# Forward Guidance and Limited Commitment

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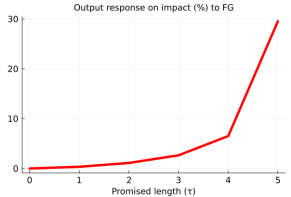
August 30, 2023

# Introduction

A prominent non-conventional policy measure: forward guidance (FG) $\rightarrow$ promises about the future interest rate path

- "Too" potent in the New Keynesian model $\rightarrow$ forward guidance puzzle (Del Negro, 2012)




**Research question:** How can we solve the forward guidance puzzle?

*Answer:* Deviation from rationality is not necessary $\rightarrow$ reputation and limited commitment

**Main result:** Limited commitment + reputation solve the forward guidance puzzle while allowing CB communication to remain useful

Lit. review

# Model

Standard New Keynesian Model: (Galí, 2015) and (Woodford, 2003)

$$\pi_t = \beta \mathbb{E}_t[\pi_{t+1}] + \kappa y_t$$
$$y_t = \mathbb{E}_t[y_{t+1}] - \frac{1}{\rho}(i_t - \mathbb{E}_t[\pi_{t+1}] - r_t^n)$$
$$i_t \geq 0$$

where the natural interest rate ($r_t^n$) follows an AR(1) process.

# Forward Guidance at the ZLB ($i_t = 0$)

The constraint $i_t \geq 0$ is binding

**Assumption:** the central bank always engages in forward guidance by giving an Odyssean promise to stimulate economic activity.

## Definition 1

Forward guidance is an integer $\tau \in \mathbb{N}$ that prescribes the duration of a zero nominal interest rate path after exiting the ZLB.

# Central Bank

The loss function of the central bank is

$$L\left(\{y_t\}_{t=0}^{\infty}, \{\pi_t\}_{t=0}^{\infty}\right) = \sum_{t=0}^{\infty} \delta^t \Big[ \underbrace{(1-\lambda)\cdot(y_t - \bar{y})^2 + \lambda \cdot \pi_t^2}_{\ell(y_t, \pi_t)} \Big]$$

$\lambda$ and $\bar{y}$ are function of model parameters.

**Assumption:** there are two types of central bankers: this allows us to model reputation

- A benevolent central banker seeking to maximize welfare of the households ($\delta = \beta$)
- A myopic central banker maximizing welfare only when she is in charge ($\delta = 0$)

**Assumption:** the mandate of a central banker lasts one period where after she is replaced

**Assumption:** discretionary monetary policy in "normal times"

FOC

# Strategies

A strategy specifies the transition when exiting the ZLB.

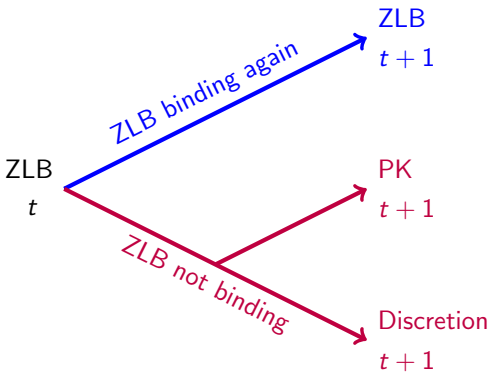
A central banker has two possible actions after exiting the ZLB: keep the promise or deviate to discretion:

$$\sigma(\delta, \mu, r^n) \equiv \mathbb{P}(PK|\delta, \mu, r^n) \in \{0, 1\}$$

where $\mu$ is the belief distribution over the type $\delta$

Agents can learn about types if they play separating strategies

# Monetary Policy



# Reputation (learning about $\delta$)

Reputation captures (heuristically) the probability that a central banker will keep her promise

There is a prior belief distribution $\mu_0$ over the type $\delta$ (reputation)

We assume Bayesian updating such that the beliefs $\mu_{t+1}$ evolve according to Bayes' rule

$$\mu_t(\delta; r_t^n, \mu_{t-1}, P_t) = \sum_{\hat{\delta}} \frac{\sigma(\hat{\delta}, r_t^n, \mu_{t-1}, P_t) \cdot \mu_{t-1}(\hat{\delta})}{\sum_{\tilde{\delta}} \sigma(\tilde{\delta}, r_t^n, \mu_{t-1}, P_t) \cdot \mu_{t-1}(\tilde{\delta})} \cdot \Gamma(\hat{\delta}, \delta)$$

