

The Central Bank Strikes Back !

Credibility of Monetary Policy under Fiscal Influence

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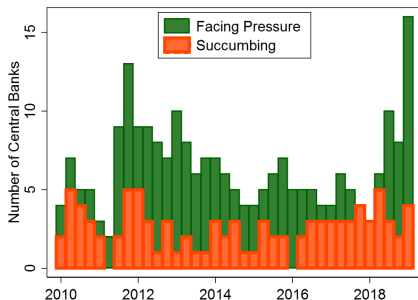
²Bank of Canada

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Disclaimer

The views expressed in this paper are solely those of the authors, and no responsibility for them should be attributed to the Bank of Canada.

Political Pressure on Central Banks



source: Binder (2019)

- Sample of 118 central banks, events based on media reports
- **Why?** electoral deadlines and public debt management

Political influence over central banks

A classic...



⇒ **Shall a central bank lean against fiscal influence to preserve its independence?**

e.g. Eurozone

Several **ECB programs** include provisions contingent on fiscal decisions:

- Liquidity support to Greek banks conditional on fiscal consolidation
- OMT: debt buying program conditional on fiscal consolidation
- Collateral framework: risk premium threshold / credit rating

more

Controversial:

"overburdening monetary policy may eventually diminish and compromise the independence of credibility of the central bank, thereby reducing its effectiveness to preserve price stability." [A. Orphanides (2013)]

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⇒ Monetary rules to **incentivize** fiscal authorities?

⇒ Risk to independence and price stability? ie. **credibility?**

This project

Monetary policy under fiscal influence

- Monetary - fiscal policy game
- Asymmetric commitment technology
 - Central bank under (limited) commitment
 - Treasury under discretion ... with influence
- Contrast different monetary rules:

↔ *standard vs. strategic*

(fiscal conditionality)

This project

Monetary policy under fiscal influence

- Monetary - fiscal policy game
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- Contrast different monetary rules:
 - ↪ *standard vs. strategic* (fiscal conditionality)
- **Key message:** strategic rules...
 1. implement better economic outcomes
 2. enhance the credibility of a central bank
 3. especially at high level of public debt, nominal and short maturity

(selected) literature

- Time inconsistency of optimal policy plans
 - Monetary policy: strategic inflation
Diaz-Gimenez, Giovanetti, Marimon and Teles (2008)
 - Fiscal policy: interest rate manipulation
Debortoli, Nunes (2013) and Debortoli, Nunes, Yared (2017)
- Non cooperative monetary-fiscal policy
Dixit and Lambertini (2003), Gnocchi (2013), Gnocchi and Lambertini (2016), Barthelemy and Plantin (2018)
- Limited commitment
Farhi, Sleet, Werning, and Yeltekin (2012), Scheuer and Wolitzky (2016)
- Strategic rules
Bassetto (2005), Atkeson, Chari and Kehoe (2010), Camous and Cooper (2019)

This project

Outline

1. Static linear quadratic framework
 - Institutional set up
 - Standard and strategic monetary rules
 - Evaluation of credibility
2. Dynamic cash-credit economy
 - Endogenous state variable: public debt
 - Level, nominal vs. real, short vs. long
 - Inflation target and credibility

Static Game

Linear Quadratic Framework

Rank economic outcomes: $\mathcal{L}(e, \tau, \pi)$

- Social Loss Function

$$\mathcal{L}(\cdot) = \frac{1}{2} [(\tau - \tau^*)^2 + \lambda(\pi - \pi^*)^2 + \gamma(y - y^*)^2]$$

- “Phillips curve”

$$y(\cdot) = \tau - \tau^e + \alpha(\pi - \pi^e)$$

- Rational expectations

$$\tau^e = \tau \quad \text{and} \quad \pi^e = \pi \quad \text{i.e.} \quad e = \tau^e + \alpha\pi^e$$

LQ framework

Key variables: (λ, α)

- Social Loss Function

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LQ framework

Benchmarks: cooperation

(or joint government)

- Under commitment

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = \tau^* + \alpha\pi^* = e^*$$

LQ framework

Benchmarks: cooperation

(or joint government)

- Under commitment

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = \tau^* + \alpha\pi^* = e^*$$

- Under discretion

$$\tau = \tau^* + \gamma y^* \quad \pi = \pi^* + \frac{\alpha}{\lambda} \gamma y^* \quad y = 0 \quad e = e^* + \left(1 + \alpha \frac{\alpha}{\lambda}\right) \gamma y^*$$

↪ *inflation* and *fiscal* biases and welfare loss

↪ higher α and lower λ \uparrow *inflation bias*

Monetary - Fiscal game

Non cooperation, asymmetric and partial commitment

- Monetary authority with limited commitment
 - Fiscal authority without commitment and with influence
- Monetary interventions to **curb fiscal discretion**?
- Are these interventions **credible**?

Monetary - Fiscal game

Non cooperation, asymmetric and partial commitment

- Monetary authority with limited commitment
 - Fiscal authority without commitment and with influence
- Monetary interventions to **curb fiscal discretion?**
- Are these interventions **credible?**
- ⇒ Specify a game ...
- ⇒ ... and contrast credibility across policy regimes

Game

Const. stage	Sequential game			Losses	
Monetary authority	Private agents	Fiscal authority	Monetary authority	Fiscal authority	Monetary authority
$\pi^k(\mathcal{S})$				$\mathcal{L}^{f,k}(e, \tau, \pi^k(\cdot))$	$\mathcal{L}^{m,k}(e, \tau, \pi^k(\cdot))$
				$\mathcal{L}^{f,r}(e, \tau, \pi^r(\cdot))$	$\mathcal{L}^{m,r}(e, \tau, \pi^r(\cdot)) + \kappa$

- Timing: fiscal influence
- $\kappa > 0$: degree of monetary commitment
- $\pi^r(\mathcal{S}) = \operatorname{argmax} \mathcal{L}(e, \tau, \pi)$

Evaluating credibility

- **A monetary rule $\pi^k(\mathcal{S})$ is credible** iff $\forall \tau \in \mathbb{T}(e)$:

$$\mathcal{L}^{m,k}(e, \tau, \pi^k(\cdot)) \leq \mathcal{L}^{m,r}(e, \tau, \pi^r(\cdot)) + \kappa$$

where

$$\mathbb{T}(e) = \left\{ \tau \text{ s.t. } \mathcal{L}^{f,r}(e, \tau, \pi^r(\cdot)) \leq \max_{\tilde{\tau}} \mathcal{L}^{f,k}(e, \tilde{\tau}, \pi^k(\cdot)) \right\}$$

