Pitfalls of Make-Up Strategies for Mitigating the ELB

Andrew Levin, Dartmouth College
Arunima Sinha, Fordham University

November 2019

Note: The views expressed here should not be interpreted as conveying the views of any other person or institution.

Introduction

- **With interest rates now below 2 percent, a severe adverse shock will almost surely pin the funds rate to the ELB for an extended time.**
- **Recent FOMC minutes and speeches indicate that policymakers are actively considering "make-up strategies" for mitigating the ELB.**
- **Such a strategy entails a commitment to maintain policy accommodation after the ELB no longer binds *("lower for longer")* by pushing inflation above its target to "make up" for prior inflation shortfalls.**

Conditions for Efficacy

The effectiveness of a make-up strategy "depends on the private sector's understanding of the strategy and on their confidence that future policymakers would follow through on promises to keep policy accommodative."

FOMC Minutes, September 2019

Pitfalls of Make-Up Strategies

- **Expectations Formation: a burgeoning research literature has highlighted the role of behavioral factors in attenuating the efficacy of forward guidance.**
- **Imperfect Credibility: the private sector may discount policymakers' promises of future action, especially for a policy committee with staggered terms and natural turnover.**
- **Model Uncertainty: policymakers' ability to make promises may be hampered by their own limited understanding of the economy.**

Analysis in the FRB/US Model

- **The Fed Board staff's macro model, FRB/US, dates to the mid-1990s and has been used extensively for analyzing FOMC strategies.**
- **FRB/US analysis can be performed under two assumptions about expectations formation:**
  - **Vector Autoregressions, which imply that forward guidance has no effect at all; or**
  - **Model-Consistent Expectations, whereby the private sector has a complete understanding of the economy (as captured by the model itself), and the policy strategy is fully credible.**

Alternative Specifications of Expectations Formation

- **McKay, Nakamura & Steinsson *(AER 2016)*: households face uninsurable income risks and borrowing constraints.**
- **Angeletos & Lian *(AER 2018)*: imperfect common knowledge reflecting heterogeneity in beliefs about the structure of the economy, attentiveness to incoming data, and access to non-public information.**
- **Gabaix (2019): bounded rationality due to cognitive discounting in the expectations and plans of households and businesses.**

Model Specification

IS and NKPC equations:

$$\begin{aligned} x_t &= -\sigma\zeta\left\{i_t - \omega E_t\pi_{t+1} - r_t^n\right\} + M_c E_t x_{t+1} \\ \pi_t &= \kappa' x_t + \beta M_f E_t \pi_{t+1} \end{aligned}$$

- Under RE: $\omega = 1$, $M_c = M_f = \zeta = 1$ and $\kappa' = \kappa$

Model Specification

- Angeletos and Lian: ω is the friction in common knowledge, same for consumers and firms and

$$\begin{aligned} M_c &= \beta + (1-\beta)\,\omega \in (\beta, 1]; M_f = \theta + (1-\theta)\,\omega \in (\theta, 1]; \\ \kappa' &= \kappa\omega; \zeta = 1 \end{aligned}$$

- Gabaix: $\omega = \zeta = 1$

$$M_c = \frac{\bar{m}}{R-r} < 1; M_f = \bar{m}\left(\theta + \frac{1-\beta\theta}{1-\beta\theta\bar{m}}(1-\theta)\right) < 1$$

- Mckay, Nakamura and Steinsson: $M_c, \zeta < 1; M_f = 1; \kappa' < \kappa$

Central bank's problem

- Minimize the loss function:

$$E_0 \sum_{t=0}^{\infty} \beta^t L_t$$

$$L_t = \pi_t^2 + \lambda x_t^2$$

subject to the IS and aggregate supply equations

Central bank's problem

- First order conditions, with initial conditions

$$\phi_{1-1} = \phi_{2-1} = 0$$

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial x_t} &: -\phi_{1t-1}\frac{M_c}{\beta} + (\lambda x_t + \phi_{1t} - \phi_{2t}\kappa') = 0 \\
\frac{\partial \mathcal{L}}{\partial \pi_t} &: \left(-\phi_{1t-1}\frac{\sigma\omega}{\beta} - \phi_{2t-1}M_f\right) + (\pi_t + \phi_{2t}) = 0 \\
i_t\phi_{1t} &= 0; i_t \geq 0, \phi_{1t} \geq 0
\end{aligned}$$

Evolution of output gap and inflation

- After lift-off:

$$\begin{bmatrix} \pi_t \\ x_t \end{bmatrix} = \begin{bmatrix} (1-\mu_1) \\ \frac{\kappa'}{\lambda}\mu_1 \end{bmatrix} \phi_{2t-1},$$

$$\phi_{2t} = \mu_1 \phi_{2t-1}$$

Evolution of output gap and inflation

- During ZLB:

$$\begin{bmatrix} \pi_t \\ x_t \end{bmatrix} = \sum_{j=t}^{T_c^*} A^{-(j-t-1)} a r_j^n + A^{-(T_c^*-t+1)} \begin{bmatrix} \pi_{T_c^*+1} \\ x_{T_c^*+1} \end{bmatrix}$$

$$A = \begin{bmatrix} \beta M_f + \kappa' \sigma\omega & \kappa' M_c \\ \sigma\omega & M_c \end{bmatrix}, \text{ and } a = \begin{bmatrix} \kappa'\sigma \\ \sigma \end{bmatrix}$$

$$\begin{bmatrix} \phi_{1t} \\ \phi_{2t} \end{bmatrix} = \begin{bmatrix} \frac{M_c}{\beta} + \kappa' \frac{\sigma\omega}{\beta} & \kappa' M_f \\ \frac{\sigma\omega}{\beta} & M_f \end{bmatrix} \begin{bmatrix} \phi_{1t-1} \\ \phi_{2t-1} \end{bmatrix} + \begin{bmatrix} -\kappa' & -\lambda \\ -1 & 0 \end{bmatrix} \begin{bmatrix} \pi_t \\ x_t \end{bmatrix}$$

