Financial Stability, Growth and Macroprudential Policy

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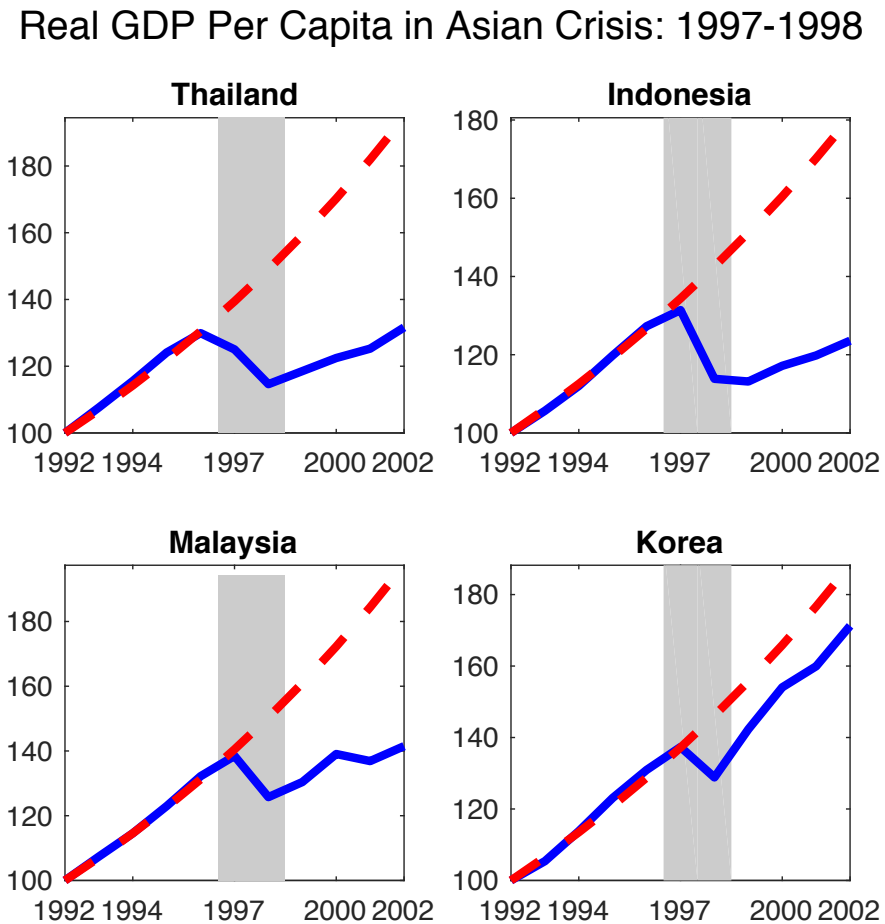
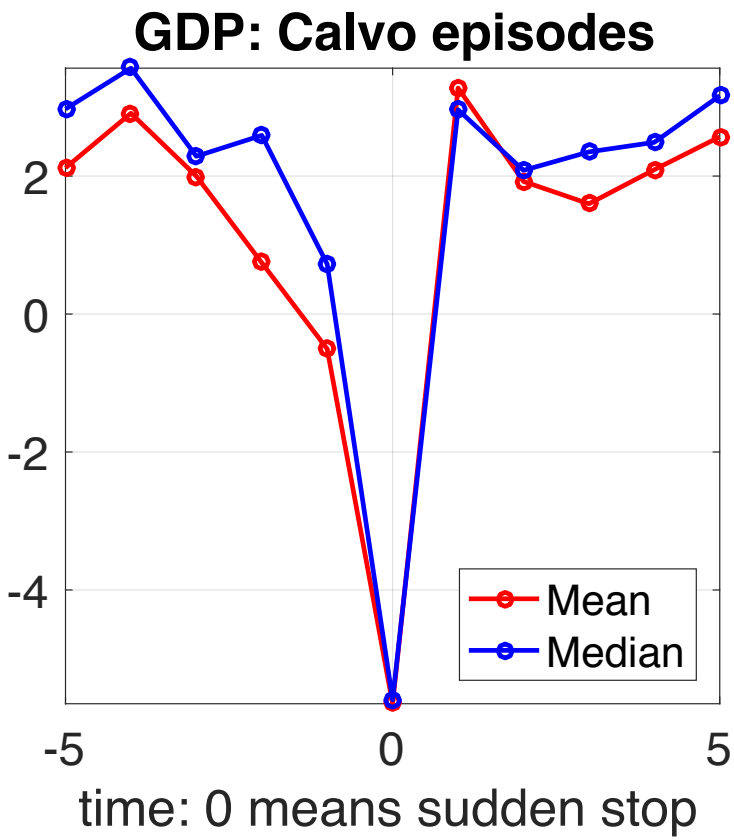
Motivation 1

Sudden stop episodes have persistent output level effects.



