Guiding Expectations Forward

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What is Forward Guidance?

- Forward Guidance (FG) is information provided by the Central Bank (CB) regarding the future path of its policy rate.
- Recent episodes from the Federal Reserve include:
  - Open-ended (Dec 2008 - Jul 2011)
    - "... for an extended period"
  - Calendar-based (Aug 2011 - Nov 2012)
    - "through mid-2013", "through late 2014", "through mid-2015"
  - Threshold-based (Dec 2012 - present)
    - unemployment below 6.5% and inflation around target of 2%

Previous literature on FG

- FG can represent two distinct intentions:
  - a promise to keep interest rates ”low for longer” (Odyssean) as in Eggertsson and Woodford (2003)
  - a forecast for future policy actions (Delphic)

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- The literature at large relies on rational expectations (RE) and views FG as a promise.
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  - backward-looking policy (e.g. some sort of price level targeting)
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- This is usually modelled as:
  - backward-looking policy (e.g. some sort of price level targeting)
  - news shocks to an otherwise standard Taylor rule
- Empirical findings are mixed, many reporting unusually large benefits of FG.

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- Without RE under the zero lower bound (ZLB) a policy change is unobservable, unless communicated somehow. Then, FG could be used as an instrument to signal a policy change due to the crisis.
- In particular, the expected point of departure from ZLB could act as a target for bringing public expectations closer to actual policy.

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- In particular, the expected point of departure from ZLB could act as a target for bringing public expectations closer to actual policy.

This project addresses the questions:

1. *Should the Central Bank try to communicate its changed reaction function to the public?*
2. *What are the benefits and dangers of doing so?*

Model environment

- Standard New Keynesian model with Rotemberg (1982) adjustment costs
- A continuum of households make consumption and labour supply decisions
- A continuum of monopolistically competitive firms produce differentiated goods using only labour and face a price setting problem
- All decisions at period t are made using information of period $t-1$.

MODEL ENVIRONMENT CONT.

- Monetary policy is defined by a Taylor rule. Agents are assumed to know only the functional form of the rule, i.e. $i(\pi_t, x_t)$ is linear.
- The Central Bank and the agents share the same expectational facility, thus the CB has no informational advantage beyond its own policy function.
- A period is a quarter.

The Model

The aggregate dynamics of the model can fully be described by:

$$x_t = \hat{\mathbb{E}}_{t-1} \sum_{T=t}^{\infty} \beta^{T-t} \left[(1-\beta)\, x_T - \beta \left(i_T - \pi_{T+1} \right) + \beta r_T^e \right] \tag{1}$$

$$\pi_t = \frac{\gamma_1 \xi}{(1-\gamma_1 \beta)} \hat{\mathbb{E}}_{t-1} \sum_{T=t}^{\infty} \left(\gamma_1 \beta \right)^{T-t} \left[(1-\gamma_1 \beta) \left(x_T + \mu_T \right) + \pi_T \right] \tag{2}$$

where $\xi > 0$ is a measure of price stickiness with $\xi \to \infty$ implying convergence to arbitrarily small costs of price adjustment (i.e. approaching fully flexible prices); and $0 < \gamma_1$ is an eigenvalue from the underlying microfoundations, where in a Calvo price adjustment it would represent the probability of not resetting the price.

Monetary Policy rule

The model is closed with the monetary policy rule allowing for a lower bound:

$$i_t = \max\left\{\chi_\pi \hat{\mathbb{E}}_{t-1}\pi_t + \chi_x \hat{\mathbb{E}}_{t-1}x_t, i^*\right\} \tag{3}$$

where

- the policy parameters satisfy $\chi_\pi > 0$ and $\chi_x = \chi_\pi \lambda_x/\xi > 0$.
- $i^* = \frac{\beta m - m}{\beta m} = 1 - \frac{1}{\beta} \approx -1\%$ is the effective ZLB as it is the return on holding cash
- All variables are expressed as log-deviations from their steady state (SS) values.
  Thus, in SS $x = \pi = i = r^e = \mu = 0$

Expectations Formation

- Agents do not know the true structure of the economy and make forecasts as econometricians using simple regression models.
- Namely, they make forecasts according to the aggregate policy functions from the minimum state-variable RE solution to the model: $x_t(r^e_{t-1}, \mu_{t-1})$ and $\pi_t(r^e_{t-1}, \mu_{t-1})$
- Each period, as additional data becomes available, agents update the coefficients to their forecasting model.