Evolution of output gap and inflation

- During ZLB:

$$\begin{aligned}
\pi_{T_c^*+1} + \phi_{2T_c^*+1} &= \phi_{1T_c^*}\frac{\sigma\omega}{\beta} + \phi_{2T_c^*}M_f \\
\lambda x_{T_c^*+1} - \phi_{2T_c^*+1}\kappa' &= \phi_{1T_c^*}\frac{M_c}{\beta} \\
\pi_{T_c^*+1} - \kappa' x_{T_c^*+1} &= \beta M_f E_{T_c^*+1}\pi_{T_c^*+2}
\end{aligned}$$

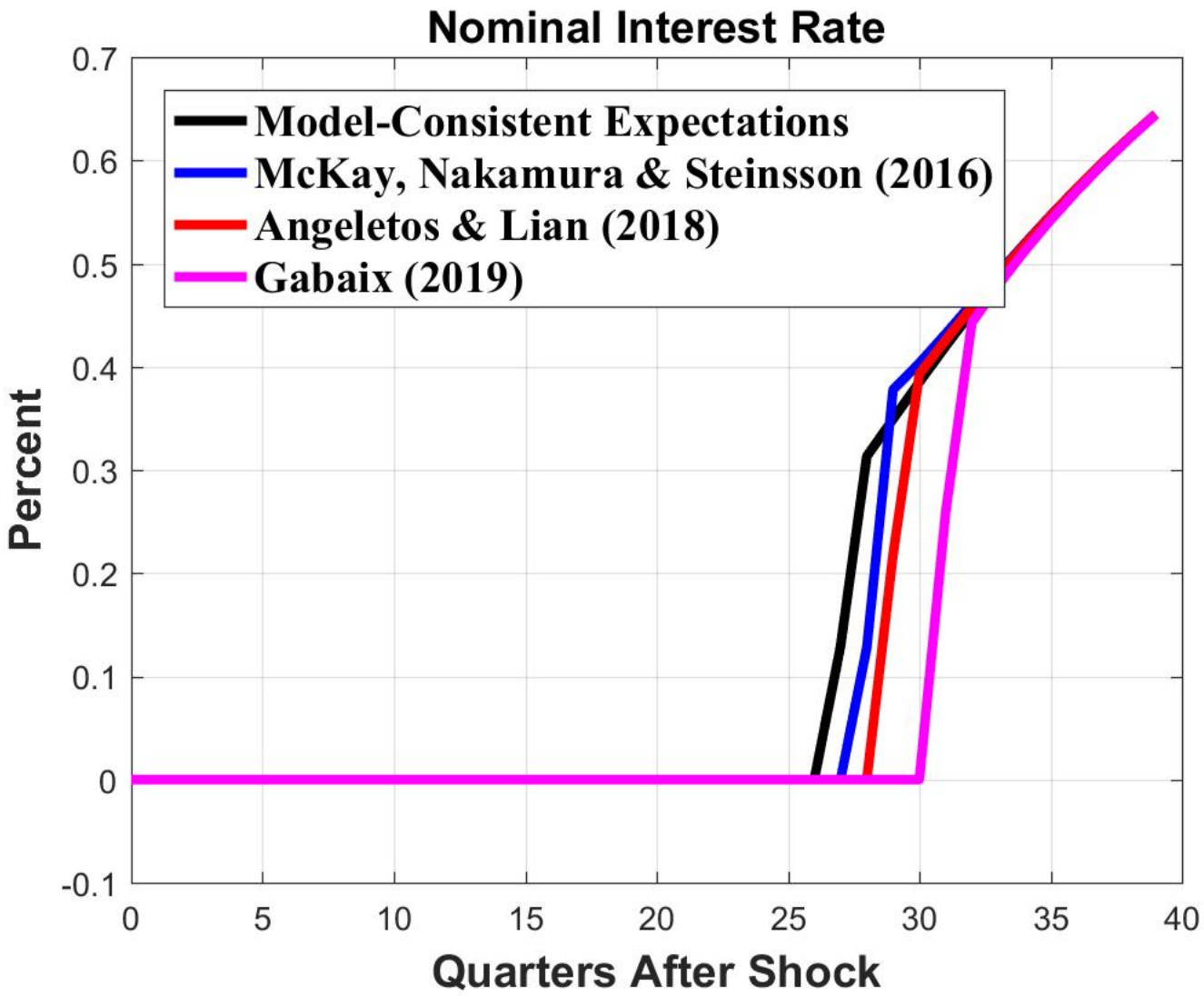
Model Parameters

- IES: $\sigma = 4$
- Discount factor: $\beta = 0.9975$
- Slope of Phillips curve: $\kappa = 0.024$
- Behavioral parameters:
  - Angeletos and Lian (2018): $\omega = 0.75, M_f = 0.9$;
  - Mckay, Nakamura and Steinsson (2016): $M_c = 0.97;\ \zeta = 0.75$
  - Gabaix: $M_c = 0.8;\ M_f = 0.8$;
- Natural rate shock: $\rho = 0.94; shock = -0.01$