Motivation 1 (Cont.)



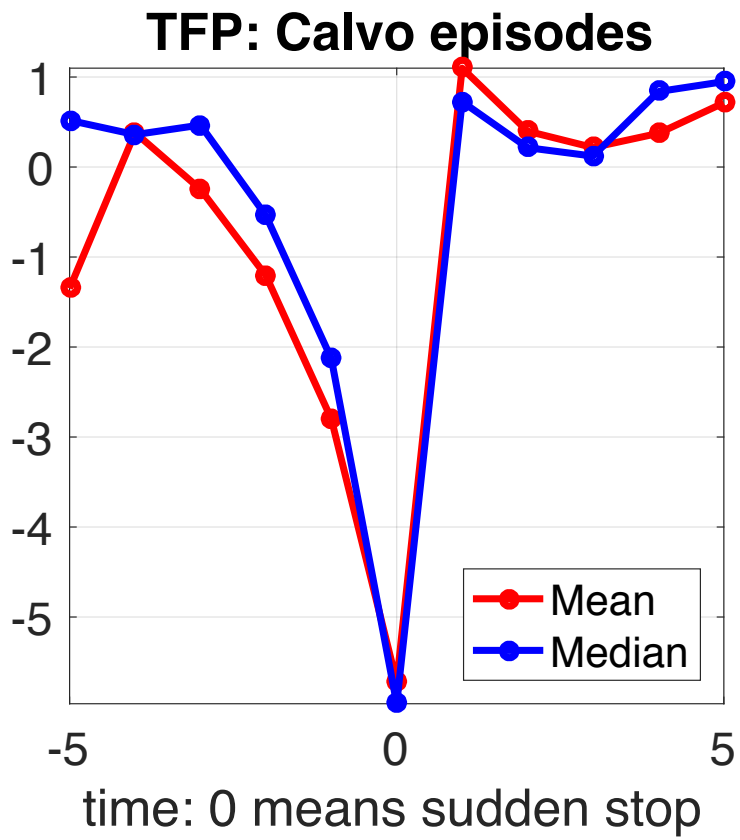


Figure: Event Study on Sudden Stop Episodes

Motivation 2

Policy debate on mitigating crisis

1. Ex-ante policy intervention
   - Bianchi (2011), Jeanne and Korinek (2010, 2017)
2. Ex-post policy intervention
   - Benigno et al. (2012, 2013)

However, current analysis ignores policy impact on growth.

Research Questions

In this paper, I ask the following questions:

1. How to incorporate growth into a model with sudden stop?
2. How to characterize optimal policies?
3. What are the effects of optimal policies on growth and stability?
4. How large are the welfare gains from optimal policy?

Preview of Results

1. Endogenous growth + occasionally binding constraint;
2. Two types of policymakers
   - Ex-ante only ⇒ Macroprudential social planner ("MP")
   - Ex-ante and ex-post⇒ Multi-instrument social planner ("SP")
3. Main findings
   1. trade-off between growth and stability only exists for MP;
   2. growth reduces by 0.01 % for MP and 0.02 % for SP;
   3. prob. of crisis reduces by 4 % for MP but increases 8 % for SP;
   4. gains are around 0.1 % for MP and 0.2 % for SP;
   5. source of gains
      - MP: increase consumption in the long run
      - SP: temporary growth spurt + permanent consumption increase

Literature and Contribution

This paper is related to the literature on

1. Persistent output level effects of crises;
   - Cerra and Saxena (2008), Rogoff and Reinhart (2009), Ball (2014), etc.
2. Macroprudential policies;
   - Bianchi (2011), Jeanne and Korinek (2010), Benigno et al. (2012, 2013).
3. Volatility and growth;
   - Ramey and Ramey (1995), Ranciere, Tornell and Westermann (2008), Aghion et al (2010), etc.
4. Business fluctuations affect economic trend.
   - Comin and Gertler (2006), Queralto (2015), etc.

My contributions

- Investigate the tradeoff between volatility and growth;
- Quantify the effects of optimal policies on growth.