Evaluating credibility

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- $\bar{\kappa}$ is **the credibility cut-off** of a rule

$$\bar{\kappa} = \max_{\tau \in \mathbb{T}(\cdot)} \mathcal{L}^{m,k}(\cdot) - \mathcal{L}^{m,r}(\cdot)$$

i.e. the minimum degree of commitment that rules out *renege*

⇒ Study fiscal and monetary decisions **on / off equilibrium**

Monetary rules

Contrast credibility for

1. **Standard rule**

↪ the central bank delivers the inflation target π^*

$$\forall \mathcal{S}, \pi^k(\mathcal{S}) = \pi^*$$

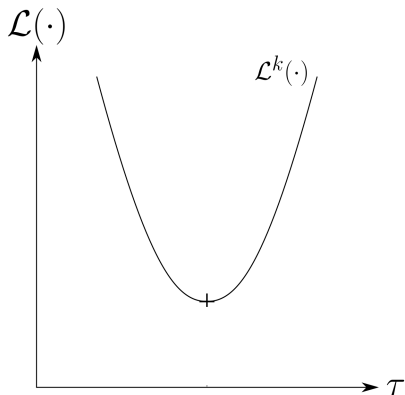
2. **Strategic rule**

↪ the central bank implements $\pi = \pi^*$ and induces $\tau = \tau^*$,

$$\forall \mathcal{S}, \pi^k(\mathcal{S}) = ??$$

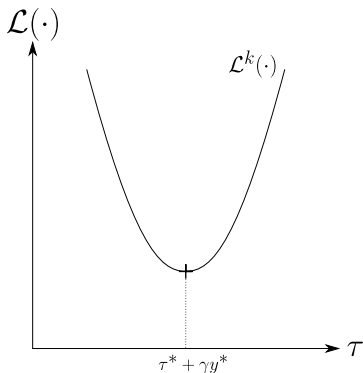
NB benevolent policy makers, i.e. $\mathcal{L}^f(\cdot) = \mathcal{L}^m(\cdot) = \mathcal{L}(\cdot)$

Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



Welfare loss under keep - $\pi^k(\cdot) = \pi^*$

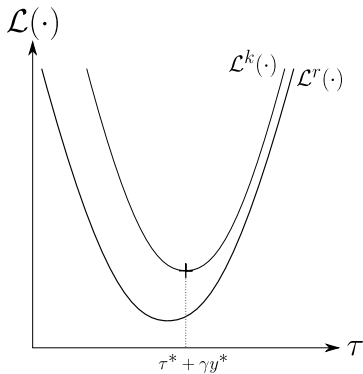
Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



If credible, eqm outcome

$$\tau = \tau^* + \gamma y^*, \pi = \pi^* \text{ and } e = e^* + \gamma y^*$$

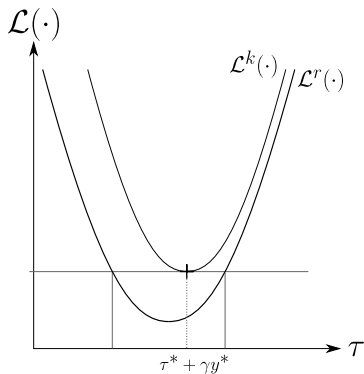
Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



Welfare loss under renege

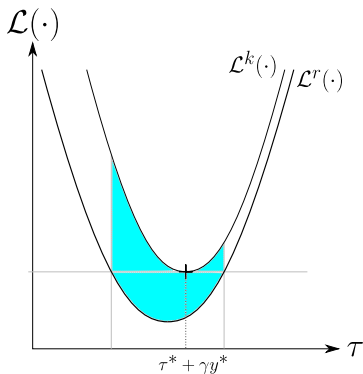
$$\pi^r(e, \tau) = \operatorname{argmin} \mathcal{L}(e, \tau, \pi)$$

Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



Profitable fiscal deviations: $\tau \in T(e)$

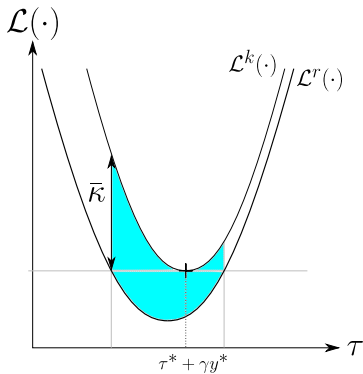
Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



The rule is credible iff

$$\forall T \in T(e), \kappa \geq \mathcal{L}^k(\cdot) - \mathcal{L}^r(\cdot)$$

Standard rule - $\pi^k(\mathcal{S}) = \pi^*$



Credibility cut-off

$$\bar{\kappa}_1 = \max_{T \in T(e)} \mathcal{L}^k(\cdot) - \mathcal{L}^r(\cdot)$$

Strategic rule

Design a rule $\pi^k(\mathcal{S})$ to

1. implement cooperation + commitment equilibrium

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = e^*$$

\Rightarrow if $\tau = \tau^*$, then $\pi^k(\cdot) = \pi^*$ **on eqm**

Strategic rule

Design a rule $\pi^k(\mathcal{S})$ to

1. implement cooperation + commitment equilibrium

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = e^*$$

\Rightarrow if $\tau = \tau^*$, then $\pi^k(\cdot) = \pi^*$ **on eqm**

2. provide incentives...

\Rightarrow if $\tau \neq \tau^*$, then punish

$$\forall \tau \mathcal{L}^{f,k}(e^*, \tau, \pi^k(\cdot)) \geq \mathcal{L}^{f,k}(e^*, \tau^*, \pi^*) \quad \text{off eqm}$$

Strategic rule

Design a rule $\pi^k(\mathcal{S})$ to

1. implement cooperation + commitment equilibrium

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = e^*$$

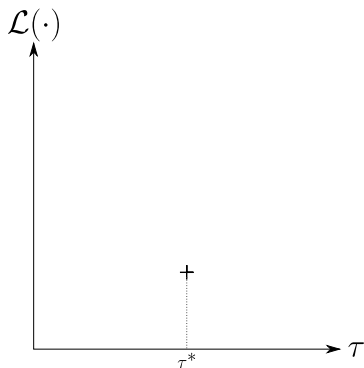
\Rightarrow if $\tau = \tau^*$, then $\pi^k(\cdot) = \pi^*$ **on eqm**

2. ... and minimize credibility cut-off

\Rightarrow if $\tau \neq \tau^*$, then offset welfare effect of fiscal deviation

$$\forall \tau \in \mathbf{T}(e^*), \mathcal{L}^{f,k}(e^*, \tau, \pi^k(\cdot)) = \mathcal{L}^{f,k}(e^*, \tau^*, \pi^*) \quad \text{off eqm}$$

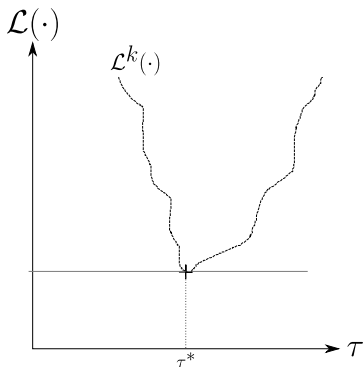
Strategic rule



On equilibrium

$$\tau = \tau^*, \pi = \pi^* \text{ and } e = e^*$$

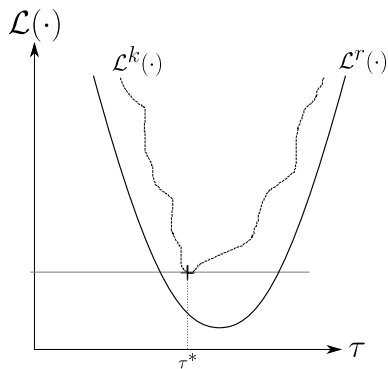
Strategic rule



Off equilibrium 1 - keep

$$\forall \tau \mathcal{L}^{f,k}(e^*, \tau, \pi^k(\cdot)) \geq \mathcal{L}^{f,k}(e^*, \tau^*, \pi^*)$$