Expectations Formation cont.

- Their perceived law of motion (PLM) then is:

$$z_t = \begin{bmatrix} r_t^e \\ \mu_t \end{bmatrix} = \tilde{\phi} z_{t-1} + \begin{bmatrix} \varepsilon_t^r \\ \varepsilon_t^\mu \end{bmatrix}, \text{ with } \tilde{\phi} = \begin{bmatrix} \rho_r & 0 \\ 0 & \rho_\mu \end{bmatrix} \tag{4}$$

$$Y_t^e = \begin{bmatrix} x_t^e \\ \pi_t^e \end{bmatrix} = \Phi_{t-1} \hat{\mathbb{E}}_{t-1} z_t + e_t = \Phi_{t-1} \tilde{\phi} z_{t-1} + e_t \tag{5}$$

$$i_t^e = \begin{bmatrix} \psi_{x,t-1} & \psi_{\pi,t-1} \end{bmatrix} Y_t^e \tag{6}$$

where Φ_t is a 2×2 transition matrix that defines the PLM.

Updating Expectations

At the end of period t agents update their transition matrices Φ_t according to the recursive least squares algorithm (RLS) for the aggregate PLM:

$$\Phi_t = \Phi_{t-1} + \tau R_{t-1}^{-1} \hat{\mathbb{E}}_{t-1} z_t \left(Y_t - \hat{\mathbb{E}}_{t-1} Y_t \right) \tag{7}$$

$$R_t = R_{t-1} + \tau (\hat{\mathbb{E}}_{t-1} Y_t Y_t' - R_{t-1}) \tag{8}$$

and ψ_t for the Taylor rule PLM (see Evans and Honkapohja (2001)):

$$\psi_t = \psi_{t-1} + \tau Q_{t-1}^{-1} \hat{\mathbb{E}}_{t-1} Y_t \left(i_t - \psi_{t-1}' \hat{\mathbb{E}}_{t-1} Y_t \right) \tag{9}$$

$$Q_t = Q_{t-1} + \tau (\hat{\mathbb{E}}_{t-1} Y_t Y_t' - Q_{t-1}) \tag{10}$$

where $\tau = 0.02$

Timing of Expectations

1. At the beginning of period t agents use the aggregate PLM (5) and the PLM for the interest rate (6) to form Y_t^e and i_t^e. Long-run expectations result from iterating forward the PLMs.
2. Y_t and i_t are realized according to (1)-(3). This gives rise to the actual law of motion of the economy (ALM).
3. Agents update their transition matrices Φ and ψ according to the recursive least squares algorithm (RLS).

Policy change

- A severe recession (negative shock in r_t^e: $\varepsilon_1^r = -0.05$) hits the economy and brings the interest rates below the ZLB for some periods.
- The Central Bank increases its reaction to output gap, χ_x, from 0.1667 to 1. This is in line with statements from the FED and BoE about the crisis changing the relative weights on x and π.
- This prolongs the period under ZLB due to a negative output gap.

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5. Ambiguous FG: $\chi_x = 1$ at $t = 2$, CB releases regular forecasts for T^{CB} - the last period under ZLB, but agents update both ψ_π and ψ_x

