Liquidity Traps, Prudential Policies and International Spillovers

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Monetary Economics

Motivation

- Low R^* and international spillovers impose challenges for monetary policy to achieve macro stabilization
- Macroprudential policy has become a new pillar in the macroeconomic policy toolkit
- But limited understanding of integration between monetary and macroprudential policy and implications for global welfare

What We Do

Open economy model with aggregate demand externalities and an occasionally binding zero lower bound constraint on nominal rates

- Analytical decomposition: transmission channels of monetary and macroprudential policy
- Normative analysis: jointly optimal policies and interactions
- International spillovers: policy and welfare implications of foreign policies

Preview of Results

Transmission channels:

$\Delta y =$ Intertemp. Subst. + Expend. Switching + Agg. Income

- Monetary policy: expenditure switching 1/3 of effects
- Macroprudential: primarily through intertemp. subst.

Normative findings:

- No scope for prudential monetary policy if macropru available
  - Absent macropru, prudential monetary policy may involve *low rates*
- International spillovers mostly benign
  - Capital controls can *help* prevent currency wars

Related Literature

Aggregate demand externalities and capital controls: Schmitt-Grohé-Uribe, Farhi-Werning, Korinek-Simsek, Acharya-Bengui

- **International spillovers:** Fornaro-Romei

Liquidity traps in open economy: Cook-Devereux, Devereux-Yetman, Eggertsson-Mehrotra-Singh-Summers, Caballero-Farhi-Gourinchas, Corsetti-Mueller-Kuester, Jeanne, Amador-Bianchi-Bocola-Perri

Interaction between monetary and macroprudential policies: Coulibaly, Farhi-Werning, Basu-Boz-Gopinath-Roch-Unsal

Decomposition of monetary policy transmission: Kaplan-Moll-Violante, Auclert

- **Open economy:** Auclert-Rognlie-Souchier-Straub

Outline

1. Environment
2. Decomposition
3. Normative analysis
4. International Spillovers

Households

Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t z_t \left[U(c_t^T, c_t^N) - \frac{h_t^{1+\phi}}{1+\phi} \right],$$

$$U\left(c_t^T, c_t^N\right) = \frac{1}{1-\sigma} \left[\omega \left(c_t^T\right)^{1-\gamma} + (1-\omega)\left(c_t^N\right)^{1-\gamma} \right]^{\frac{1-\sigma}{1-\gamma}},$$

- γ: elasticity of subst. T-NT
- σ: intertemp.elasticity

Households

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$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t z_t \left[U(c_t^T, c_t^N) - \frac{h_t^{1+\phi}}{1+\phi} \right],$$

Budget constraint (expressed in units of domestic currency)

$$P_t^N c_t^N + P_t^T c_t^T + \frac{1}{1+\tau_t}\left[\frac{b_{t+1}}{R_t} + P_t^T \frac{b_{t+1}^*}{R_t^*}\right] =$$
$$\phi_t^N + W_t h_t + P_t^T(y_t^T + T_t) + b_t + P_t^T b_t^\star.$$

- b: nominal domestic bonds
- b^*: real foreign bonds

- Tradables satisfy law of one price $P_t^T = P^{T*} e_t$

Firms and Nominal Rigidities

- Firms produce non-tradable goods with labor, $F(n) = n_t^{\alpha}$
- Prices are perfectly rigid $P_t^N = \bar{P}^N$
  - Firms produce to satisfy demand

Government Policies

- Nominal interest rate $\{R_t\}_{t=0}^{\infty} \geq 1$
- Tax $\{\tau_t\}_{t=0}^{\infty}$ on local and foreign bond issuances and rebates lump-sum

Competitive Equilibrium

Given an initial condition b_0^*, exogenous process $\{R_t^*, y_t^T, z_t\}_{t=0}^{\infty}$, a rigid price $\bar{P}^N$, and government policies $\{R_t, \tau_t\}_{t=0}^{\infty}$, an equilibrium is a stochastic sequence of prices $\{e_t, P_t^T, W_t\}$ and allocations $\{c_t^T, c_t^N, b_{t+1}^*, b_{t+1}, n_t, h_t\}_{t=0}^{\infty}$ such that

1. Households optimize
2. Firms choose hours to meet demand, $n_t = (c_t^N)^{\frac{1}{\alpha}}$;
3. Labor market clears and the domestic currency bond is in zero net supply
4. Government budget constraint is satisfied;
5. Law of one price holds: $P_t^T = e_t P_t^{T*}$.