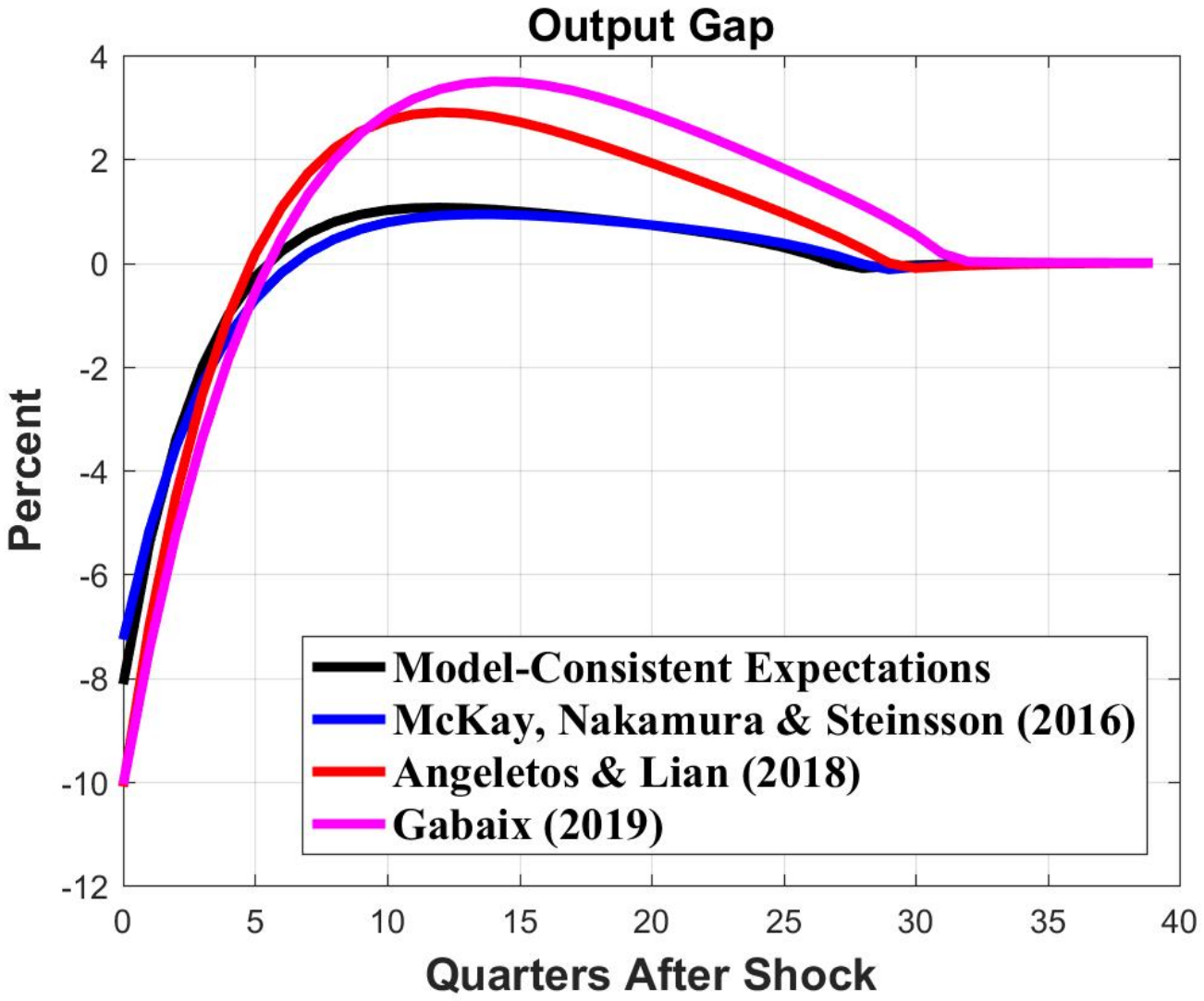
Assessments with Full Credibility

- **Using a small New Keynesian model, we can compare the implications of these alternative specifications of expectations formation.**
- **We consider a scenario involving a persistent shortfall in aggregate demand, i.e., the natural rate of interest is negative for almost 6 years.**
- **The optimal policy defers liftoff from the ELB for an additional 1-2 years.**
- **Real output initially declines sharply and then booms over subsequent years.**
- **Inflation drops temporarily below target and then remains elevated for about five years.**