Environment: A Small Open Economy

1. **Preference:** CRRA + Stone/Geary form

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t - h_t\right) \equiv E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(c_t - h_t\right)^{1-\gamma}}{1-\gamma}$$

2. **Production:**

$$y_t = A_t n_t^{\alpha}$$

n_t: productive assets with fixed supply.

3. **Endogenous TFP:** $A_t = \theta_t z_t$

$$\log \theta_t = \rho \log \theta_{t-1} + \varepsilon_t, \text{ where } \varepsilon_t \sim N(0, \sigma^2)$$

4. **Assumption**

$$h_t = h z_t$$

Environment (Cont.)

- Budget constraint

$$c_t + \Psi(z_{t+1}, z_t) + q_t n_{t+1} + b_{t+1} = y_t + q_t n_t + (1 + r)\, b_t$$

- Growth-enhancing expenditure $\Psi(z_{t+1}, z_t)$ includes
  - physical capital
  - human capital
  - R & D expenditure
- Collateral Constraint

$$-b_{t+1} \leq \phi q_t$$

- In aggregate level, $n_t = 1$.

Competitive Equilibrium (CE)

- Denote $c_t^h = c_t - h_t$.

$$
\begin{aligned}
V_t^{CE}(z_t, n_t, b_t, \theta_t) &= \max_{c_t^h, z_{t+1}, n_{t+1}, b_{t+1}} u\left(c_t^h\right) + \beta E\left[V_{t+1}^{CE}(z_{t+1}, n_{t+1}, b_{t+1}, \theta_{t+1})\right] \\
\text{s.t.} \quad & c_t^h + hz_t + \Psi(z_{t+1}, z_t) + q_t n_{t+1} + b_{t+1} \\
& = \theta_t z_t n_t^\alpha + q_t n_t + (1+r) b_t, \ \left(\lambda_t^{CE}\right) \\
& -b_{t+1} \leq \phi q_t. \ \left(\mu_t^{CE}\right)
\end{aligned}
$$

Two Types of Social Planners

- Constrained social planners who face the collateral constraint.
- Implementation: Pigovian taxes/subsidies and lump-sum transfer

$$c_t^h + h_t + (1+\tau_t^z)\,\Psi(z_{t+1}, z_t) + q_t n_{t+1} + \left(1+\tau_t^b\right) b_{t+1}$$
$$= y_t + q_t n_t + (1+r)\, b_t + T_t$$

  where $T_t = \tau_t^z \Psi(z_{t+1}, z_t) + \tau_t^b b_{t+1}$.
- Depending on the availability of instruments:
  1. Macroprudential social planner (only ex-ante)
     - only τ_t^b (*capital control*)
  2. Multi-instrument social planner (both ex-ante and ex-post)
     - both τ_t^b (*capital control*) and τ_t^z (*growth policy*);

Macroprudential Social Planner (MP)

$$
\begin{aligned}
V_t^{MP}(z_t, b_t, \theta_t) \quad &= \max_{c_t^h, z_{t+1}, b_{t+1}, q_t} u\left(c_t^h\right) + \beta E\left[V_{t+1}^{MP}(z_{t+1}, b_{t+1}, \theta_{t+1})\right] \\
\text{s.t.} \quad & c_t^h + hz_t + \Psi(z_{t+1}, z_t) + b_{t+1} = \theta_t z_t + (1+r)b_t, \left(\lambda_t^{MP}\right) \\
& -b_{t+1} \leq \phi q_t, \left(\mu_t^{MP}\right) \\
& u'(c_t^h) q_t = \underbrace{\beta E_t\left[u'(c_{t+1}^h)\left(\alpha\theta_{t+1} z_{t+1} + q_{t+1}\right)\right]}_{G(z_{t+1}, b_{t+1})}, \left(\xi_t^{MP}\right) \\
& u'(c_t^h)\Psi_{1,t} = \underbrace{\beta E_t\left[u'(c_{t+1}^h)\left(\theta_{t+1} - h - \Psi_{2,t+1}\right)\right]}_{I(z_{t+1}, b_{t+1})}. \left(\nu_t^{MP}\right)
\end{aligned}
$$