Decomposition

- Goal is to separate direct from indirect effects of policies
  - Auclert; Kaplan, Moll and Violante (also Auclert et al. 2022)

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Households' policies as a function of income and prices (deterministic)

$$\frac{\bar{P}^N}{P^{T*}e_0} c_0^N = (1 - \tilde{\omega}_t) \; \mu_0 \underbrace{\sum_{t=0}^{\infty} Q_{t|0} \mathcal{P}_t Y_t}_{\text{lifetime income}}, \qquad c_0^T = \tilde{\omega}_t \; \mu_0 \underbrace{\sum_{t=0}^{\infty} Q_{t|0} \mathcal{P}_t Y_t}_{\text{lifetime income}}$$

- $\mu_0 \equiv 1 / \sum_{t=0}^{\infty} \beta^{t\sigma} \left[Q_{t|0} \frac{\mathcal{P}_0}{\mathcal{P}_t} \right]^{\sigma - 1}$
- $\tilde{\omega} \equiv \omega^{\gamma} (\mathcal{P}_0)^{\gamma - 1}$
- $Q_{t|0} \equiv \prod_{s=0}^{t-1} [R_s^* (1 + \tau_s)]^{-1}$

Decomposition

Equilibrium

$$y_0^N = \mathcal{C}^N\left(\left\{R_t, \tau_t, \bar{P}^N/(P^{T*}e_t), Y_t\right\}_{t\geq 0}\right)$$

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Consider one period shock to R or τ at $t = 0$

- Assume first-best policies after $t = 1$ (deterministic)

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	Monetary
Inter. Subst.	$\beta\sigma\,(1-\tilde{\omega})dr_0$

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Agg. Income	$(1-\beta)\left[(1-\kappa)\sigma + \kappa\gamma\right](1-\tilde{\omega}) dr_0$

$$\kappa \equiv \tilde{\omega} \left[1 + \frac{\alpha(1-\tilde{\omega})(\gamma-\sigma)}{\alpha\sigma + (1-\alpha+\phi)\gamma\sigma} \right]^{-1}$$

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Exp. Switching	$\gamma\tilde{\omega}\;\; d\log e_0$	$\gamma\tilde{\omega}\;\; d\log e_0$
Agg. Income	$(1-\beta)\left[(1-\kappa)\sigma+\kappa\gamma\right](1-\tilde{\omega})dr_0$	$(1-\beta)(1-\kappa)\sigma d\tau_0$

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Interactions

- Monetary policy transmission is dynamic: capital flows affect future output & exchange rates $\Rightarrow$ current aggregate demand

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Interactions

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★ Do capital flows amplify or attenuate an expansion of monetary policy?

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- If $\sigma < \gamma$, y rises above c:
  - Open capital account pushes $\downarrow$ demand. *Attenuation*
- If $\sigma = \gamma$, response is independent of capital flows

Quantitative Inspection

- Quarterly calibration using data for UK
- Stochastic processes: $\{R_t^*, y_t^T, z_t\}$ assumed to be independent
- Parameters: $\alpha = 1$, $\phi = 3$, $\omega = 0.25$, $\beta = 0.99$ $\sigma = 1$, $\gamma = 1$

	Monetary	Macroprudential
Intertemporal Substitution	60%	96%
Expenditure Switching	35%	1%
Aggregate Income	5%	3%

Other elasticities

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Other elasticities

Extension with Heterogeneity (TANK):

- No effect (almost) on the size of expenditure switching
- No effect on aggregate response if $\gamma = \sigma$. Magnify if $\sigma < \gamma$

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Efficient allocation and liquidity traps

- Efficient allocation (coincides with flex-price)

$$\alpha h_t^{\alpha-1} u_N(c_t^T, c_t^N) = v'(h_t)$$

$$u_T(c_t^T, c_t^N) = \beta R_t^* \mathbb{E}_t \left[\frac{z_{t+1}}{z_t} u_T(c_{t+1}^T, c_{t+1}^N) \right]$$

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- Absent ZLB, implementing efficient allocation requires

$$R_t = R_t^* \frac{1}{e_t^{flex}} \left[E_t \frac{\Upsilon_{t+1}}{e_{t+1}^{flex}} \frac{P_t^{T*}}{P_{t+1}^{T*}} \right]^{-1}$$

where e^{flex} replicates flexible price allocation

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  where e^{flex} replicates flexible price allocation

- If R_t violates ZLB, efficient allocation is not feasible

  ★ How should R_t and τ_t be set ex ante?