Rational Expecations

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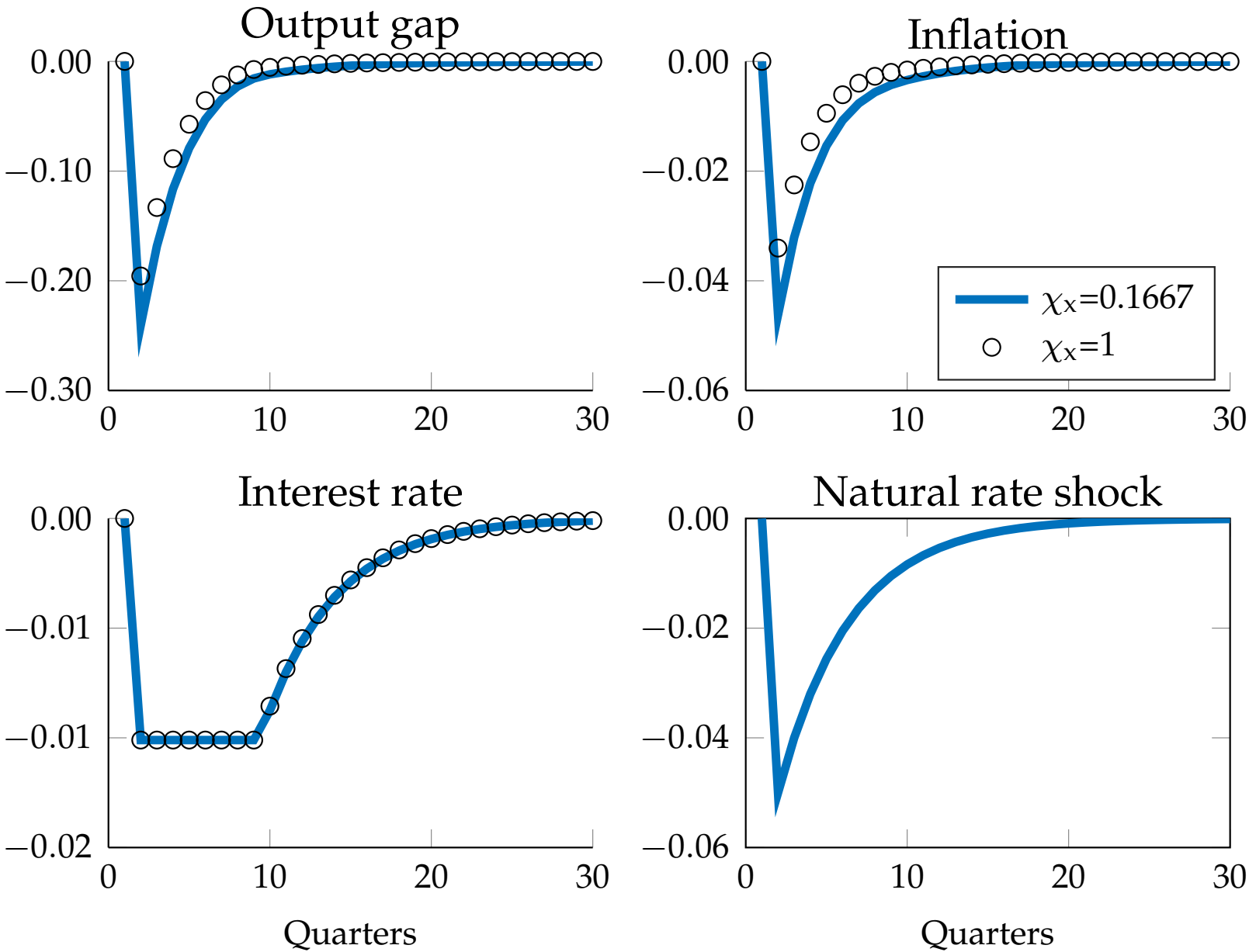

Results

Result 1

The Central Bank faces tradeoffs with such a policy change ⇒ non-trivial decision.