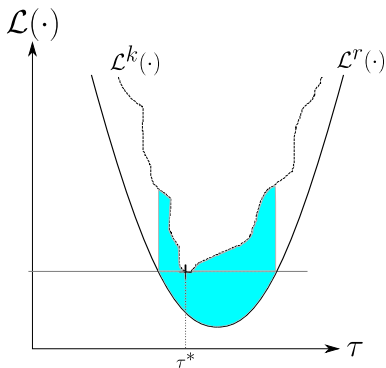
Strategic rule



Off equilibrium 2 - renege

$$\pi^r(e, \tau) = \operatorname{argmin} \mathcal{L}(e, \tau, \pi)$$

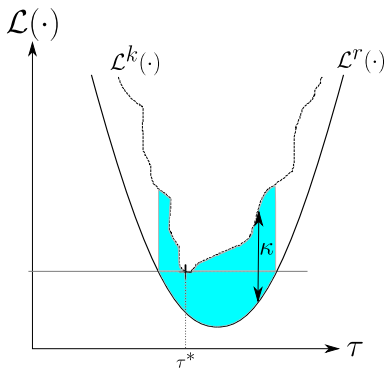
Strategic rule



Profitable fiscal deviations

$$T(e^*) = \{ \tau \text{ s.t. } \mathcal{L}^{f,r}(e^*, \tau, \pi^r(\cdot)) \leq \mathcal{L}^{f,k}(e^*, \tau^*, \pi^k(\cdot)) \}$$

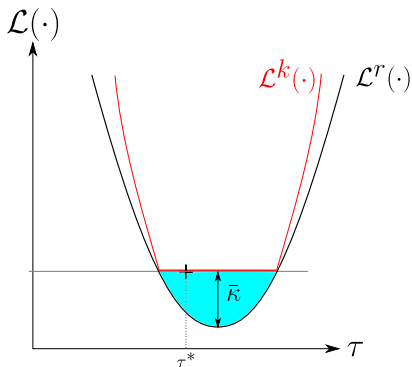
Strategic rule



Credibility cut-off

$$\max_{\tau \in T(e^*)} \mathcal{L}^{m,k}(e^*, \tau, \pi^k(\cdot)) - \mathcal{L}^{m,r}(e^*, \tau, \pi^r(\cdot))$$

Strategic rule



Minimize credibility cut-off

$$\bar{\kappa}_2 = \mathcal{L}^{m,k}(e^*, \tau^*, \pi^*) - \min_{\tau \in T(\cdot)} \mathcal{L}^{m,r}(e^*, \tau, \pi^r(\cdot))$$

Comparing rules

1. different equilibrium outcomes

- **Standard** inflation target π^* credible iff $\kappa \geq \bar{\kappa}_1(\cdot)$

$$\tau = \tau^* + \gamma y^* \quad \pi = \pi^* \quad y = 0 \quad e = e^* + \gamma y^*$$

- **Strategic** rule credible iff $\kappa \geq \bar{\kappa}_2(\cdot)$

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = e^*$$

Comparing rules

1. different equilibrium outcomes

- **Standard** inflation target π^* credible iff $\kappa \geq \bar{\kappa}_1(\cdot)$

$$\tau = \tau^* + \gamma y^* \quad \pi = \pi^* \quad y = 0 \quad e = e^* + \gamma y^*$$

- **Strategic** rule credible iff $\kappa \geq \bar{\kappa}_2(\cdot)$

$$\tau = \tau^* \quad \pi = \pi^* \quad y = 0 \quad e = e^*$$

2. sensitivity of credibility cut-off

- For both rules $i \in \{1, 2\}$

$$\frac{d\bar{\kappa}_i(\cdot)}{d\lambda} < 0$$

$$\frac{d\bar{\kappa}_i(\cdot)}{d\alpha} > 0$$

⇒ The higher the relative gain to renouncing the rule, the higher the degree of commitment to defend the rule against fiscal influence

Comparing rules

3. credibility gains of strategic rule?

$$\bar{\kappa}_2(\cdot) < \bar{\kappa}_1(\cdot) ?$$

- Benefits:
 - anchor private agents expectations
 - eliminate fiscal bias $\tau \neq \tau^*$
- Costs: off eqm threat $\pi^k(\cdot) \neq \pi^*$

Comparing rules

3. credibility gains of strategic rule?

$$\bar{\kappa}_2(\cdot) < \bar{\kappa}_1(\cdot) ?$$

- Benefits:
 - anchor private agents expectations
 - eliminate fiscal bias $\tau \neq \tau^*$
- Costs: off eqm threat $\pi^k(\cdot) \neq \pi^*$

⇒ **strategic rule is more credible** when:

- λ is low, i.e. monetary deviations from π^* are not costly
- α is high, i.e. small deviations from π^* are required to deter $\tau \neq \tau^*$

i.e. **when monetary credibility to fiscal influence is weak**

Strategic rule

Lack of monetary commitment: $\kappa < \bar{\kappa}_2$

1. Adjust inflation target $\pi^S > \pi^*$

more

- decreases the relative gains to renouncing the rule
- i.e. decreases the required credibility of the rule $\pi^k(\mathcal{S})$

$$\left. \frac{d\bar{\kappa}(\cdot)}{d\pi^S} \right|_{\pi^S=\pi^*} < 0$$

Strategic rule

Lack of monetary commitment: $\kappa < \bar{\kappa}_2$

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more

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$$\left. \frac{d\bar{\kappa}(\cdot)}{d\pi^s} \right|_{\pi^s=\pi^*} < 0$$

2. Constrained efficient policy mix

- trade-off: intertemporal losses vs. provision (credible) incentives
- implementation as an outcome of the fiscal-monetary game
- "adjust more π/π^* than τ/τ^* if $\alpha/\lambda > 1$ "

Other Extensions

1. Aggregate shocks

↔ Credibility \perp Stabilization

more

2. Different objective functions

- Conservative central banker
- Self-interested treasury

more

3. Repeated static game

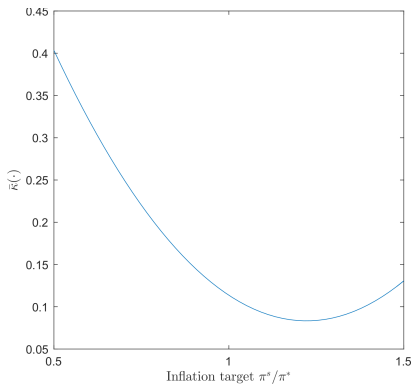
↔ Credibility vs. reputation?

more

SKIP

1. Adjust inflation target

$\bar{\kappa}_2$ as a function of π^s/π^*



$$e = \tau^* + \alpha\pi^s \quad \tau = \tau^* \quad \text{and} \quad \pi = \pi^s$$

($\lambda = 3/2$ and $\gamma = 1/2$, all other parameters set to 1)

BACK

1. Aggregate shocks

- PC with shocks ϵ

BACK

$$y(\cdot) = \tau + \alpha\pi - e + \epsilon$$

- Stabilization \Rightarrow state contingent policy choices:

$$\tau_{\epsilon}^* = \tau^* - \frac{\gamma\lambda}{\lambda + \gamma\alpha^2 + \lambda\gamma}\epsilon \quad \pi_{\epsilon}^* = \pi^* - \frac{\gamma\alpha}{\lambda + \gamma\alpha^2 + \lambda\gamma}\epsilon$$

- State contingent credibility?