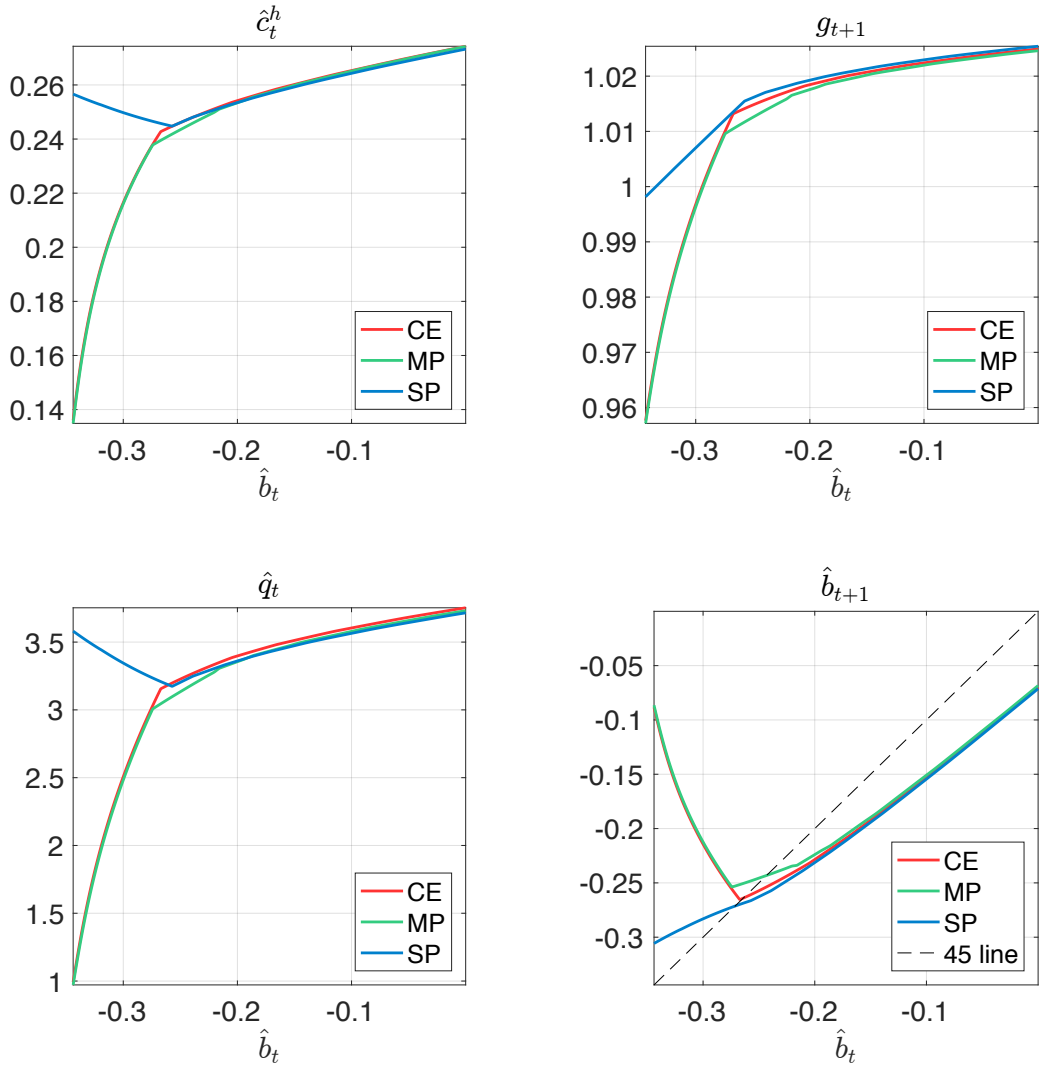
Multi-instrument Social Planner (SP)

$$
\begin{aligned}
V_t^{SP}(z_t, b_t, \theta_t) \quad &= \max_{c_t^h, z_{t+1}, b_{t+1}, q_t} u\left(c_t^h\right) + \beta E\left[V_{t+1}^{SP}(z_{t+1}, b_{t+1}, \theta_{t+1})\right] \\
\text{s.t.} \quad & c_t^h + hz_t + \Psi(z_{t+1}, z_t) + b_{t+1} = \theta_t z_t + (1+r)b_t, \ \left(\lambda_t^{SP}\right) \\
& -b_{t+1} \leq \phi q_t, \ \left(\mu_t^{SP}\right) \\
& u'(c_t^h) q_t = \underbrace{\beta E_t\left[u'(c_{t+1}^h)\left(\alpha\theta_{t+1} z_{t+1} + q_{t+1}\right)\right]}_{G(z_{t+1}, b_{t+1})}. \ \left(\xi_t^{SP}\right)
\end{aligned}
$$