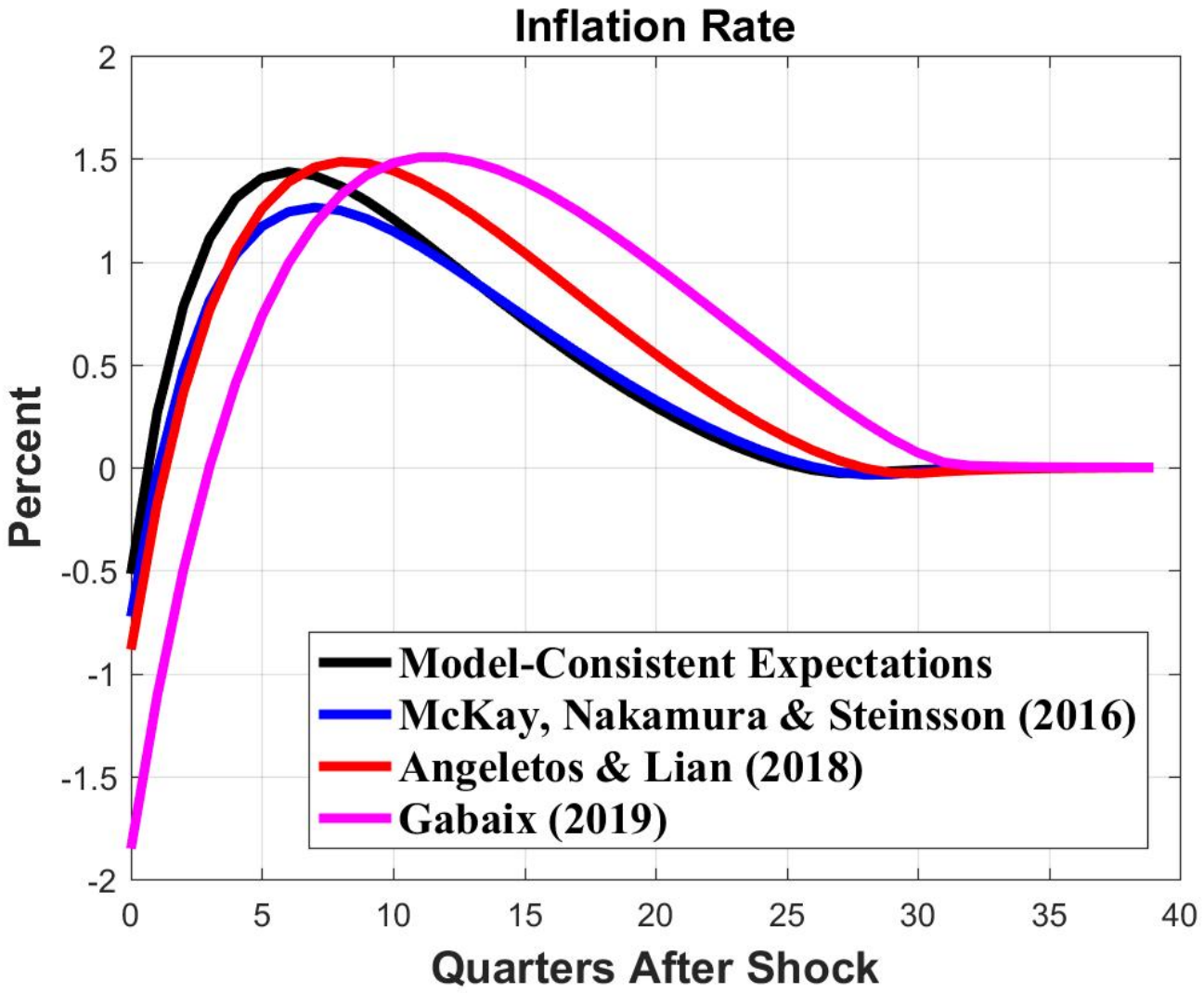
Optimal Policy with Full Credibility



Optimal Policy with Full Credibility



Optimal Policy with Full Credibility



Pitfalls of Imperfect Credibility

- Now we turn to scenarios in which the central bank has limited credibility in making policy commitments over a multi-year timeframe.
- Bernanke, Laubach, Mishkin & Posen (2001) found the announcement of an inflation target had little or no immediate impact on inflation; rather, the central bank gained credibility by tightening at the start of the disinflation.
- By contrast, earning credibility may be particularly difficult as long as policy is pinned to the ELB, because policymakers cannot take action to show their resolve.

Concerns about Imperfect Credibility

"...we need to be mindful of the intrinsic limits on our ability to make credible promises over time horizons that extend beyond several years."

Janet Yellen, FOMC Transcript, Nov. 2011

"... the public could focus on the potential for the rotation of voters to change the path...or, in the worst case for credibility, the political debate could become fixated on effecting such a change through legislation or personnel changes."

Elizabeth Duke, FOMC Transcript, Nov. 2011

Analysis of Imperfect Credibility

- We assume that over the period that policy is constrained by the ELB, the private sector perceives a risk that in any given period the central bank may renege on its promise and revert to a discretionary policy.
- For simplicity, we assume the commitment is fully credible once the ELB no longer binds because at that point the private sector can verify that the strategy is being implemented.
- The central bank's strategy incorporates its recognition of its own imperfect credibility.

Imperfect credibility

- From $t = 0$ to T', the agents assign a probability $(1 - \Theta)$ to the central bank reneging on its commitment and following the discretion path

$$
\begin{aligned}
x_t &= M_c \left(\Theta E_t x_{t+1} + (1-\Theta) E_t x^D_{t+1}\right) \\
&\quad -\sigma' \left\{i_t - \omega \left(\Theta E_t \pi_{t+1} + (1-\Theta) E_t \pi^D_{t+1}\right) - r^n_t\right\} \\
\pi_t &= \kappa' x_t + \beta M_f \left(\Theta E_t \pi_{t+1} + (1-\Theta) E_t \pi^D_{t+1}\right)
\end{aligned}
$$

Imperfect credibility

- The shock dissipates at T'
- From $T' + 1$ once agents observe that the central bank has maintained the commitment path, the imperfect credibility is resolved.

Imperfect Credibility

- FOCs

FOCs with respect to x_t at $t = T' + 1$:

$$\frac{\partial \mathcal{L}}{\partial x_t} = \beta^{T'} \left\{ 2\phi_{1T'} \left(-M_c \Theta \right) \right\} + \beta^{T'+1} \left\{ 2\lambda x_{T'+1} + 2\phi_{1T'+1} - 2\phi_{2T'+1} \kappa' \right\} = 0$$

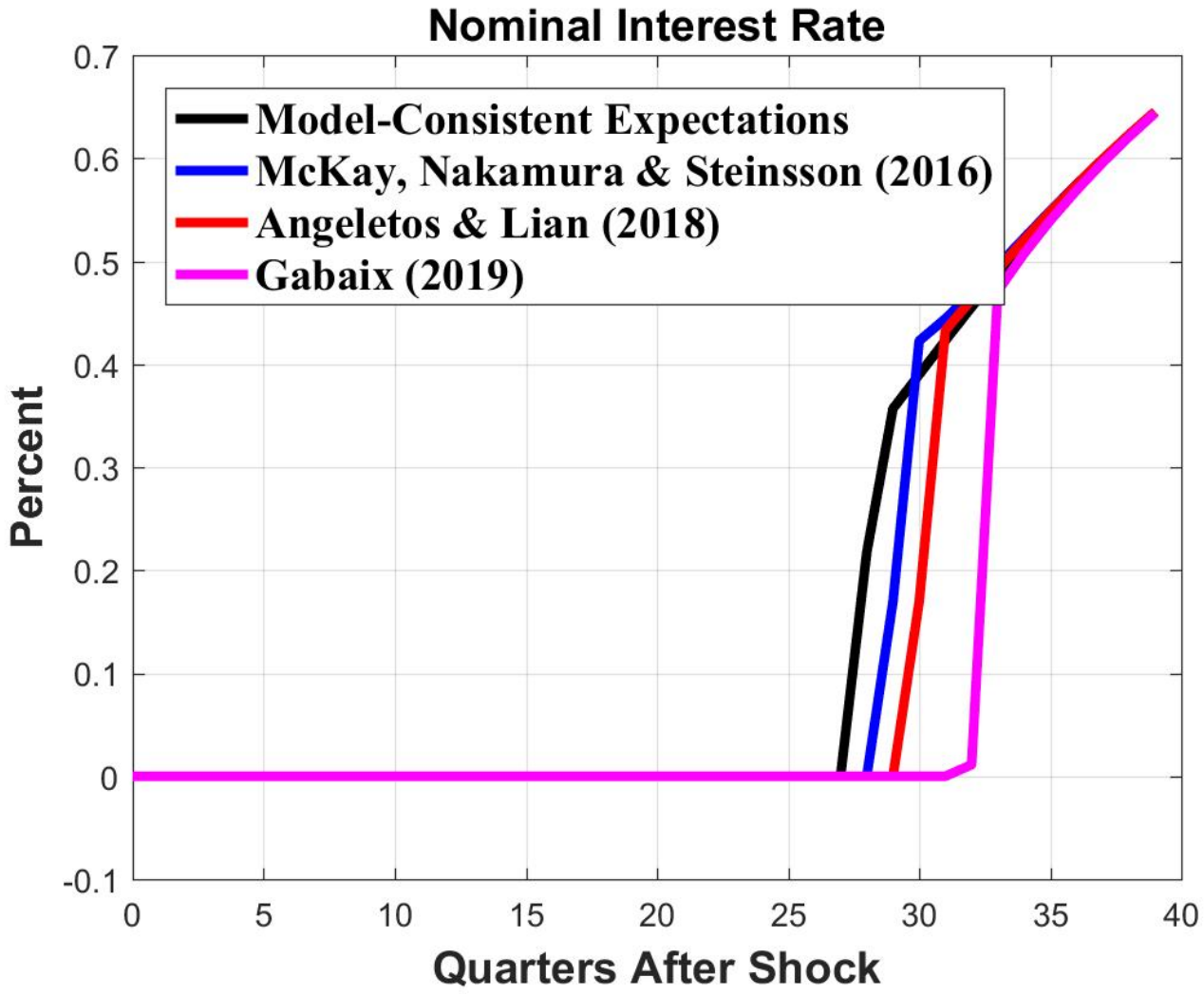
FOCs with respect to x_t at $t = T' + 2$:

