= (1-\xi\beta)x_t + \hat{E}_t \sum_{T=t}^{\infty} (\xi\beta)^{T-t} \left[\xi\beta(1-\xi\beta)x_{T+1} + \xi\beta\pi_{T+1}\right]
\end{aligned}
$$

1. Households: permanent income theory [x_t = income; R_t = policy rate; π_t = inflation]
2. Firms: monopolistic competition and Calvo nominal rigidities
3. Bounded rationality: $\hat{E}_t \neq$ model-consistent expectation
4. Aggregate: Market clearing condition [$c_t = x_t$] + aggregate prices [$\xi p_t(j) = (1-\xi)\pi_t$] + policy
   - x_t also output gap, as natural output is constant
   - Agents are identical but not aware of it

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$$p_t(j) = (1-\xi\beta) x_t + \hat{E}_t \sum_{T=t}^{\infty} (\xi\beta)^{T-t} \left[\xi\beta(1-\xi\beta) x_{T+1} + \xi\beta\pi_{T+1} \right]$$

1. Crisis: Shock to the natural rate of interest r_t^n [Eggertsson and Woodford]

- Start at REE equilibrium with $x_t = \pi_t = 0, R_t = r_t^n = r_H > 0$
- Exogenous shift in the natural rate of interest $r_t^n = r_L < 0$ (such that ZLB binds)
- Two-state Markov structure: r_L persists with probability $1-\delta$; $r_t^n = r_H > 0$ absorbing state

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\end{aligned}
$$

2. Optimal monetary policy response to the shock: $\hat{E}_t R_{t+j}$

a. State-contingent FG (rational expectations + full commitment + perfect credibility)

- Let τ be the possible date when r^n_t returns to the high state
- For each contingency τ the CB makes a promise of k_τ extra periods at ZLB

b. Exit from the ZLB: optimal policy under "normal times"

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\end{aligned}
$$

3. Bounded rationality: private agents know

1. The process r_t^n and observe current state
2. $R_T = 0$ in the low state
3. Optimal state-contingent FG about R_T when $r_t^n = r_H$
4. Optimal policy rule upon exit from zero bound: $\hat{E}_t R_{t+j} = r_H + \psi_\pi \hat{E}_t \pi_{t+j} + \psi_x \hat{E}_t x_{t+j}$

Simple New Keynesian Model

Aggregate demand and supply

$$x_t = \hat{E}_t \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta)x_{T+1} - \sigma\left(R_T - \pi_{T+1} - r_T\right)\right]$$

$$\pi_t = \hat{E}_t \sum_{T=t}^{\infty} (\xi\beta)^{T-t} \left[\frac{(1-\xi\beta)(1-\xi)}{\xi} x_T + (1-\xi)\beta\pi_{T+1}\right]$$

3. Bounded rationality: private agents don't know aggregate effects of policy on x_t and π_t

Actual Law of Motion of x_t, π_t: Structural equations + beliefs + shock + policy

– Time varying and state-dependent mapping between policy and π_t and x_t Details

Perceived Law of Motion: Approximate with statistical model with unobserved components

$\Rightarrow$ Revise $\hat{E}_t \pi_{t+j}, \hat{E}_t x_{t+j}$ gradually from observed output and inflation

$\Rightarrow$ ALM $\neq$ PLM but converges to RE over time

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$$\pi_t = \hat{E}_t \sum_{T=t}^{\infty} (\xi\beta)^{T-t} \left[\frac{(1-\xi\beta)(1-\xi)}{\xi} x_T + (1-\xi)\beta\pi_{T+1}\right]$$

3. Bounded rationality: Partial and general equilibrium effects of FG policy

- Partial equilibrium: direct immediate effects on x_t through $\hat{E}_t R_{t+j}$
- General equilibrium: delayed effects on x_t, π_t through $\hat{E}_t \pi_{t+j}, \hat{E}_t x_{t+j}$
- GE effects initialy weak but grow over time