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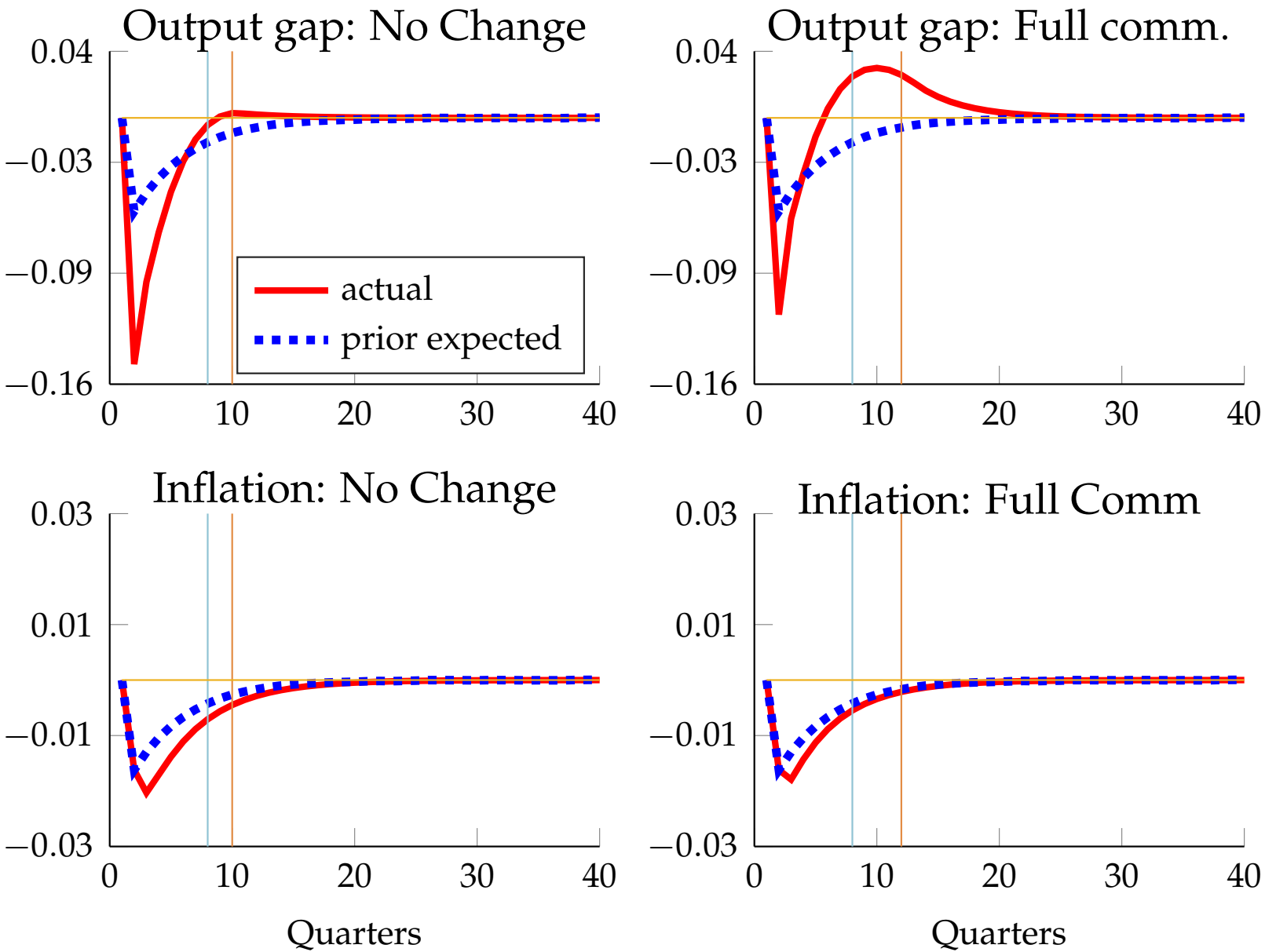

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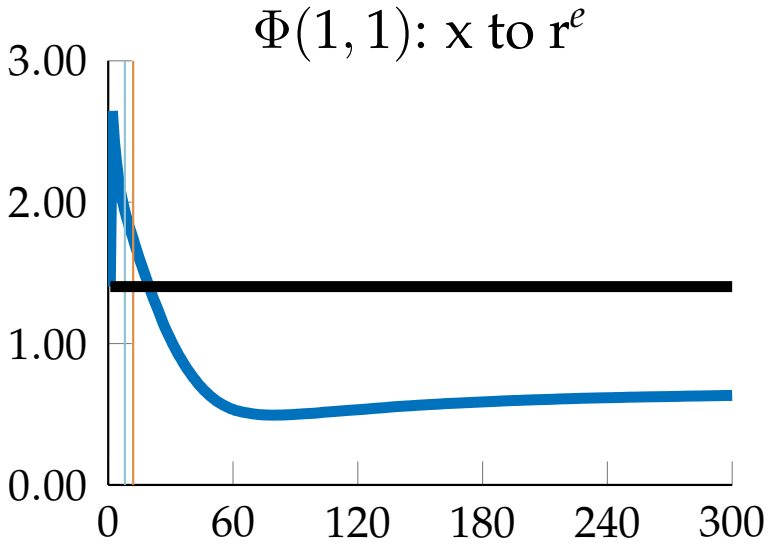