$$\frac{\partial \mathcal{L}}{\partial x_t} = \beta^{T'} \left\{ 2\phi_{1T'+1} \left(-M_c \right) \right\} + \beta^{T'+1} \left\{ 2\lambda x_{T'+2} + 2\phi_{1T'+2} - 2\phi_{2T'+2} \kappa' \right\} = 0$$

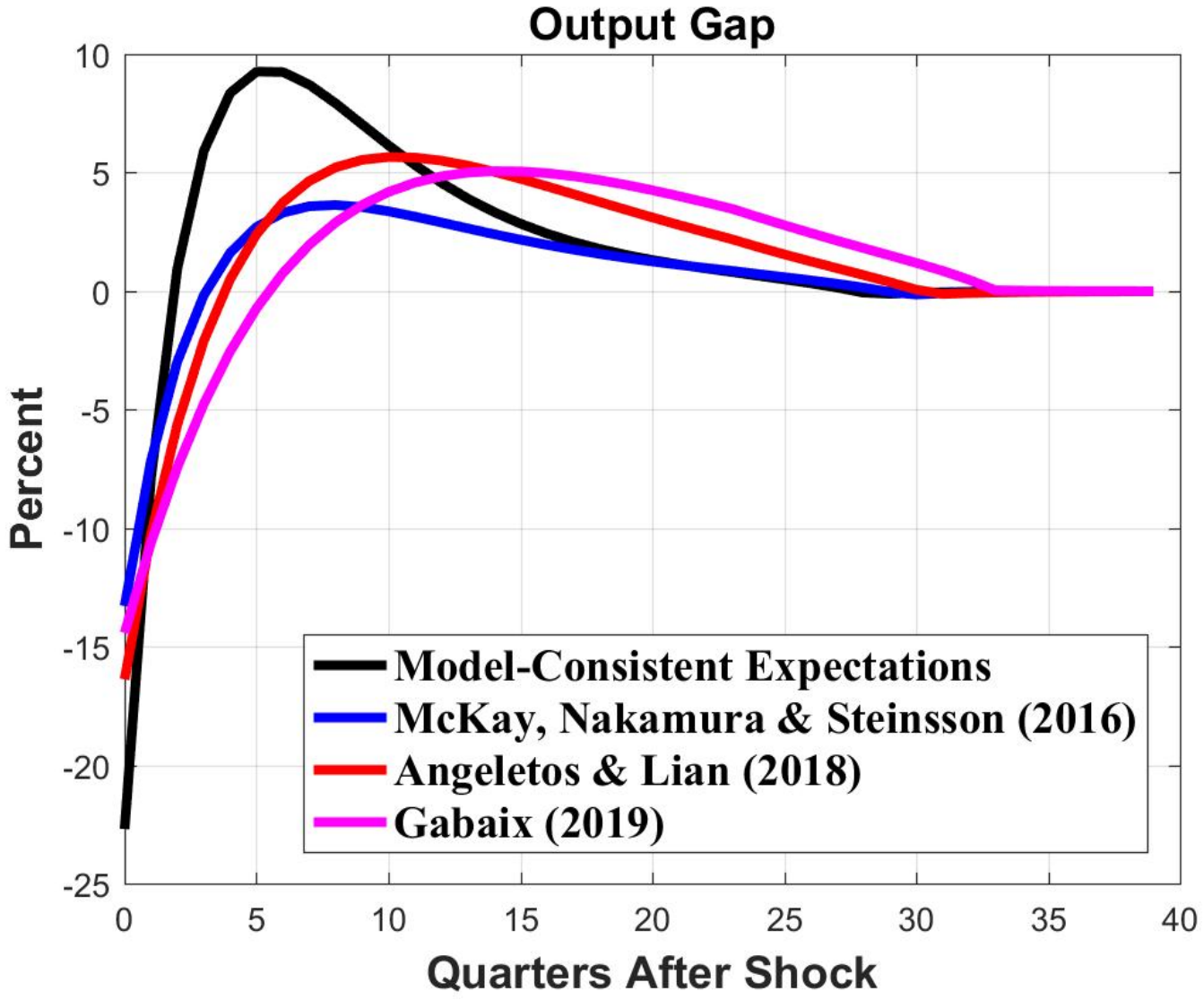
Implications of Imperfect Credibility

- We calibrate the credibility parameter so that the probability of reneging is perceived to be 2.5 percent in any given quarter.
- Thus, at the start of the scenario, the private sector perceives 50/50 odds that the central bank will carry out its strategy, and those perceived odds rise gradually over time.
- The timing of liftoff from the ELB is similar to the case of full credibility, but the outcomes for output and inflation are markedly worse.
- Evidently, the efficacy of a make-up strategy hinges crucially on its credibility.