Calibration

	Value	Source/target
Share of productive asset income	α=0.2	Jeanne and Korinek (2010)
Risk-free interest rate	$r = 6\%$	Standard in the literature
Risk Aversion	$\gamma = 2$	Standard in the literature
Parameters in Ψ functions	$\eta = 2$	Quadratic Form
Volatility of technology shock	$\sigma = 0.04$	Growth rate in the year of sudden stop episodes= -5.65 %
Parameters in Ψ functions	$\psi = 0.95$	Growth rate in the year after sudden stop episodes= 3.28 %
Parameters in Ψ functions	$\kappa = 26.29$	Share of consumption= 77.6 %
Subsistence level parameter	$h = 0.51$	Average growth= 2.3 %
Discount rate	$\beta = 0.968$	Probability of crisis= 5.5 %
Persistence of technology shock	$\rho = 0.83$	Correlation between current account and output= -0.25
Collateral constraint parameter	$\phi = 0.0852$	Average NFA-GDP ratio= -30 %

Policy functions



Model Moments

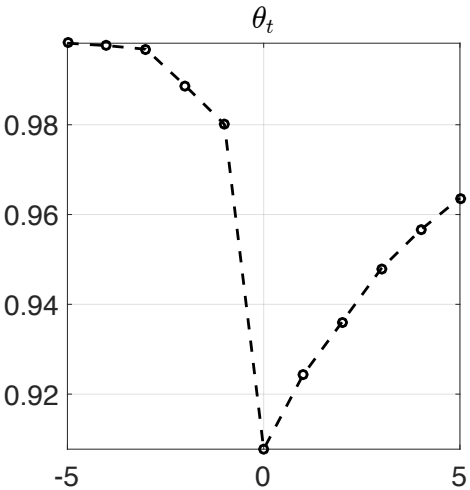
Table: Moments

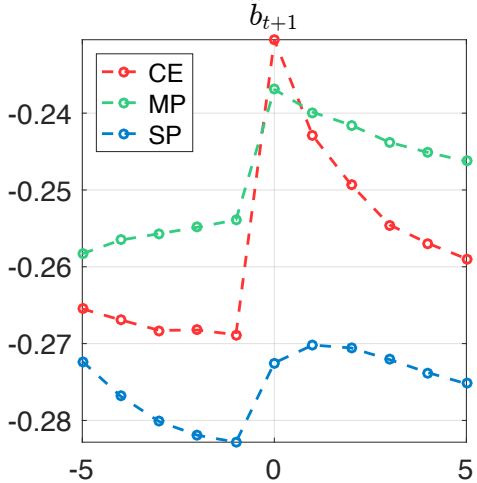
Moments	Data	CE	MP	SP
Average GDP growth (%)	2.30	2.31	2.31	2.29
Prob. of crisis (%)	5.50	6.23	1.89	14.23
NFA-GDP ratio (%)	-30.00	-27.18	-25.78	-28.98
Consumption-GDP ratio (%)	77.6	77.53	77.65	77.58
Correlation between current account and GDP	-0.25	-0.22	-0.37	-0.54

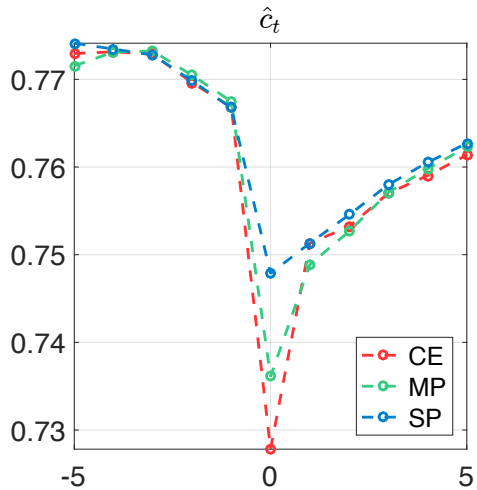
Table: Trade-off between growth and stability