Macroprudential Policy

- Consider generic monetary policy $\{R_t, e_t\}$

$$V\left(b^*, s\right) = \max_{\tau, b^{*\prime}, c^N, c^T} \; u\left(c^T, c^N\right) - v\left((c^N)^{1/\alpha}\right) + \beta \mathbb{E}_{s'|s} \frac{z'}{z} V\left(b^{*\prime}, s'\right)$$

subject to

$$c^T = y^T + b^* - \frac{b^{*\prime}}{R_t^*}$$

$$c^N = \left[\frac{1-\omega}{\omega} \; \frac{P_t^{T*}}{\bar{P}^N} \; e\right]^\gamma c^T$$

$$u_T(c^T, c^N) = \beta R^* \; (1+\tau) \mathbb{E}_{s'|s} \left[\frac{z'}{z} u_T\left(\mathcal{C}^T(b^{*\prime}, s'), \mathcal{C}^N(b^{*\prime}, s')\right)\right]$$

Macroprudential Tax

- Sign depends on current and future labor wedges ψ

$$\tau_t = \frac{1}{\beta R_t^* E_t \frac{z_{t+1}}{z_t} u_T(t+1)} \Big\{ -\frac{1-\tilde{\omega}_t}{\tilde{\omega}_t} \psi_t u_T(t) + \beta R_t^* E_t \frac{z_{t+1}}{z_t} \left[\frac{1-\tilde{\omega}_{t+1}}{\tilde{\omega}_{t+1}} \psi_{t+1} u_T(t+1) \right] \Big\}$$

Joint Optimal Monetary and Macroprudential Policy

$$V(b^*, s) = \max_{R,e,\tau,b^{*\prime},c^N,c^T} \; u\left(c^T, c^N\right) - v\left(\left(c^N\right)^{1/\alpha}\right) + \beta \mathbb{E}_{s'|s} \frac{z'}{z} V\left(b^{*\prime}, s'\right)$$

subject to

$$c^T = y^T + b^* - \frac{b^{*\prime}}{R^*}$$

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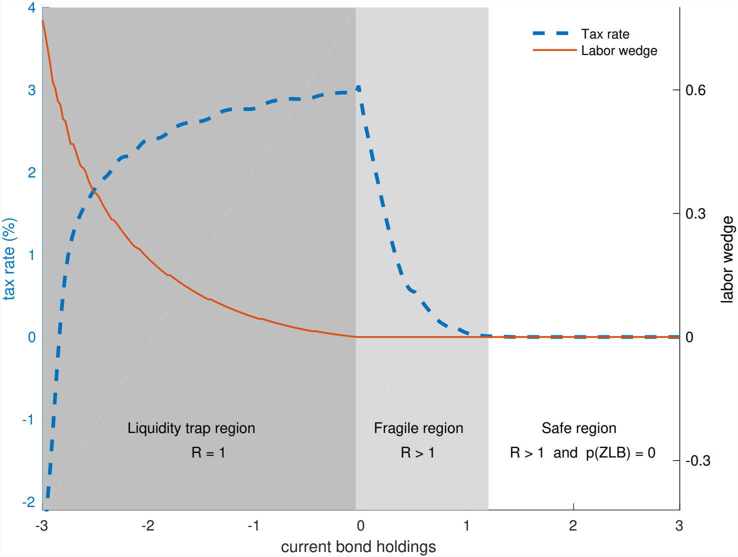
$$R^* = R \; \mathbb{E}_{s'|s} \left[\Upsilon\left(\mathcal{C}^T(b^{*\prime}, s'), \mathcal{C}^N(b^{*\prime}, s')\right) \frac{P^{T*}}{P^{T*\prime}} \frac{e}{\mathcal{E}(b^{*\prime}, s')}\right]$$

$$R \; \geq 1$$

Results of Joint Optimal Policies

formal



Optimal Monetary Policy Alone

$$V(b^*, s) = \max_{R, e, b^{*\prime}, c^N, c^T} u\left(c^T, c^N\right) - v\left((c^N)^{1/\alpha}\right) + \beta \mathbb{E}_{s'|s} \frac{z'}{z} V\left(b^{*\prime}, s'\right)$$

subject to

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$$c^N = \left[\frac{1-\omega}{\omega} \frac{P^{T*}}{\bar{P}^N} e\right]^{\gamma} c^T$$

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$$R \geq 1$$

Prudential Monetary Policy

- Depart from zero labor wedge today if ZLB binds in the future ($\xi_{t+k} > 0$ for some $k > 0$)

$$u_T(t)\psi_t = \frac{\tilde{\omega}(\sigma - \gamma)}{(1-\tilde{\omega})\sigma + \tilde{\omega}\gamma} \underbrace{E_t \sum_{k=1}^{\infty} \beta^k \frac{z_{t+k}}{z_t} \left(\prod_{s=0}^{k-1} R^*_{t+s} \right) \frac{\xi_{t+k}}{\gamma c^T_{t+k}}}_{\text{mg. costs of future binding ZLB}}$$

- Logic: use monetary policy to reduce capital inflows (at the cost of inefficient output today)

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Optimal to increase or decrease R?

- Depends on expend. switching vs. intertemp. substitution
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  - If $\sigma > \gamma$ $\Uparrow R$
  - If $\sigma < \gamma$ $\Downarrow R$

Quantitative Implications

	Frequency of ZLB	Duration of ZLB	Unemp.	Welfare costs from ZLB
Monetary Policy Only	3.8%	2.0	6.0%	0.4%
Monetary & Macropru	3.1%	2.4	1.5%	0.1%

Note: Duration expressed in years.