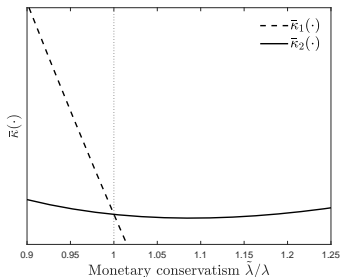
$$\bar{k}(\epsilon) = \mathcal{L}^{m,k}(e^*, \epsilon, \tau_{\epsilon}^*, \pi_{\epsilon}^*) - \min_{\tau} \mathcal{L}^{m,r}(e^*, \epsilon, \tau, \pi^r(S))$$

- No! Credibility \perp Stabilization

$$\frac{d\bar{k}(\epsilon)}{d\epsilon} = 0$$

2. Different objective functions

Conservative central banker $\tilde{\lambda} > \lambda$



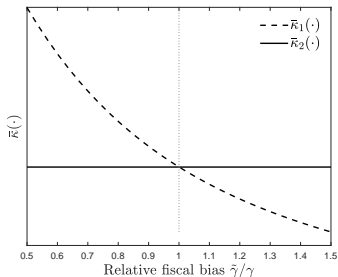
- Reduce inflation bias and relative gains to *renege*
- Increases the cost to implement a strategic threat if *keep*

$\Rightarrow \bar{\pi}_1$ is decreasing in $\tilde{\lambda}$ $\bar{\pi}_2$ is U-shape in $\tilde{\lambda}$

BACK

2. Different objective functions

Self interested fiscal authority $\tilde{\gamma} > \gamma$



- Standard rule the higher $\tilde{\gamma}$, the higher the fiscal bias, the lower the relative gain to the monetary authority to *renege*.
- Strategic rule eqm outcome not sensitive to $\tilde{\gamma}$ + does not enter into the central bank's objective

BACK

3. Repeated static game

Reputation vs. credibility

A monetary rule $\pi^k(\cdot)$ is sustainable in a reputational eqm iff $\forall \tau \in \mathbb{T}(e)$:

$$\Delta(\cdot) = \underbrace{\mathcal{L}^k(e, \tau, \pi^k(\mathcal{S})) - \mathcal{L}^r(e, \tau, \pi^r(\mathcal{S}))}_{\text{ST Benef } (= \bar{\kappa})} - \underbrace{\frac{\beta}{1 - \beta} \left[\mathcal{L}(e^d, \tau^d, \pi^d) - \mathcal{L}(e, \tau^*, \pi^*) \right]}_{\text{LT Costs } (= \kappa)} \leq 0$$

⇒ Focus on the game between private agents and the central bank !

BACK

Dynamic Game

Cash-credit economy with public debt

Monetary-Fiscal and Public Debt

"The second reason for the changing relations between the central bank and the Treasury is the growth of the public debt. The cheap money policy in the 'thirties gave the Treasury a vested interest in a monetary policy that would bring about a decline in the rate of interest; and the war finance exigencies accelerated and amplified these trends. At the present time the existence of a debt of unprecedented magnitude in all countries of the world makes it desirable to so manage this debt as to prevent a material increase in interest rates. It is thus the increase in the public debt, rather than the supposed dominance of the Treasury over the central bank, that is the precondition of the **present-day changes in the principles and technique of central banking.**"

Kriz M. (1948) "Central Banks and The State Today", *American Economic Review*, Vol 38

Monetary-Fiscal and Public Debt

JOINT ANNOUNCEMENT BY THE SECRETARY OF THE TREASURY
AND THE CHAIRMAN OF THE BOARD OF GOVERNORS, AND OF THE
FEDERAL OPEN MARKET COMMITTEE, OF THE FEDERAL RESERVE SYSTEM

RELEASE MORNING NEWSPAPERS,
Sunday, March 4, 1951.

S-2614

The Treasury and the Federal Reserve System have reached full accord with respect to debt-management and monetary policies to be pursued in furthering their common purpose to assure the successful financing of the Government's requirements and, at the same time, to minimize monetization of the public debt.

Dynamic game

Cash-credit economy

- Time inconsistency: **public debt**
 - Monetary: strategic inflation
 - Fiscal: interest rate manipulation

outstanding debt
newly-issued debt

Dynamic game

Cash-credit economy

- Time inconsistency: **public debt**

- Monetary: strategic inflation
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outstanding debt
newly-issued debt

- Dynamic game with endogenous public debt s

- on/off equilibrium paths to assess credibility

↪ *a rule might be credible today at s but not tomorrow at $s' > s...$*

Dynamic game

Cash-credit economy

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- Monetary: strategic inflation outstanding debt
- Fiscal: interest rate manipulation newly-issued debt

- Dynamic game with endogenous public debt s

- on/off equilibrium paths to assess credibility
- ↳ *a rule might be credible today at s but not tomorrow at $s' > s...$*

- Monetary rules

- *Standard* - constant money growth rate e.g. Friedman rule
- *Strategic* - lean against fiscal influence to
 - eliminate *fiscal bias*
 - and deliver monetary objective

Results

Cash-credit with debt

Households

- Utility

$$\sum_{t=0}^{+\infty} \beta^t U(c_t, d_t, l_t) = \sum_{t=0}^{+\infty} \beta^t \left[\delta \log(c_t) + (1 - \delta) \log(d_t) + \gamma l_t \right]$$

- Cash-in-advance constraint

$$P_t d_t \leq M_{t-1}$$

- Budget constraint, nominal debt

$$M_t + q_t B_t + P_t c_t + P_t d_t \leq M_{t-1} + B_{t-1} + P_t (1 - l_t) (1 - \tau_t)$$

- + No Ponzi condition

Cash-credit with debt

Government

- Budget constraint, nominal debt

$$M_t - M_{t-1} + q_t B_t + P_t(1 - l_t)\tau_t = B_{t-1} + P_t g$$

- Institutions

- Fiscal: $\{\tau_t\}$
- Monetary: $\{\sigma_t\}$
- ... and debt $\{B_t\}$ is s.t. the GBCs are satisfied

$$M_t = M_{t-1}(1 + \sigma_t)$$

Cash-credit with debt

Policy Regimes

1. Cooperation under commitment

↪ *Ramsey equilibrium*

optimal policy ... and incentives to deviate

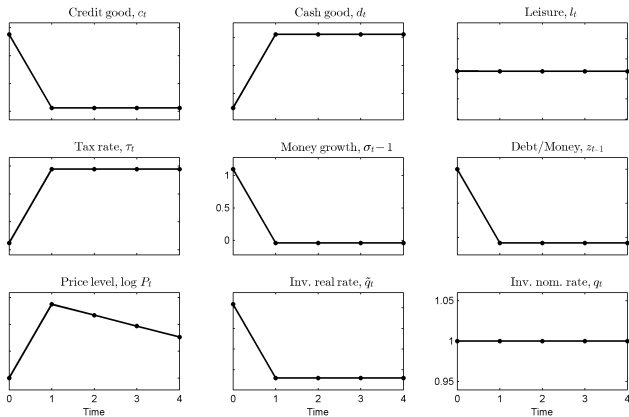
program

2. Non cooperation and asymmetric commitment

↪ *Markov-perfect fiscal policy under monetary rules*

curbing fiscal bias and credibility?