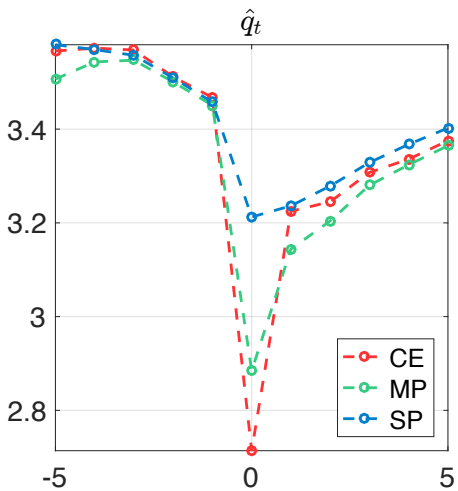
	Average	Volatility
CE	2.33	0.34
MP	2.32	0.33
SP	2.31	0.36

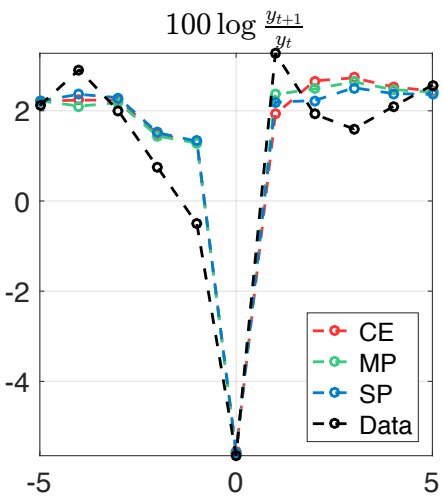
Event windows

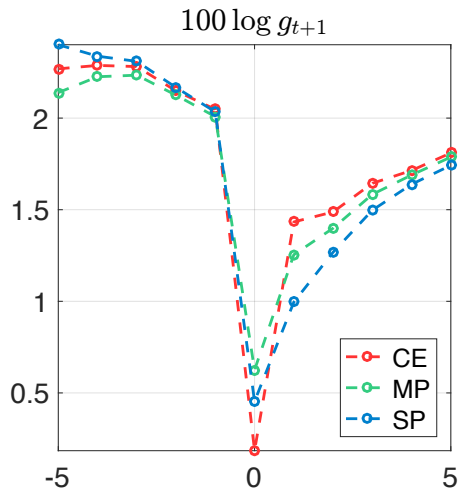






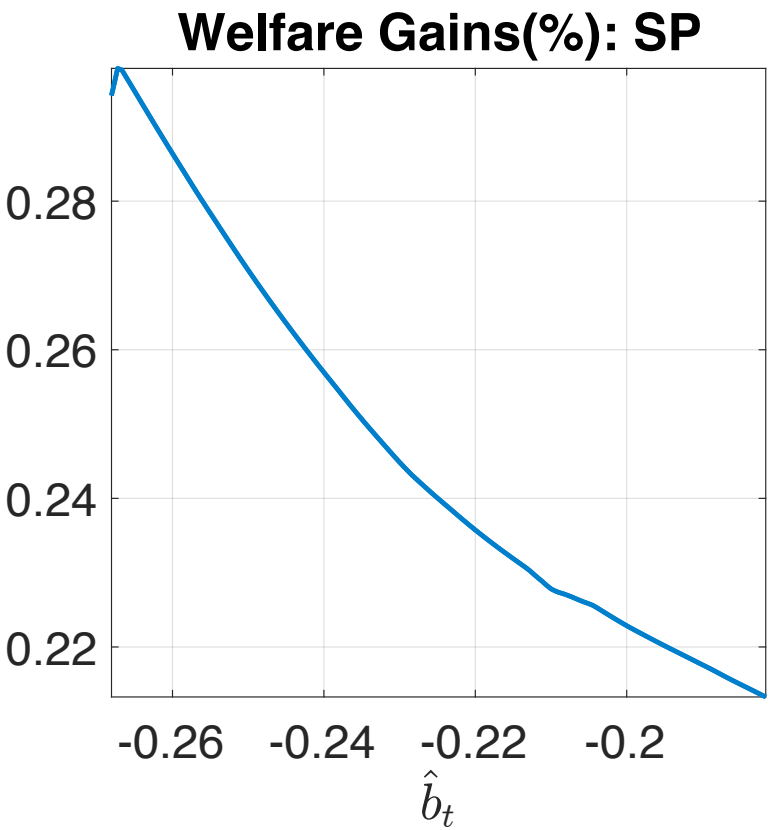