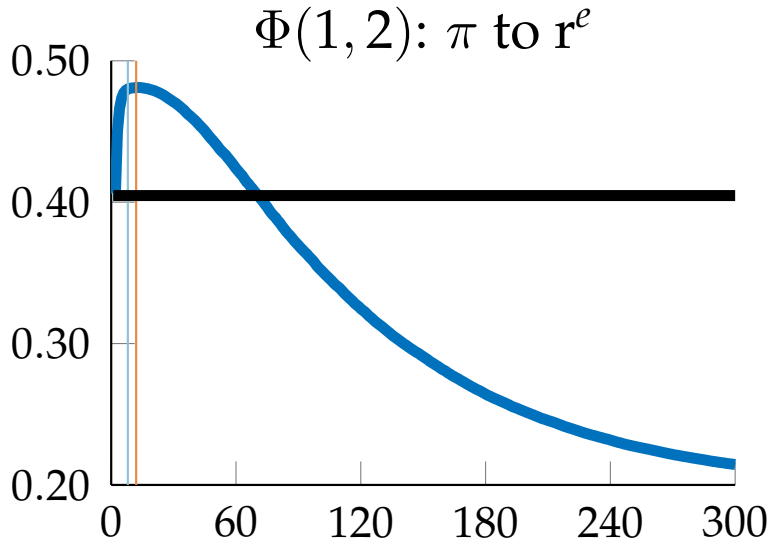

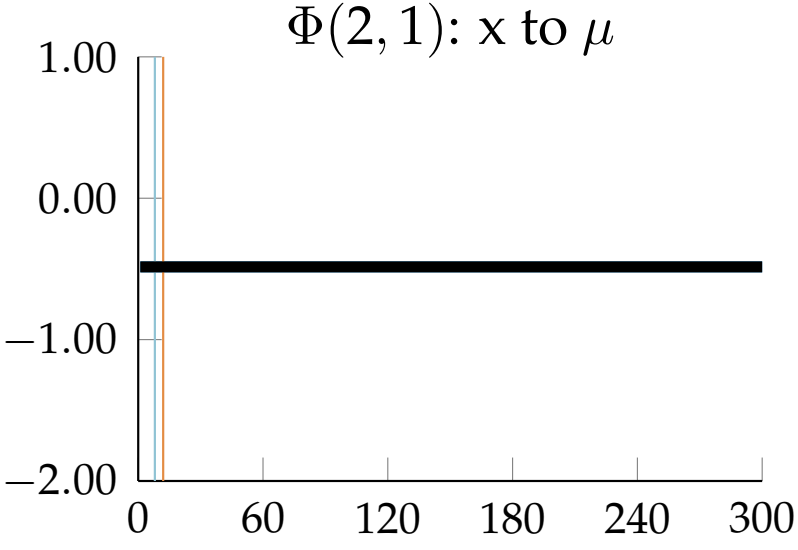

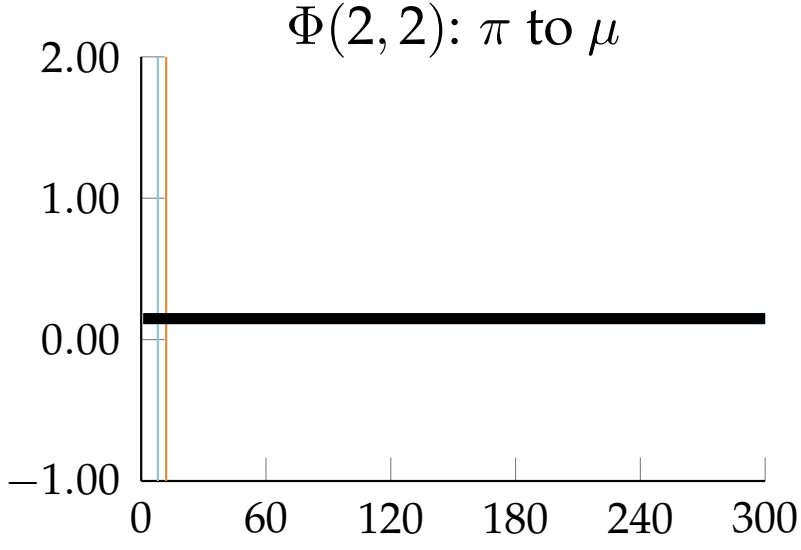

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