1. Ramsey - N-debt



"If the continuation plan of a Ramsey plan is not a Ramsey plan, then the Ramsey plan is time-inconsistent"

MORE

2. Asymmetric commitment

Analysis

1. Game

more

- Constitutional stage: $\{\sigma^k(\mathcal{S})\}$
- Then fiscal and monetary authorities play a sequential Markov game

2. Recursive formulation

more

3. *Standard* rule: constant money growth rate

more

4. *Strategic* rule

more

5. Credibility, nature of debt and conduct of monetary policy

more

Dynamic game

Key results

- Nominal debt provides incentives to the fiscal authority
 - credible Friedman rule implements *optimal* allocation
 - strategic rules require less credibility to implement same allocation

Dynamic game

Key results

- Nominal debt provides incentives to the fiscal authority
 - credible Friedman rule implements *optimal* allocation
 - strategic rules require less credibility to implement same allocation
- Credibility cut-off of strategic rule is lower
 - when debt is low
 - when debt is real rather than nominal
 - when debt is long term rather than short term
 - when the central bank deviates from the Friedman rule

Conclusions

Should CB strike back if pressured by elected policy makers?

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Should CB strike back if pressured by elected policy makers?

- Strategic rule designed to curb fiscal dominance:
 - improves economic outcomes
 - (generally) improves the credibility of core monetary objective
 - ↳ esp. when debt is high, nominal and short term
- Deviation from optimal monetary target on eqm improves credibility
 - Credibility as criteria for optimal inflation target

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 - ↳ esp. when debt is high, nominal and short term
- Deviation from optimal monetary target on eqm improves credibility
 - Credibility as criteria for optimal inflation target
- Next? Heterogenous agents to study
 - fiscal political economy, e.g. progressive labor taxes
 - monetary Fisher channel

Conclusions

Should CB strike back if pressured by elected policy makers?

- Strategic rule designed to curb fiscal dominance:
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THANK YOU !

Dynamic Game

Detailed analysis

Cash-credit with debt

Households

- Utility

$$\sum_{t=0}^{+\infty} \beta^t U(c_t, d_t, l_t) = \sum_{t=0}^{+\infty} \beta^t \left[\delta \log(c_t) + (1 - \delta) \log(d_t) + \gamma l_t \right]$$

- Cash-in-advance constraint

$$P_t d_t \leq M_{t-1}$$

- Budget constraint, nominal debt

$$M_t + q_t B_t + P_t c_t + P_t d_t \leq M_{t-1} + B_{t-1} + P_t (1 - l_t) (1 - \tau_t)$$

- + No Ponzi condition

Cash-credit with debt

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- Cash-in-advance constraint

$$P_t d_t \leq M_{t-1}$$

- Budget constraint, real debt

$$M_t + q_t P_{t+1} b_t + P_t c_t + P_t d_t \leq M_{t-1} + P_t b_{t-1} + P_t (1 - l_t) (1 - \tau_t)$$

- + No Ponzi condition

Cash-credit with debt

Government

- Budget constraint, nominal debt

$$M_t - M_{t-1} + q_t B_t + P_t(1 - l_t)\tau_t = B_{t-1} + P_t g$$

- Institutions

- Fiscal: $\{\tau_t\}$
- Monetary: $\{\sigma_t\}$
- ... and debt $\{B_t\}$ is s.t. the GBCs are satisfied

$$M_t = M_{t-1}(1 + \sigma_t)$$

Cash-credit with debt

Policy Regimes

1. Cooperation under commitment

↪ *Ramsey equilibrium*

commitment ... and incentives to deviate

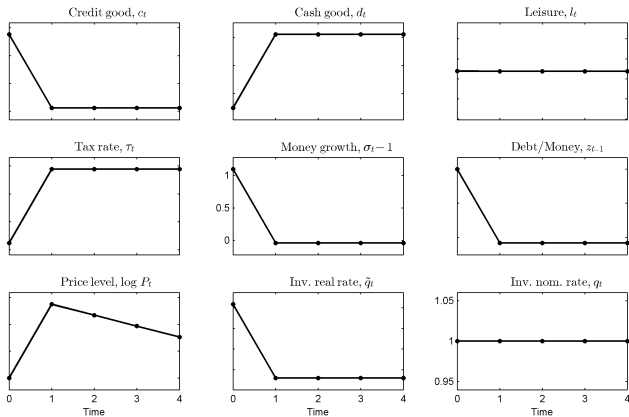
program

2. Non cooperation and asymmetric commitment

↪ *Markov-perfect fiscal policy under monetary rules*

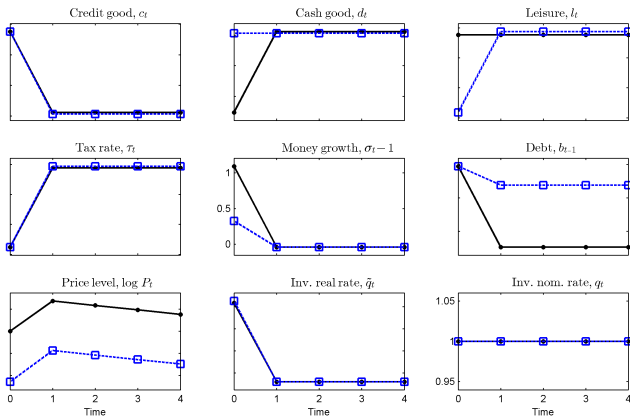
curbing fiscal bias and credibility?

1. Ramsey - N-debt



“If the continuation plan of a Ramsey plan is not a Ramsey plan, then the Ramsey plan is time-inconsistent”

1. Ramsey - N vs. R-debt



“If the continuation plan of a Ramsey plan is not a Ramsey plan, then the Ramsey plan is time-inconsistent”

1. Ramsey - N and R-debt

- Optimal “timeless allocation”, $t \geq 1$
 - Smooth tax distortions \Rightarrow constant path of debt
 - Don't distort twice \Rightarrow Friedman rule, i.e. $\sigma_t = \beta - 1$
 - \hookrightarrow *stationary allocation*
- Short run incentives to deviate, $t = 0$
 - Strategic inflation, esp. N-debt
 - Interest rate manipulation, $\tau_0 < \tau_1$

$$\tilde{q}_0 = \frac{P_1}{P_0} q_0 = \beta \frac{U_{c,1}}{U_{c,0}} = \beta \frac{1 - \tau_0}{1 - \tau_1} > \beta$$

- Welfare: Ramsey $W^{rp}(s_{-1})$ vs. timeless $W^{ta}(s_{t-1})$

BACK

2. Asymmetric commitment

Analysis

1. Game
2. Recursive formulation
3. *Standard* rule: constant money growth rate
4. *Strategic* rule
5. Credibility, nature of debt vs. conduct of monetary policy

1. Dynamic Game

- Constitutional stage: design of monetary rule

$$\sigma^k = \{\sigma^k(z_{-1}, \tau)\}$$

- Markov dynamic game, for all $t \geq 0$

- i. State: $z_{t-1} = \frac{B_{t-1}}{M_{t-1}}$
- ii. Fiscal authority plays τ_t
- iii. Monetary authority
 - either *keeps* its promise and plays $\sigma^k(\cdot)$
 - or *reneges* and plays $\sigma^r(\cdot)$ at cost $\kappa > 0$
- iv. Households choose $\{c_t, d_t, l_t\}$ and $\{M_t, B_t\}$
- v. Next state: $z_t = \frac{B_t}{M_t}$

BACK

2. Eqm of the game

Given $\sigma^k \equiv \sigma^k(\cdot)$, an equilibrium is a set (τ, σ, P) of fiscal, monetary and private agents policy functions, and value functions $\{V^F(\cdot), V^M(\cdot)\}$ s.t.