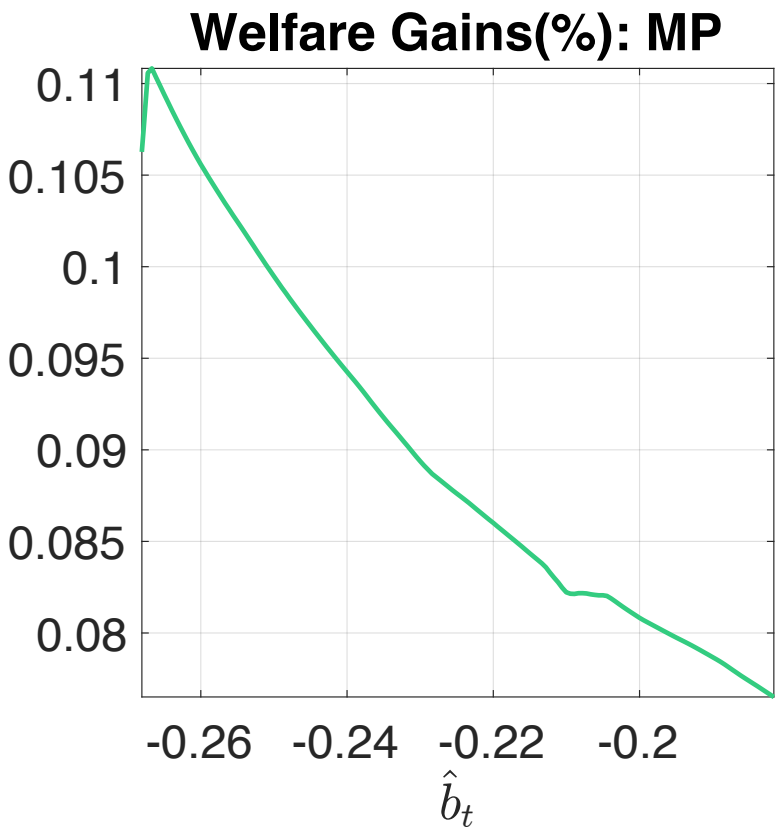




Welfare gains

$$\Delta V(\hat{b}_t, \theta_t) = \left(\frac{V^{SP,CC}(\hat{b}_t, \theta_t)}{V^{LF}(\hat{b}_t, \theta_t)} \right)^{\frac{1}{1-\gamma}} - 1$$