# Equilibrium

## Definition 1

*An equilibrium is a tuple* $(\sigma, \mu, y, \pi, i)$ *such that:*

1. *Given strategies and beliefs* $(\sigma, \mu)$*, output* $y$*, inflation* $\pi$*, and nominal interest rates* $i$ *are consistent with the New Keynesian model.*

2. *Given* $(y, \pi, i)$*, the pair* $(\sigma, \mu)$ *is a Perfect Bayesian equilibrium.*
   - *Beliefs* $\mu$ *are consistent with the strategies* $\sigma$ *of the central bankers on the equilibrium path. Off-path beliefs put probability 1 on the central banker being of type* $\delta = 0$*.*
   - *Strategies* $\sigma$ *of the central bankers are optimal given the beliefs* $\mu$*.*

Computation

# Results

The trade off faced by a central banker is the following:

1. Keeping the promise causes an excess expansion today

2. Keeping the promise builds reputation which makes forward guidance more useful in the future

Results:

- Pooling always exists
- For a too expansionary demand shock, promises are never kept
- The effect of forward guidance eventually drops to zero

# The effect of FG converges to 0

## Proposition 1

*There exists* $\hat{R} < \infty$ *such that in any equilibrium, for all* $r_t^n > \hat{R}$, $\mu_t$, $P_t$ *and* $\delta$ *we have* $\sigma(\delta, r_t^n, \mu_t, P_t) = 0$.

## Proposition 2

*There exists* $\bar{\tau} \in \mathbb{N}$ *such that for any variable* $X$, *for all* $\tau > \bar{\tau}$, $IR_X(\tau) = 0$ .

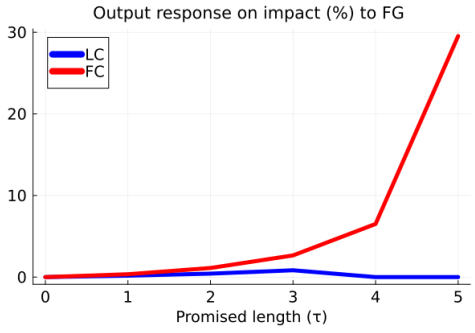
**Intuition:** A too generous promise is too costly to keep, even for the patient central banker.

$\rightarrow$ Solution to the FG puzzle

# Numerical Analysis

We calibrate the persistence of the demand shock and its auto correlation to match the auto correlation in output gap and the output gap at the ZLB.

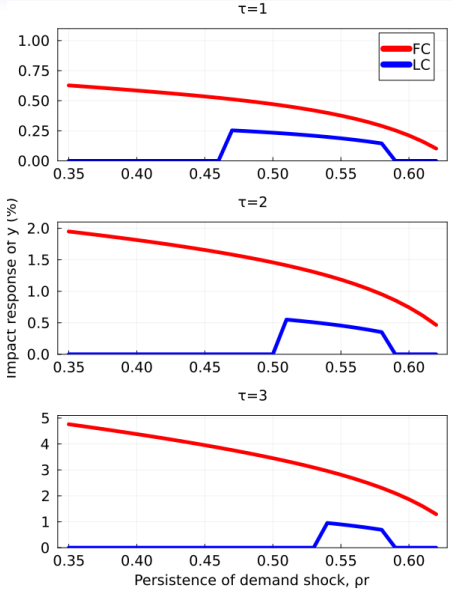
For the remaining parameters we choose values that are standard in the literature



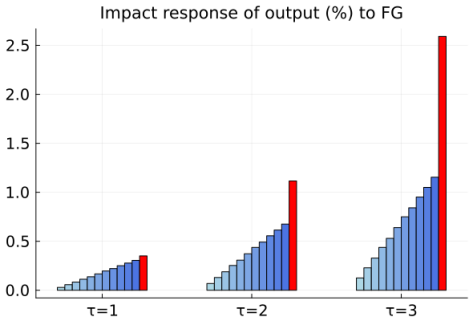

Mitigation of FG effect

Calibration

# Persistence of demand shock

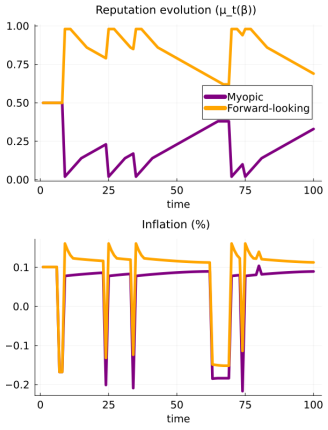


# Reputation




The lower the reputation, the less potent is FG

# Reputation




A simulation of reputation and inflation with $\tau = 2$.