- The fiscal policy function $\tau \equiv \tau(z_{-1}, \sigma^k)$ solves the following program:

$$V^F(z_{-1}, \sigma^k) = \max_{\tau} U(\tau, \sigma) + \beta V^F(z, \sigma^k)$$

s.t. to the government budget constraint and $\sigma = \sigma$.

- The monetary policy function $\sigma \equiv \sigma(z_{-1}, \tau, \sigma^k)$ solves:

$$V^M(z_{-1}, \tau, \sigma^k) = \max_{\sigma, z} \begin{cases} U(\tau, \sigma) + \beta V^M(z, \tau, \sigma^k) & \text{if } \sigma = \sigma^k(z_{-1}, \tau) \\ U(\tau, \sigma) + \beta V^M(z, \tau, \sigma^k) - \kappa & \text{otherwise} \end{cases}$$

s.t. to the government budget constraint and τ .

- P is a competitive equilibrium.

BACK

3. Standard rule

Nominal debt provides incentives to treasury

Consider a *standard* rule of **constant money growth rate**:

$$\forall (t, s, \tau) \sigma_t = \sigma^s \geq \beta - 1$$

If κ be arbitrary large and **debt is nominal** ...

... then the policy game results in **stationary allocation**:

- debt is constant and equal to its “initial value”,
- allocation $\{c_t, d_t, l_t\}_{t=0}^{+\infty}$ and taxes $\{\tau_t\}_{t=0}^{+\infty}$ are constant.

BACK

3. Standard rule

Constant money growth rate and nominal debt

- Interpretation?

- ↪ The best response of the fiscal authority to credible constant money growth rate is NOT to manipulate the real interest rate

- Mechanism?

- ↪ Nominal debt is subject to de/revaluation (not real)

- ↪ Interest rate manipulations of newly issued debt induce offsetting revaluation of outstanding debt

3. Standard rule

Constant money growth rate and nominal debt

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- Implication?

- ↪ Commit to $\sigma^k = \beta - 1$, get the optimal “timeless” allocation.

- ↪ Pb: credibility

BACK

4. Strategic rule

Principles

1. Implement *timeless* allocation

- if $\tau_t = \tau^*(z_{t-1})$, then $\sigma^k(z_{t-1}, \tau_t) = \beta - 1$
- if $\tau_t \neq \tau^*(z_{t-1})$, then $\sigma^k(z_{t-1}, \tau_t) = \sigma$ s.t.

$$V^{Fk}(z_{t-1}, \tau_t) \leq W^{ta}(z_{t-1})$$

2. Minimize credibility cut-off

if $\tau_t \in T(z_{t-1})$ and $\tau_t \neq \tau^*(z_{t-1})$, then $\sigma^k(z_{t-1}, \tau_t) = \sigma$ s.t.

$$V^{Fk}(z_{t-1}, \tau_t) = W^{ta}(z_{t-1})$$

with

$$T(z_{t-1}) = \{\tau \text{ s.t. } V^{Fr}(z_{t-1}, \tau) \geq W^{ta}(z_{t-1})\}$$

BACK

5. Credibility

A monetary rule $\{\sigma^k(\cdot)\}$ is credible

if the central bank implements the rule along the eqm path
 $\{\tilde{\sigma}_t, \tilde{\tau}_t, \tilde{z}_{t-1}\}_{t=0}^{\infty}$

i.e. if the commitment intensity satisfies for all t

$$\kappa \geq \max_{\tau_t \in T(\tilde{z}_{t-1})} \{V^{Mr}(\tilde{z}_{t-1}, \tau_t) - V^{Mk}(\tilde{z}_{t-1}, \tau_t)\}$$

where

$$T(\tilde{z}_{t-1}) = \{\tau \text{ s.t. } V^{Fr}(\tilde{z}_{t-1}, \tau) \geq V^{Fk}(\tilde{z}_{t-1}, \tau)\}$$

5. Credibility

Credibility cut-off, strategic rule

- When debt is **nominal**

$$\bar{\kappa}_2(z_{-1}) = W^{rp}(z_{-1}) - W^{ta}(z_{-1}) \quad \text{with} \quad \frac{d\bar{\kappa}_2(\cdot)}{dz_{-1}} > 0$$

since continuation debt under Ramsey is decreasing: $z < z_{-1}$

5. Credibility

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- When debt is **real**

BACK

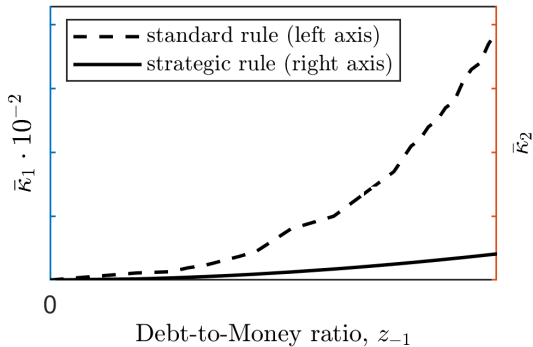
$$\bar{\kappa}_2(b_{-1}) \leq W^{rp}(b_{-1}) - W^{ta}(b_{-1}) \quad \text{with} \quad \frac{d\bar{\kappa}_2(\cdot)}{db_{-1}} > 0$$

where the inequality is binding at higher level of debt $b_{-1} \geq \hat{b}$

BACK

5. Credibility cut-off

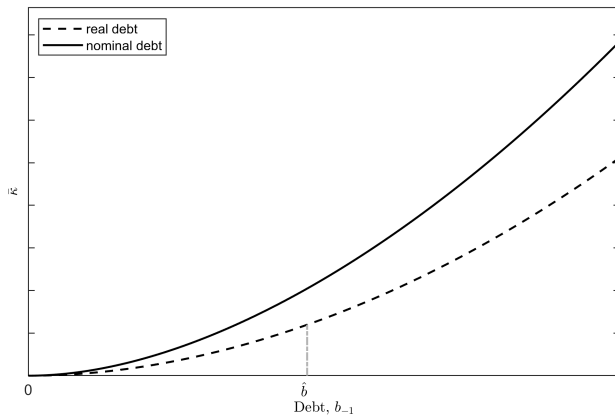
$\bar{\kappa}$ for standard vs. strategic rule, N-debt



increasing in the level of debt z_{-1}

5. Credibility cut-off

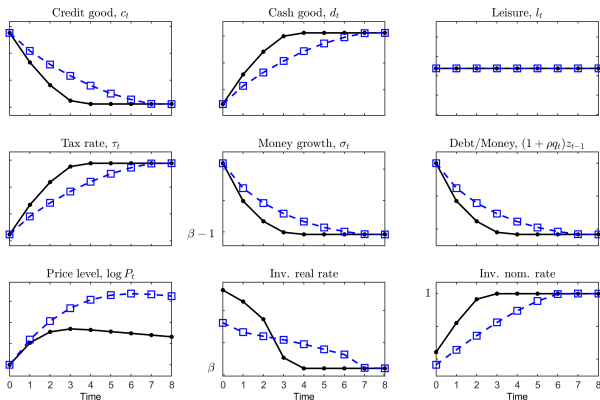
$\bar{\kappa}$ for strategic rule, N-debt vs. R-debt



lower for real debt

5. Debt maturity

Ramsey policy, N debt, different maturities



implicit duration: 5 years ($\rho = 0.93$) - 10 years ($\rho = 0.94$)

more

5. Debt maturity

Proposition

- Let
 - debt be **real**
 - debt be long run $\rho = 1$

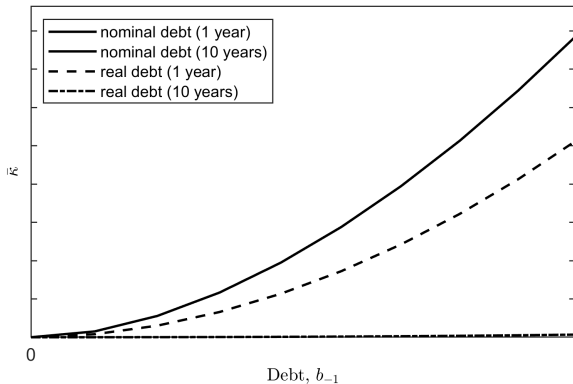
then the policy game results in **timeless allocation**

$$\forall b_{-1} \geq 0 \bar{\kappa}(b_{-1}) = 0$$

- **Why?**
 - MP: log preference and real debt (DGGMT 2008)
 - FP: debt maturity $\rho = 1$ (DN 2013)