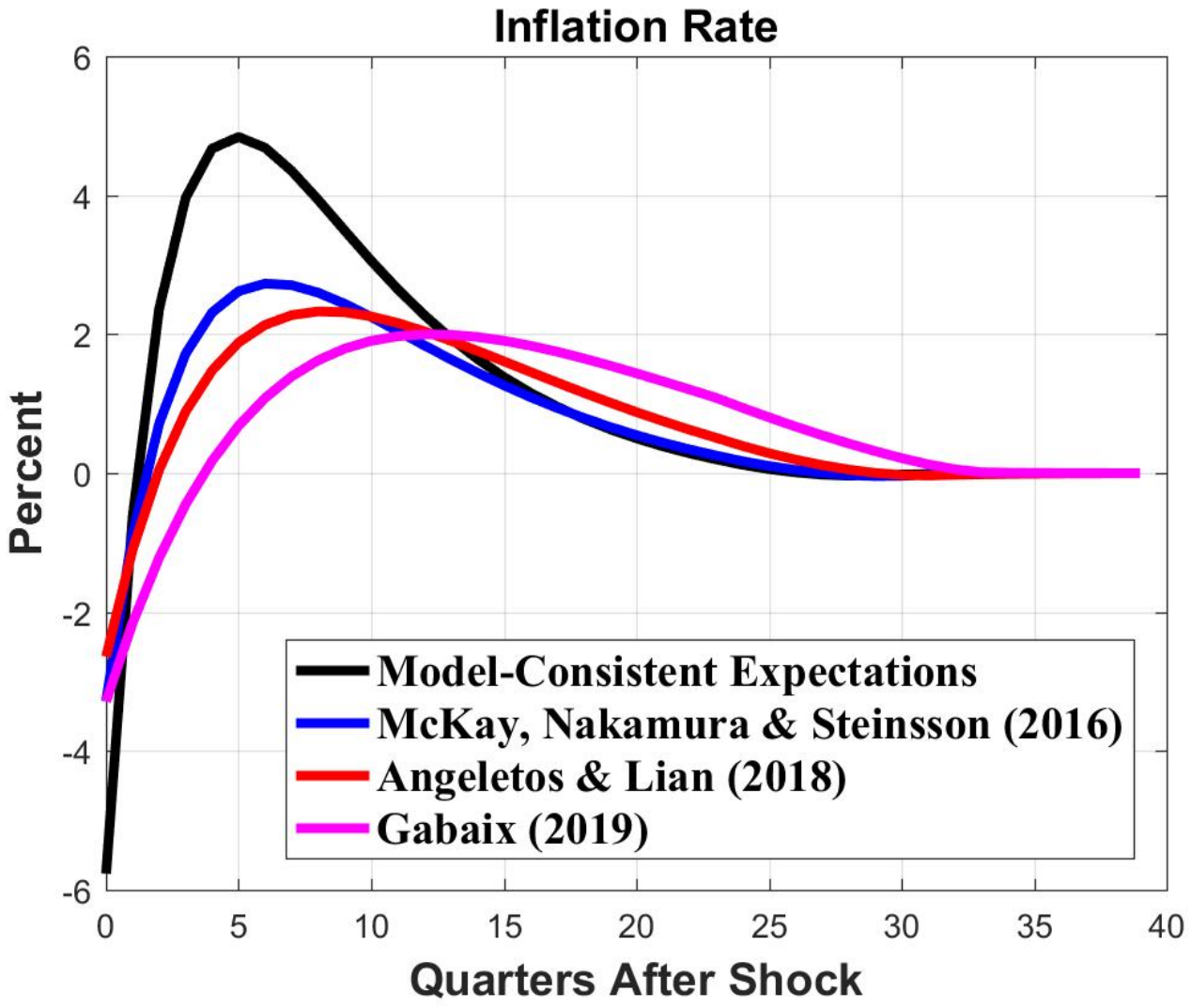
Implications of Imperfect Credibility



Implications of Imperfect Credibility



Implications of Imperfect Credibility



Comparison across credibility parameters

Table 1 : *Varying credibility parameters*

Θ	T	$\sigma(\pi)$	$\sigma(x)$	T	$\sigma(\pi)$	$\sigma(x)$	T	$\sigma(\pi)$	$\sigma(x)$	T	$\sigma(\pi)$	$\sigma(x)$
	Rational Exp			Gabaix (2016)			AL (2018)			MNS (2016)		
1	28	0.6	1.9	32	0.8	3.0	30	0.6	2.7	29	0.5	1.8
0.950	30	3.9	10.6	35	1.7	6.1	32	1.7	6.5	31	2.1	5.1

Pitfalls of Model Uncertainty

- **Thus far, we have assumed (as in most other studies of the ELB) that policymakers have a complete understanding of the economy, as captured by a specific macro model.**
- **However, it has long been recognized that the central bank's strategy should be robust to model uncertainty; see Taylor (1993, 1999), Hansen & Sargent (2001).**
- **That literature has underscored the pitfalls of strategies finetuned to a particular model or that hinge on long-horizon forecasts; see Levin, Wieland & Williams (1999, 2003) and Levin & Williams (2003).**

Policymaker Recognition of Uncertainty

"We need to follow a pragmatic approach,... recognizing the limits of our understanding of the structure and evolution of the economy and of our ability to anticipate or plan for all possible contingencies."

Janet Yellen, FOMC Transcript, Nov. 2011

"...making binding commitments might be viewed as potentially reckless in a world where the outlook is highly uncertain."