Optimal Forward Guidance: Front-Loaded Promises

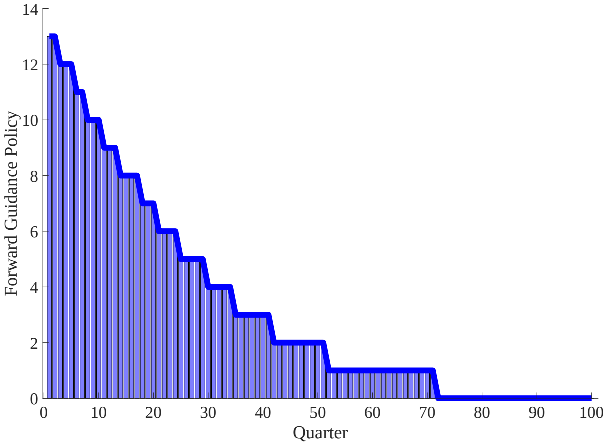
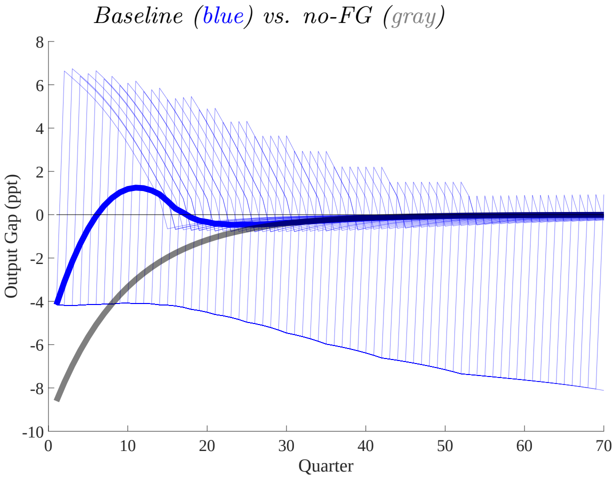


Figure: Promises k_τ (y-axis) as function of shock duration τ (x-axis).

Large initial commitments, declining with shock duration $\approx$ calendar-based FG

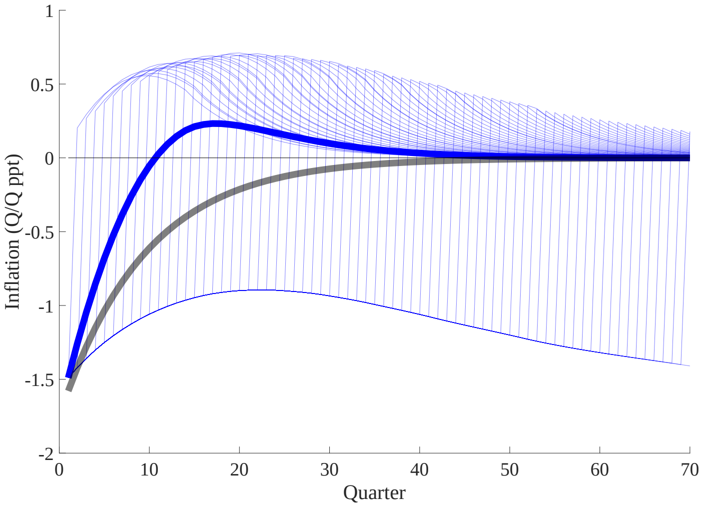
Optimal Policy Response: Boom and Slowdown



- **No forward guidance** (gray): restriction on beliefs $\rightarrow$ optimal discretion (RE)

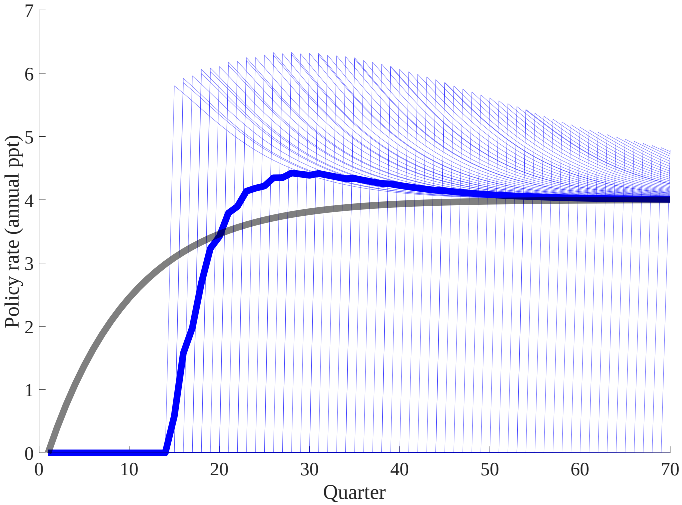
- **Optimal policy** (blue):
  - Large partial equilibrium effects on impact, delayed GE
  - Larger boom for short-duration crises
  - Upon exit from ZLB, policy induced slowdown
  - Large stimulus insurance for long-lasting crisis