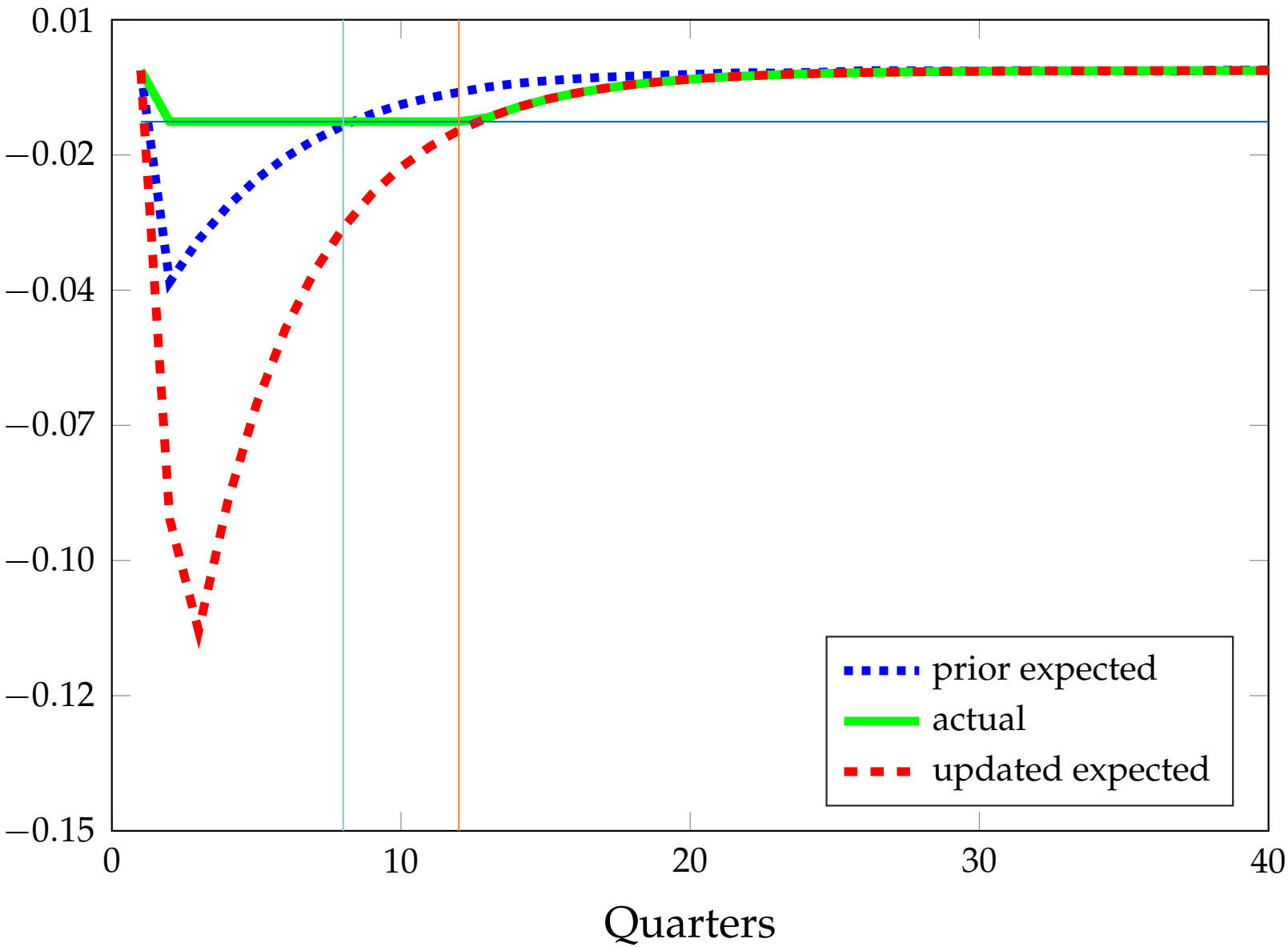

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Result 2

Forward Guidance is welfare improving compared to no communication.