William Dudley, FOMC Transcript, Nov. 2011

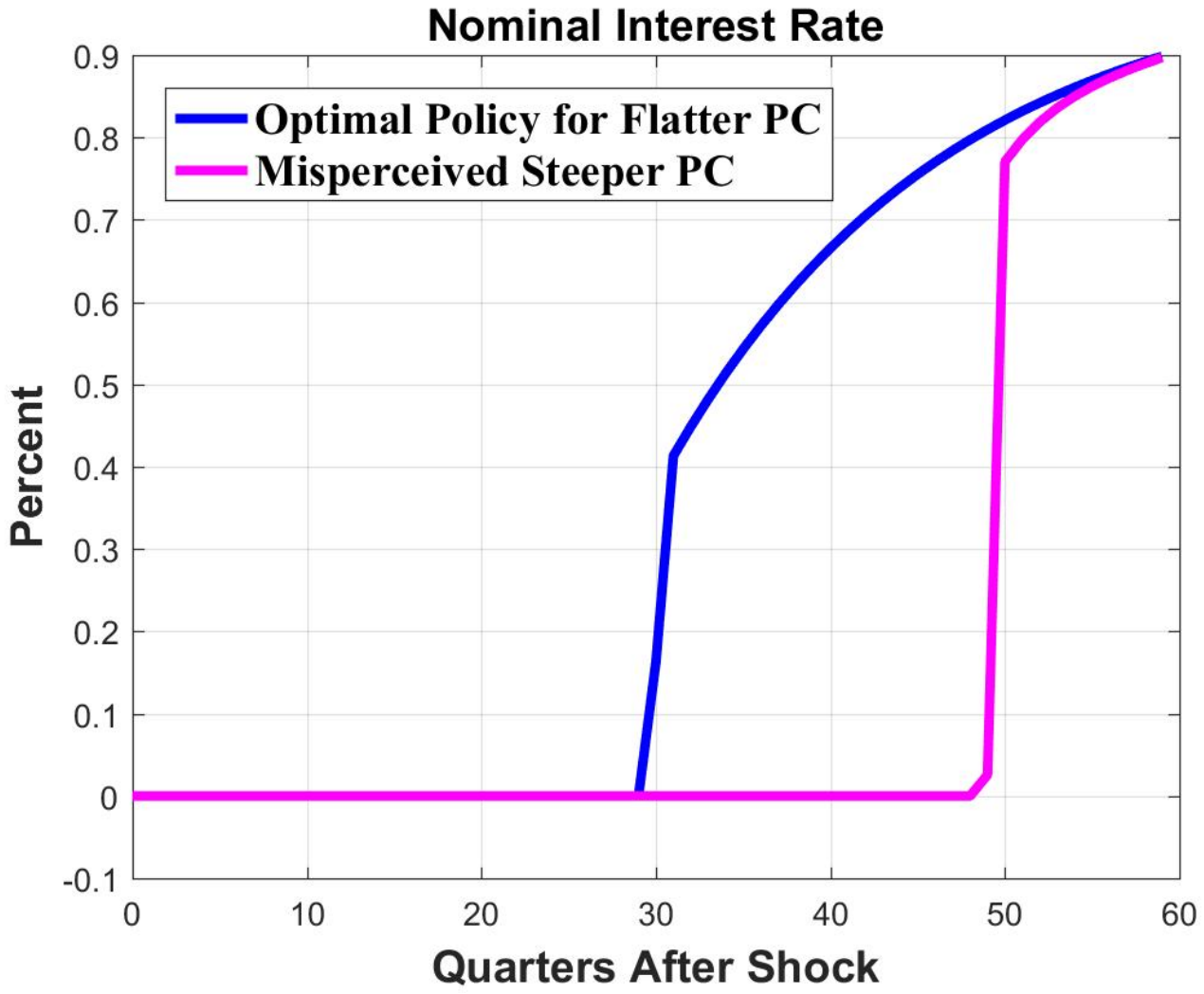
Analysis of Model Uncertainty

- As a rudimentary illustration of this pitfall, we now analyze a scenario in which the New Keynesian Phillips Curve (PC) is flatter than in our baseline calibration.
- With a flatter PC, a shift in the output gap has more muted effects on inflation and hence induces a smaller change in the real interest rate for a given nominal rate.
- For simplicity, we analyze this scenario using the expectations mechanism of Angeletos and Lian (2018), and we assume that the central bank's policy strategy is transparent and credible to the private sector.