Optimal Forward Guidance Policy: Gradual GE Effects



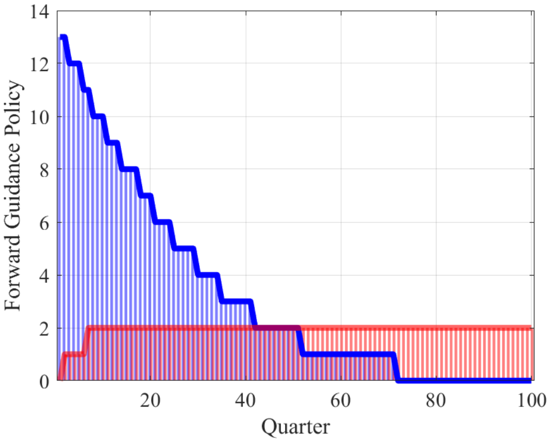
Inflation driven by GE effects. [Details: Why is policy not backloaded?]

Optimal Forward Guidance Policy: Policy Overshooting



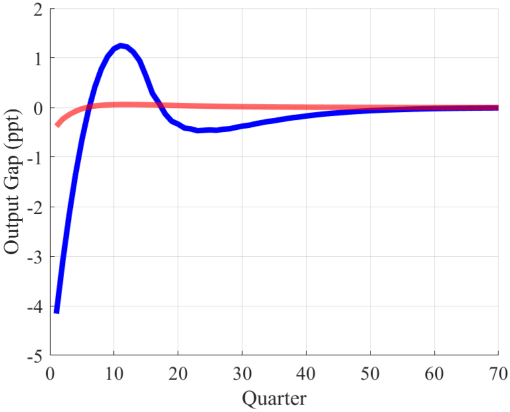
Optimal Policy: Rational Expectations versus Learning

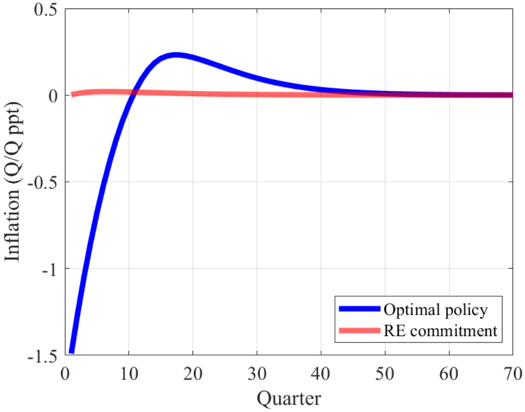
Baseline (blue) vs. RE (red)



- **Rational Expectations**: period of zero interest rate commitments rise with the length of the crisis
  - Small commitments
  - Larger stimulus only for persistent shocks $\rightarrow$ no front-loaded stimulus
  - Conditional on a transitory shock the central bank can easily remove the stimulus

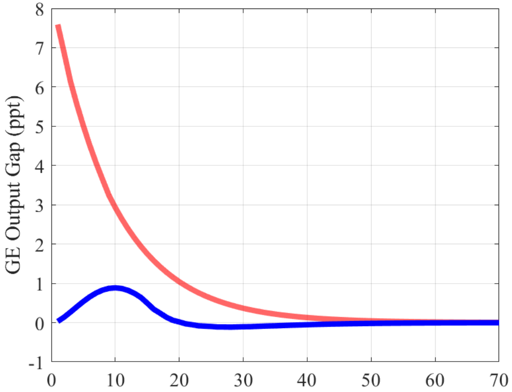
Optimal Forward Guidance: RE versus Learning

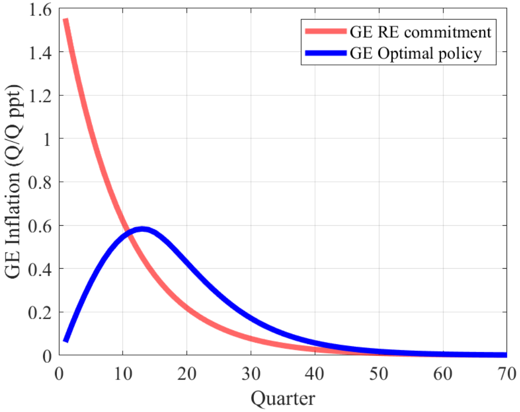




Near-complete stabilization under **RE** with vastly smaller stimulus: why?