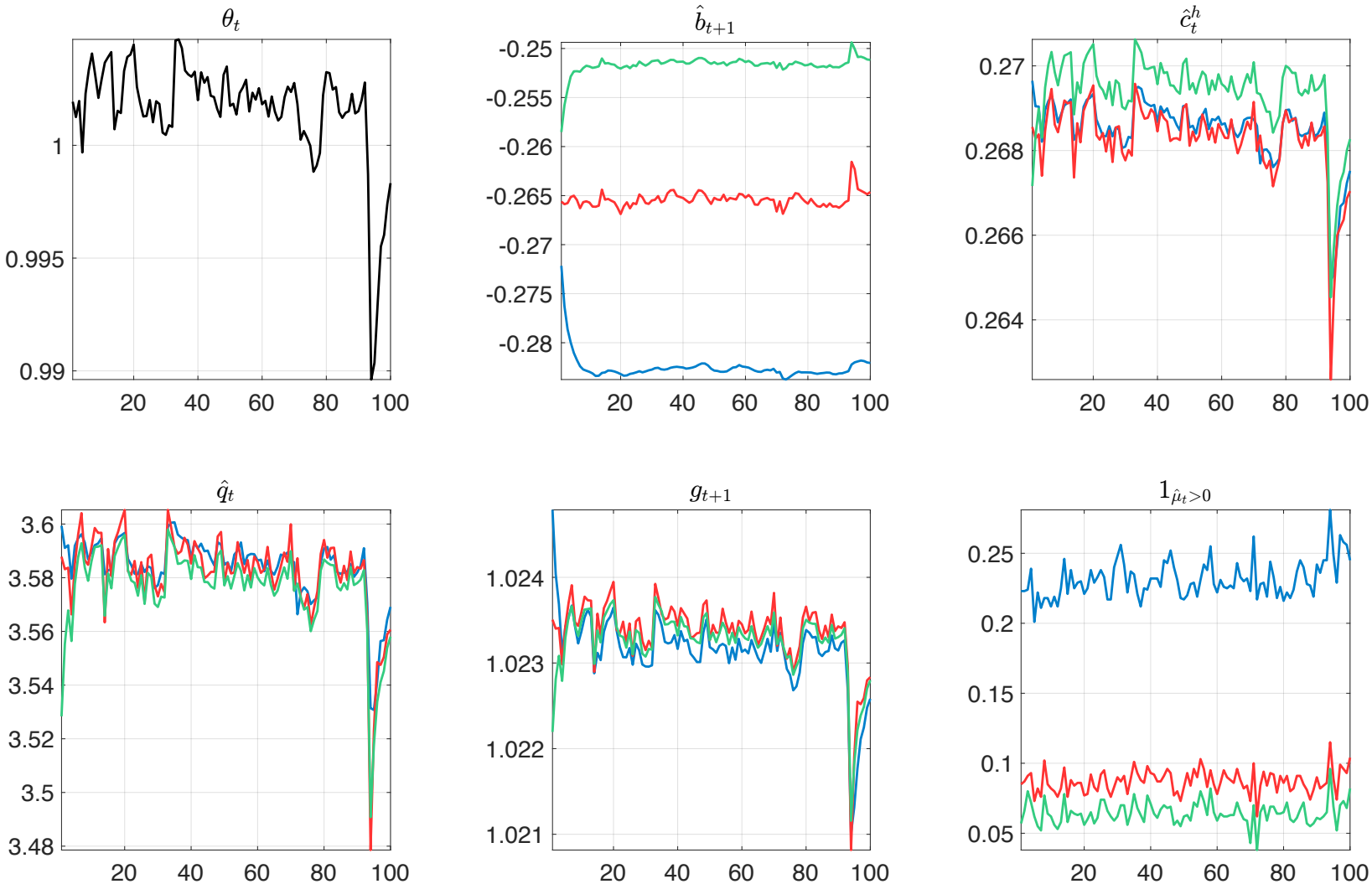


Source of gains

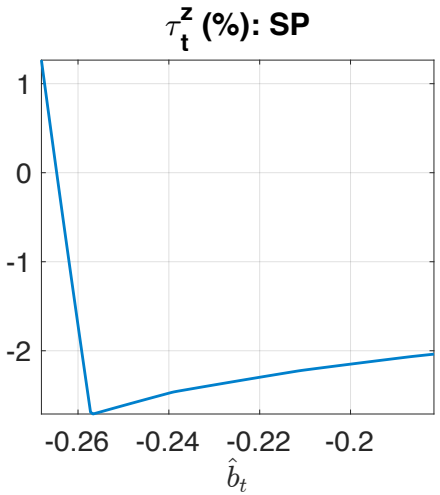
Table: Source of welfare gains (%)

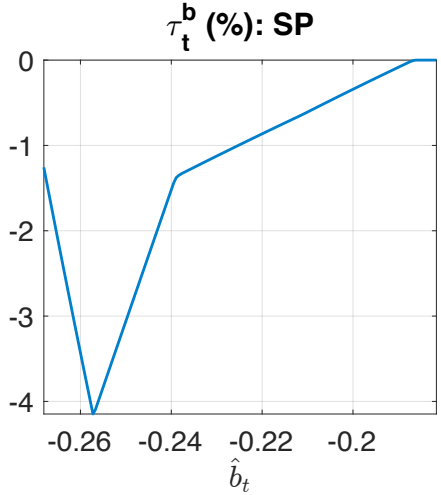
	Overall	Control for consumption	Control for growth
MP	0.06	-0.34	0.40
SP	0.25	-0.13	0.38

Source of gains (Cont.)



Policies





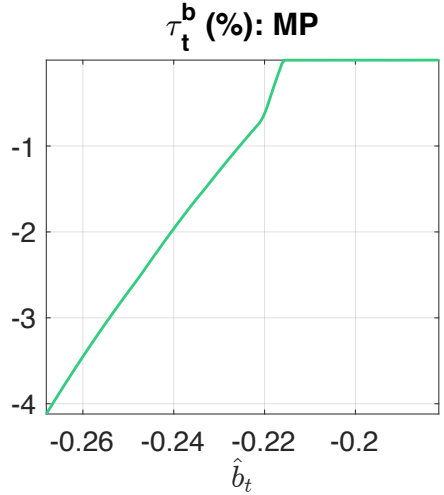


Table: Taxes (%)

	Taxes on borrowing	Subsidies on growth
MP	1.28	N.A.
SP	1.00	1.00

Conclusions

1. Endogenous growth + occasionally binding constraint;
2. Two types of policymakers
   - Ex-ante only ⇒ Macroprudential social planner ("MP")
   - Ex-ante and ex-post⇒ Multi-instrument social planner ("SP")
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