5. Credibility cut-off

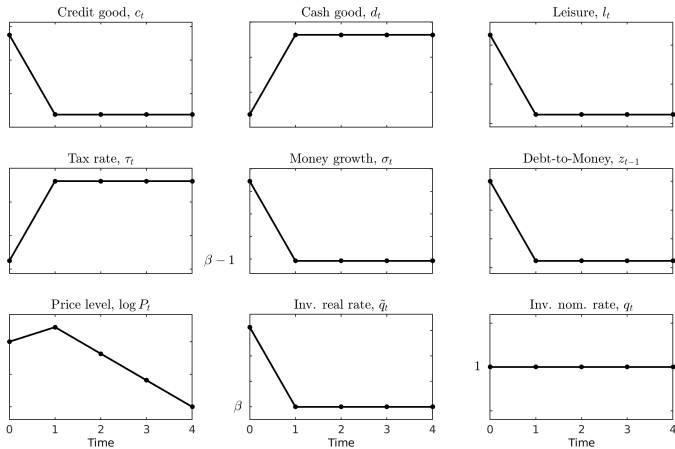
$\bar{\kappa}$, strategic rule, varying debt maturity



the longer maturity, the lower credibility cut-off

5. Credibility cut-off

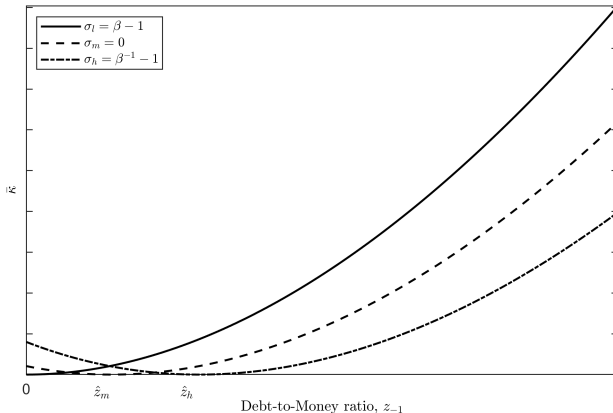
Dynamic path under lack of commitment: $\kappa < \bar{\kappa}_2(z-1)$



deleveraging to z_0 s.t. $\kappa \geq \bar{\kappa}_2(z_0)$

5. Credibility cut-off

$\bar{\kappa}$ for strategic rule, N-debt with $\sigma_h > \sigma_m > \sigma_l$



deviating from the Friedman rule lowers required commitment intensity at higher level of debt

Conclusions

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THANK YOU !

ANNEXES

Refinancing eligibility

Eligibility criteria for securities used in Eurosystem refinancing operations.

The Eurosystem's regulatory framework for monetary policy implementation requires the best of the ratings issued by the four main agencies to be applied, according to the 'first best' rule. Only in the extreme event of all four agency ratings going below investment grade level would banks no longer be able to use Italian government bonds as collateral for refinancing operations and the Eurosystem cease purchasing such bonds as part of the expanded asset purchase programme (APP).¹

Ref *Financial Stability Report*, Banca d'Italia, November 2018

back

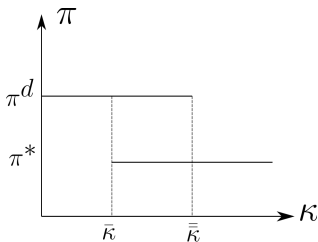
¹Guideline ECB/2014/31. The ECB's Governing Council can decide to suspend the application of the Eurosystem's credit quality thresholds if the State is receiving financial assistance through a European Union, International Monetary Fund or ECB programme and complies with its conditions.

Disciplined private expectations

- Consider a simple LQ framework

$$\mathcal{L}(\cdot) = \frac{1}{2} [(\pi - \pi^*)^2 + \gamma(y - y^*)^2] \text{ s.t. } y = \pi - \pi^e$$

- Objective: support strategy $\pi^s = \pi^*$ with credibility κ
- Multiple equilibria for intermediate values of κ



- Solution? “Taylor principle”

$$\pi^s = \pi^* + \alpha(\pi^e - \pi^*), \text{ stable iff } \alpha < 1$$

Competitive Equilibrium, N-debt

A competitive equilibrium in an economy with nominal debt consists of a price system $\{P_t, q_t\}_{t=0}^{\infty}$, a private sector allocation $\{c_t, d_t, l_t, M_t^h, B_t^h\}_{t=0}^{\infty}$, and a government policy $\{M_t, B_t, \tau_t\}_{t=0}^{\infty}$ s.t.:

- Given initial asset positions $\{M_{-1}^h, B_{-1}^h\}$ as well as the price system and the policy, the allocation solves the maximization program of the representative household subject to the sequence of household budget constraints, the cash-in-advance constraints, and the exogenous debt limits.
- Given initial liabilities $\{M_{-1}, B_{-1}\}$ as well as the allocation and the price system, the policy satisfies the sequence of government budget constraints.
- All markets clear, hence at all times $M_t^h = M_t$, $B_t^h = B_t$, and the resource constraint holds.

Policy Representation

A sequence of tax rates and money growth rates, $\{\tau_t, \sigma_t\}_{t=0}^{\infty}$, supports a competitive equilibrium when government debt is nominal if and only if the following constraint is satisfied for all $t \geq 0$ given z_{-1} :

$$\beta \left[\frac{(1-\alpha)\beta}{1+\sigma_{t+1}} \right] z_t - \alpha(1-\tau_t) - (1-\alpha)\beta \frac{(1-\tau_t)}{(1+\sigma_t)} + \Phi = \left[\frac{(1-\alpha)\beta}{1+\sigma_t} \right] z_{t-1},$$

where $\Phi \equiv (\beta(1-\alpha) + \alpha - \gamma g)$, $z_t \equiv B_t/M_t$, and Ponzi-schemes are ruled out by the exogenous debt limits.