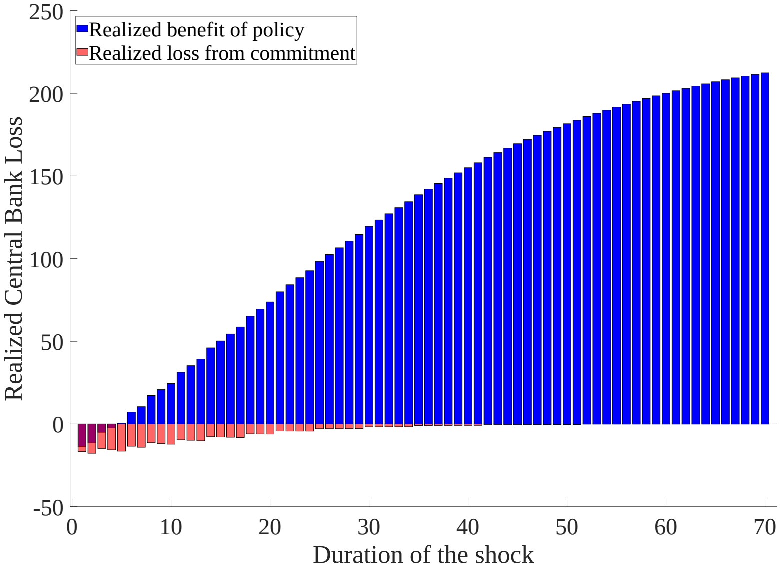
Distinct General Equilibrium Effects





Large and immediate GE effects under RE: no front-loaded stimulus (insurance) needed

The Insurance Premium



Conclusions

- **Insurance principle:** large front-loaded promises

  The historical record is thick with examples of underdoing it … And pretty much in every cycle, we just tend to underestimate the damage and underestimate the need for a response. I think we've avoided that this time.

  — *Jerome Powell (2021)*

- Central trade-off: the cost of insurance is inflation overshooting and a downturn

- Optimal state-contingent policy approximated by calendar-based guidance

- Relevant to contemporary policy discussion:

  - Critical distinction between ex ante and ex post evaluation of policy

  - Inflation itself does not signal bad policy

ALM and PLM

Let $z_t = \begin{pmatrix} \pi_t & x_t \end{pmatrix}'$

Perceived Law of Motion

$$z_t = \begin{cases} \bar{\omega}_L r_L + \omega_t + e_t, & S = L \\ \omega_t + e_t, & S = H \end{cases}$$

where $\bar{\omega}_L$ measures perceived impact of the shock and

$$\omega_t = \rho\omega_{t-1} + u_t, \quad 0 \leq \rho \leq 1.$$

Estimates' updating

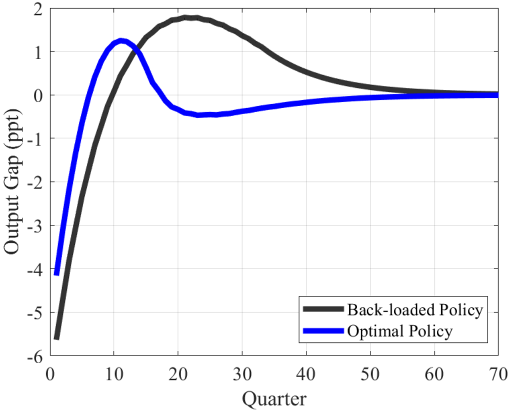
$$\omega_{t+1|t} = (\rho - g)\omega_{t|t-1} + g\left(z_t - \bar{\omega}_L r_L \cdot \mathbf{1}_{\{\mathbf{S=L}\}}\right)$$

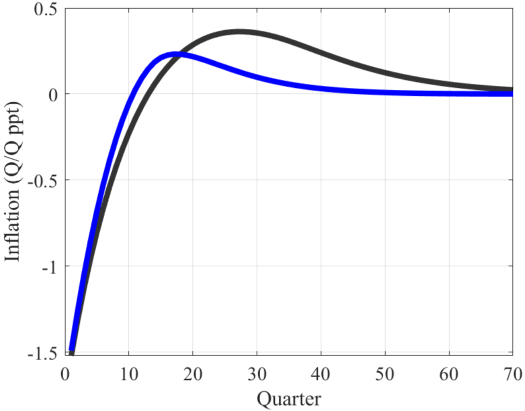
Actual Law of Motion

$$z_t = \begin{cases} \bar{\omega}_L r^L + \mathcal{T}_t\left(\omega_{t|t-1}\right) & S = L \\ \mathcal{T}_t\left(\omega_{t|t-1}\right), & S = H \end{cases}$$

Back

Why Front-Loaded under Learning? Long and Variable Lags





Back-loaded policy: Zero interest rate policy to be implemented rises with the length of the crisis ⇒ get stimulus when it is too late Back