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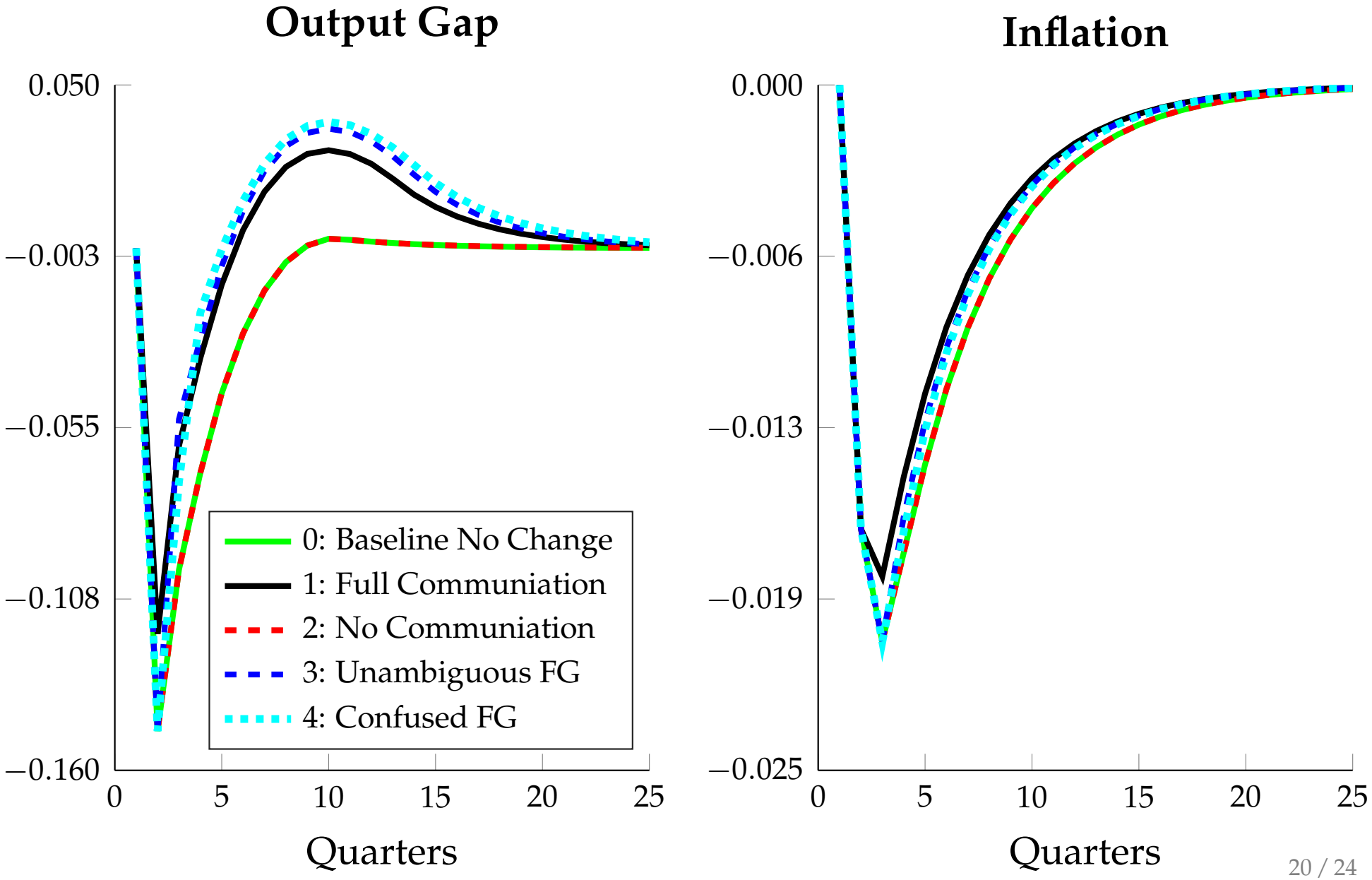