The flow utility function is

$$U(\tau_t, \sigma_t) = \alpha [\log(1-\tau_t) - (1-\tau_t)] + (1-\alpha) \left[\log \left(\beta \frac{(1-\tau_t)}{(1+\sigma_t)} \right) - \beta \frac{(1-\tau_t)}{(1+\sigma_t)} \right]$$

back

N vs. R debt

- **Nominal debt**

$$\beta \left[\frac{(1-\alpha)\beta}{1+\sigma_{t+1}} \right] z_t - \alpha(1-\tau_t) - (1-\alpha)\beta \frac{(1-\tau_t)}{(1+\sigma_t)} + \Phi = \left[\frac{(1-\alpha)\beta}{1+\sigma_t} \right] z_{t-1},$$

- **Real debt**

$$\beta \left[\frac{\gamma}{(1-\tau_{t+1})} \right] b_t - \alpha(1-\tau_t) - (1-\alpha)\beta \frac{(1-\tau_t)}{(1+\sigma_t)} + \Phi = \left[\frac{\gamma}{(1-\tau_t)} \right] b_{t-1}.$$

back

Cooperation and commitment - Ramsey

$$\max_{\{\tau_t, \sigma_t\}} \sum_{t=0}^{+\infty} \beta^t U(\tau_t, \sigma_t)$$

s.t. intertemporal implementability constraint

$$\sum_{t=0}^{\infty} \beta^t \left\{ \Phi - \alpha(1 - \tau_t) - (1 - \alpha)\beta \frac{(1 - \tau_t)}{(1 + \sigma_t)} \right\} = \left[\frac{(1 - \alpha)\beta}{(1 + \sigma_0)} \right] z_{-1}$$

back

Cooperation w/o commitment - Markov

$$V(z_{t-1}) = \max_{\tau_t, \sigma_t, z_t} U(\tau_t, \sigma_t) + \beta V(z_t),$$

subject to

$$\beta \left[\frac{(1-\alpha)\beta}{1+\sigma(z_t)} \right] z_t - \alpha(1-\tau_t) - (1-\alpha)\beta \frac{(1-\tau_t)}{(1+\sigma_t)} + \Phi = \left[\frac{(1-\alpha)\beta}{1+\sigma_t} \right] z_{t-1}$$

back

Debt maturity

- **HH budget constraint**

$$q_t B_t + M_t + P_t \tau_t (1 - l_t) = P_t g + (1 + \rho q_t) B_{t-1} + M_{t-1}.$$

- **Implementability condition**

$$\begin{aligned} & \beta \left[\frac{(1 - \alpha)\beta}{1 + \sigma_{t+1}} \right] (1 + \rho q_{t+1}) z_t - \alpha(1 - \tau_t) - (1 - \alpha)\beta \frac{(1 - \tau_t)}{(1 + \sigma_t)} + \Phi \\ & = \left[\frac{(1 - \alpha)\beta}{1 + \sigma_t} \right] (1 + \rho q_t) z_{t-1}. \end{aligned}$$

back

Numerical simulations

Table: Parameter values

Parameter	Description	Value
β	Discount factor	0.96
γ	Preference leisure weight	5
α	Preference credit good weight	0.5
g	Public spending	0.05

Parameters are set to target moments of the first best allocation - which is the solution to HH utility maximization subject to the sequence of resource constraints. The implied moments are $g/(c + d) = 0.25$, the fraction of time devoted to leisure $l = 0.75$ and an equal consumption of cash and credit good.

[back](#)

Did Trump break the FED?

Markets believe Donald Trump will get his rate cuts now

Expectations have collapsed as new fronts open up in US trade war

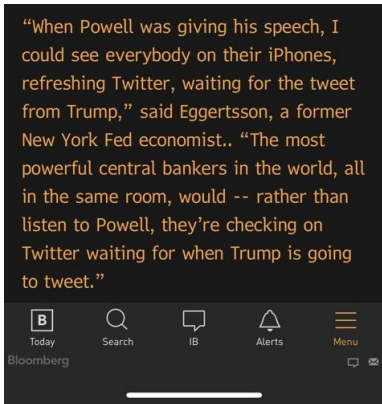
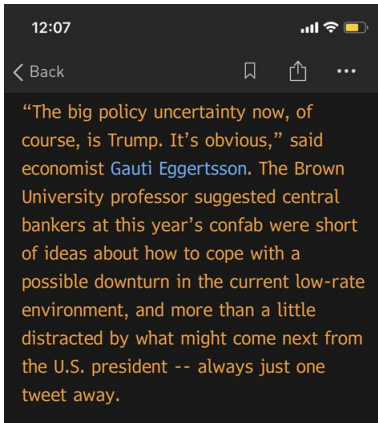


Donald Trump this week again aired his irritation with higher interest rates ahead of Fed chairman Jay Powell's address

Robin Wigglesworth and Peter Wells in New York JUNE 1, 2019

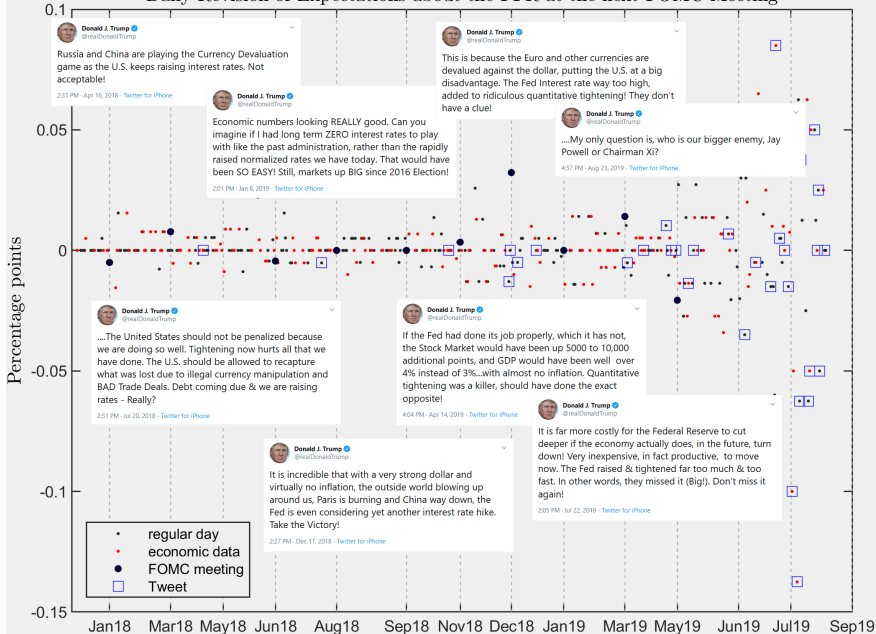
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Did Trump break the FED?



⇒ **Our answer?** not as much as market expected !

Daily Revision of Expectations about the FFR at the next FOMC Meeting



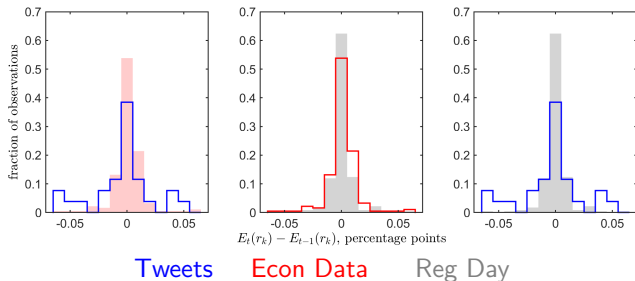


Table 1: Summary Statistics

	Regular Days			Data Days			Twitter Days		
	avg	std	N	avg	std	N	avg	std	N
Full sample	0.0004	0.0107	213	0.0010	0.0137	182	-0.0030	0.0274	26
Past May-19	0.0012	0.0228	34	0.0049	0.0301	31	-0.0037	0.0351	16
Selected tweets	————	————	—	————	————	—	-0.0229	0.0276	8

back