# Welfare loss

| Scenario | $\tau = 0$ | $\tau = 1$ | $\tau = 2$ | $\tau = 3$ |
|---|---|---|---|---|
| ZLB with no forward guidance | 0.0514 % | - | - | - |
| Loss with full commitment | - | 0.0043 % | 0.0036 % | 0.0040 % |
| Loss with limited commitment | - | 0.0044 % | 0.0040 % | 0.0037 % |

Table: Welfare losses. Initial belief distribution is $\mu_0(\beta) = 1/2$.

The optimal length of a promise is higher under limited commitment

- The effect of FG is mitigated under limited commitment
- The promise is not kept in states of the world where it is very costly to do so

# Conclusion

A model with limited commitment and reputation can solve the forward guidance puzzle.

- The effect of FG drops to zero for a too expansionary promise
- Even with limited commitment, central bank communication is useful

**Thank you for your attention!**

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# Literature Review

**Time inconsistency of monetary policy:**
(Kydland & Prescott, 1977) and (Barro & Gordon, 1983)

**Forward Guidance:**
(Del Negro, Giannoni, & Patterson, 2012), (Bernanke, 2020), and (Bilbiie, 2019)

**Bounded rationality:**
(Farhi & Werning, 2019), (García-Schmidt & Woodford, 2019), and (Gabaix, 2020)

**Sustainable plans:** (Stokey, 1991), (Chari & Kehoe, 1990), (Walsh, 2018), and (Nakata, 2018)

**Loose commitment:**
(Debortoli & Nunes, 2010), (Debortoli & Lakdawala, 2016), and (Debortoli, Maih, & Nunes, 2014)

Return

# Monetary policy in normal times ($i_t > 0$)

In normal times, the central bank conducts optimal discretionary policy.

$$i_t = \arg\min\{(1-\lambda)\cdot(y_t-\bar{y})^2 + \lambda\cdot\pi_t^2\}$$

subject to IS curve and NKPC.

FOC:

$$\kappa\cdot\lambda\cdot\pi_t + (1-\lambda)\cdot(y_t-\bar{y}) = 0$$

Discretionary monetary policy is uninformative about $\delta$:

- The type cannot be learned in normal times

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# Equilibrium

Condition 1: Given strategies and beliefs $(\sigma, \mu)$, output $y$, inflation $\pi$, and nominal interest rates $i$ are consistent with the New Keynesian model.

**Example:** NK Phillips curve at the ZLB

$$\pi_t^Z = \kappa y_t^Z + \beta \mathbb{E}\left[\underbrace{\pi_{t+1}^Z \mathbb{1}\{r_{t+1}^n \in Z_{\sigma,\mu}\}}_{(a)} + \mathbb{1}\{r_{t+1}^n \notin Z_{\sigma,\mu}\}\Big(\underbrace{\pi_{t+1}^P \mathbb{E}_\delta^{\mu_t}[\sigma(\delta)]}_{(b)} + \underbrace{\pi_{t+1}^D \mathbb{E}_\delta^{\mu_t}[1-\sigma(\delta)]}_{(c)}\Big)\right]$$

where the outer expectation is over the natural rate of interest, and the subset $Z_{\sigma,\mu}$ are values of the natural rate of interest such that the ZLB is binding.

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# Parameterization

| Parameter | Value | Description |
|---|---|---|
| $\beta$ | 0.99 | Discount factor of private agents |
| $\kappa$ | 0.02 | Slope of Phillips Curve |
| $\rho$ | 2.0 | Coefficient of relative risk aversion |
| $\lambda$ | 0.9 | Weight on inflation |
| $\mu_0(\delta_H)$ | 0.5 | Ex-ante probability of high type |
| $\sigma_r$ | 0.0185 | Standard deviation of the demand shock |
| $\rho_r$ | 0.56 | Autocorrelation of the demand shock |
| $\bar{r}$ | 1% | Average natural real interest rate |
| $\bar{y}$ | 0.5% | Target output gap |

Table: Parameter values

Return