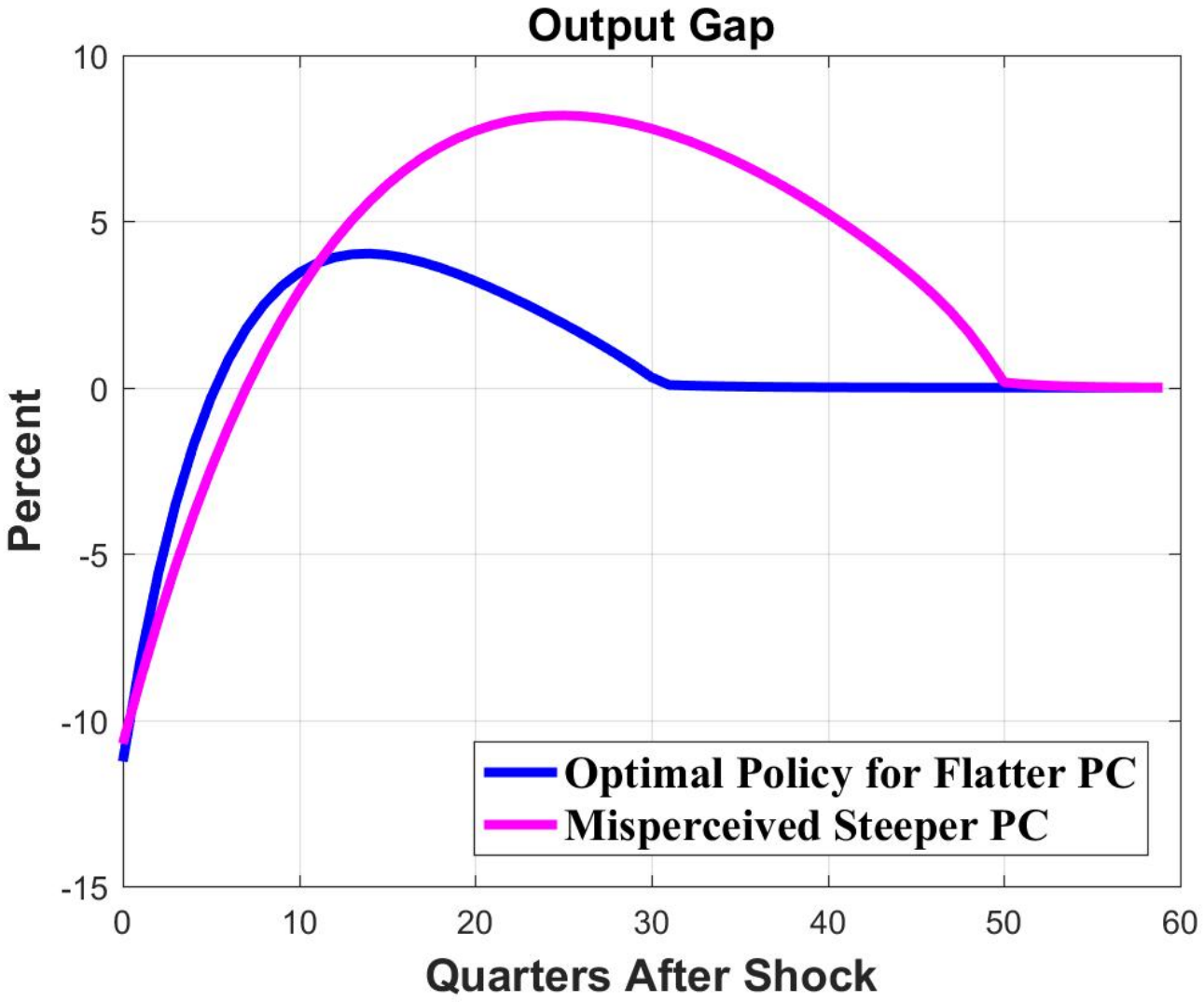
Implications of Model Uncertainty

- **If the central bank knows the PC is quite flat, then the optimal policy remains at the ELB for about 9 years, inducing a prolonged but shallow overshooting of output and inflation.**
- **If the central bank incorrectly formulates its strategy on the premise of a steeper PC, that misperception delays the timing of liftoff and inflation remains elevated for a decade.**
- **Of course, this exercise is merely illustrative; in practice, policymakers face uncertainty about many key aspects of the economy.**

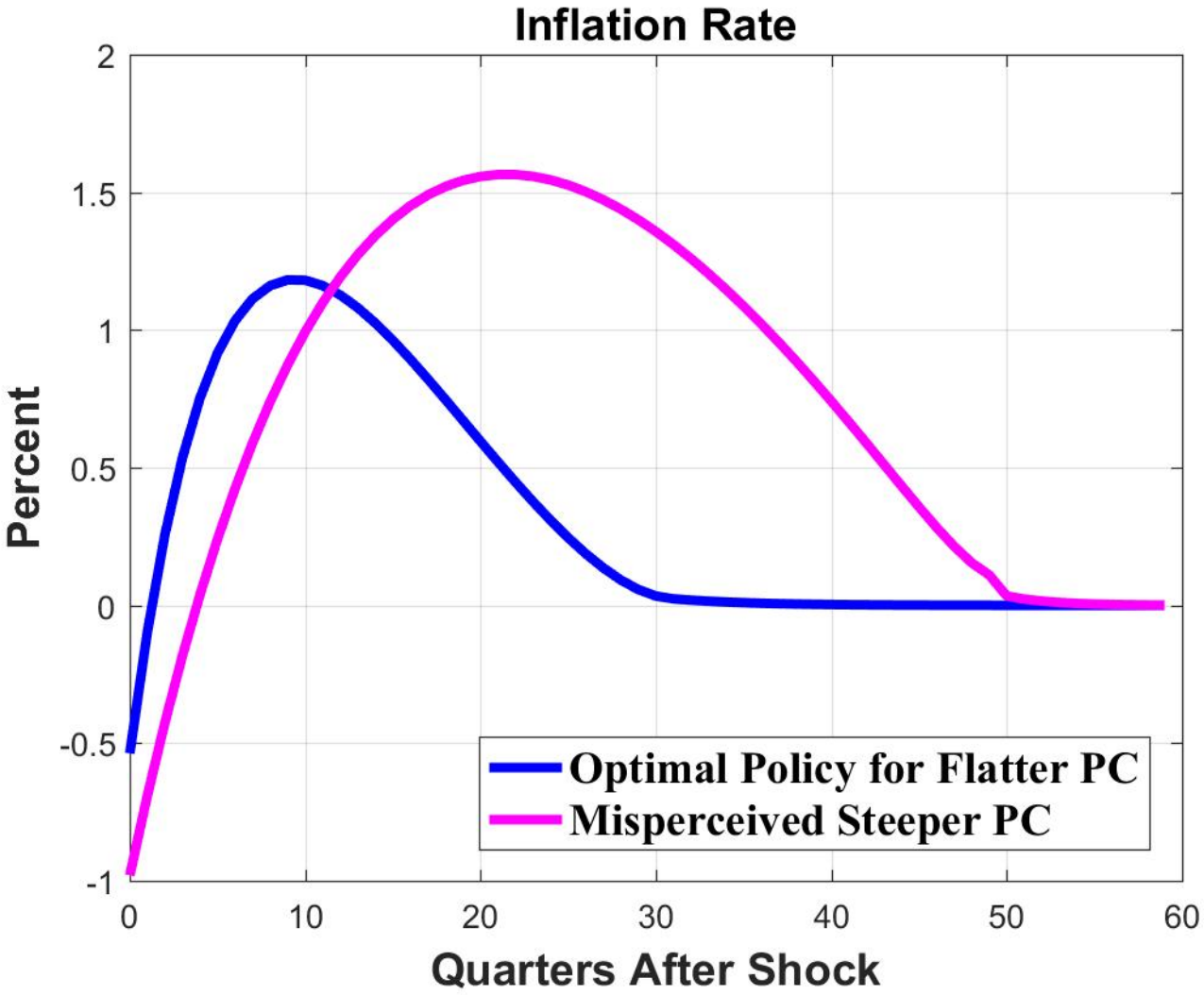
Implications of Model Uncertainty



Implications of Model Uncertainty



Implications of Model Uncertainty



The Rationale for Digital Cash
(see Bordo & Levin Cato Journal article)

- **An account-based system of digital cash can provide an efficient medium of exchange.**
- **Partnerships between the central bank and commercial banks preserve privacy, foster innovation, and promote financial stability.**
- **The interest rate on digital cash can serve as the primary tool of monetary policy.**
- **The central bank can foster true price stability and more satisfactory economic recovery.**

Key Elements of a Digital Cash System

- **Individuals & businesses should remain free to use paper cash or private payments.**
- **Fees should be imposed on large transfers between digital cash and paper cash, thereby curtailing arbitrage and eliminating the ELB.**
- **Moderate amounts of digital cash balances should be exempt from negative interest rates.**
- **Thus, the central bank can respond to shocks while ensuring that no implicit taxes or fees would be imposed on ordinary households or small businesses.**

Conclusion

- **The global economy remains turbulent, and the ELB is likely to be a recurring constraint on U.S. monetary policy.**
- **Make-up strategies are subject to a number of severe pitfalls and hence are unlikely to be adequate for mitigating the ELB.**
- **Digital cash can enhance the monetary system and eliminate the ELB.**
- **The Federal Reserve should act promptly to foster the implementation of U.S. digital cash.**