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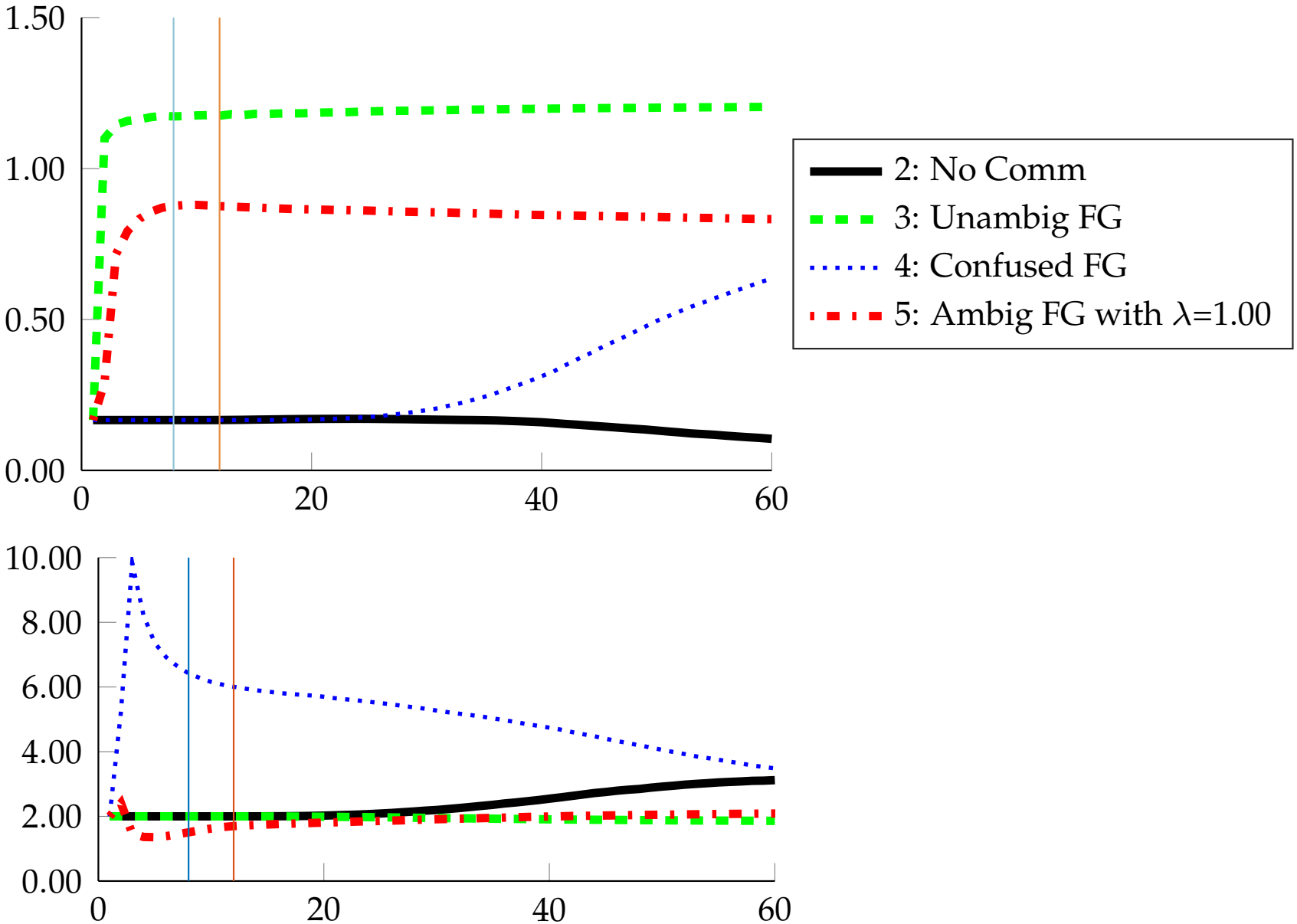

Welfare Analysis

$$\min \mathbb{E}_{t-1} \sum_{T=t}^{\infty} \beta^{T-t} \left(\pi_T^2 + \lambda_x x_T^2 \right) \tag{11}$$

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	Model 0 No change	Model 1 Full Comm	Model 2 No Comm	Model 3 Unam FG	Model 4 Conf. FG
total	165.5712	121.6338	165.5686	145.2381	150.2124
$\sum x^2$	3891.0823	2368.4768	3891.1160	3328.9318	3666.5521
$\sum \pi^2$	146.1158	109.7914	146.1131	128.5935	131.8797

$\times 10^{-6}$

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- The model can generate realistic disparities in heterogeneous expectations which increase with FG and decrease as time goes on as shown in Andrade et al. (2015). All this supports the FG interpretation here.

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3. Is the story of FG as a communication device plausible?
   - *Yes!* The model manages to capture realistic heterogeneous expectations during the crisis and FG periods. It also complies with explanations from Central Banks about the nature of their communication.