With macroprudential policy:

- Welfare costs from liquidity traps fall from 0.4% to 0.1%.
- Less frequent but more persistent liquidity traps

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International Spillovers: Monetary Policy

- Spillovers operate via world real rate

$$\frac{\partial V_{H,0}}{\partial R_{F,0}} = \left[\frac{u_T(c^T_{H,0}, c^N_{H,0})}{R^*_0} \upsilon_{H,0} \right] \frac{\partial R^*_0}{\partial R_{F,0}}$$

where $\upsilon_{H,0}$ is the Lagrange multiplier on HH Euler equation for b^*

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where $\upsilon_{H,0}$ is the Lagrange multiplier on HH Euler equation for b^*

  - If $\sigma = \gamma$, no monetary policy spillovers
  - If $\sigma \neq \gamma$, non-insularity through changes in R^*

- Prudential mon. policy abroad $\Downarrow R^*$ and raises home borrowing

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- Prudential mon. policy abroad $\Downarrow R^*$ and raises home borrowing
- Macroprudential policy can offset this and provide insulation

  $\Rightarrow$ help avoid currency wars

International Spillovers: Macroprudential Policy

Is a capital control regime preferable to laissez-faire?

Proposition. *Starting from an equilibrium with zero net positions.*

i) Away from a ZLB, higher welfare in a capital control regime

ii) At the ZLB, higher welfare if $\tau_{F,t} < 0$ or if $\tau_{F,t} > 0$ and $\sigma \geq \gamma$.

Intuition:

- Away from a liquidity trap, always insulation
- In a liquidity trap, two opposing forces:
  - Positive $\tau_{F,t}$ reduces R^* and tighten ZLB (Fornaro-Romei)
  - But lower R^* makes it cheaper to borrow and increase demand (dominates if $\sigma > \gamma$)

▸ Coordination

Conclusion

- Monetary and macroprudential policy work through entirely different channels
- Macroprudential policy ameliorates monetary policy trade-offs
  - Zero output gap away from ZLB
- Without macroprudential, monetary policy does not necessarily lean against the wind
- Overall, capital controls have benign global implications

Coordination Problem

$$V_H\left(b^*_{H,0}\right) = \max_{\{c^N_{k,0}, c^T_{k,0}, P^T_{k,0}, b^*_{k,1}, R^*_0\}} \left[u\left(c^T_{H,0}, c^N_{H,0}\right) - v\left((c^N_{H,0})^{1/\alpha}\right)\right] + \beta \frac{z_{H,1}}{z_{H,0}} V_H\left(b^*_{H,1}\right)$$

subject to

$$c^T_{k,0} = y^T_{k,0} + b^*_{k,0} - \frac{b^*_{k,1}}{R^*_0}, \qquad \forall k \in \{H, F\}$$

$$c^N_{k,0} = \left[\frac{1-\omega}{\omega}\frac{P^T_{k,0}}{\bar{P}^N}\right]^{\gamma} c^T_{k,0}, \qquad \forall k \in \{H, F\}$$

$$R^*_0 \geq \frac{P^T_{k,0}}{\mathcal{P}^T_{k,1}(b^*_{k,1})}, \qquad \forall k \in \{H, F\}$$

$$\bar{V}_F\left(b^*_{F,0}\right) \leq u\left(c^T_{F,0}, c^N_{F,0}\right) - v\left((c^N_{F,0})^{1/\alpha}\right) + \beta V_F\left(b^*_{F,1}\right)$$

$$0 = \int_0^n b^*_H dH + \int_n^1 b^*_F dF$$

back

Table 1: Transmission channels of monetary policy

back

	$\sigma = 0.5$			$\sigma = 1$		
	$\gamma = 0.5$	$\gamma = 1$	$\gamma = 2$	$\gamma = 0.5$	$\gamma = 1$	$\gamma = 2$
RANK						
Change in y^N (pp)	0.50	0.62	0.91	0.89	1.00	1.27
Intertemporal subst.	0.37	0.36	0.34	0.74	0.71	0.69
Expend. switching	0.11	0.24	0.53	0.12	0.25	0.53
Aggregate income	0.02	0.02	0.04	0.03	0.04	0.05
TANK						
Change in y^N (pp)	0.50	0.72	1.18	0.78	1.00	1.45
Intertemporal subst.	0.27	0.26	0.25	0.53	0.51	0.49
Expend. switching	0.11	0.25	0.54	0.11	0.25	0.55
Aggregate income	0.12	0.21	0.39	0.14	0.24	0.41

Note: The monetary policy shock we consider is a 1 percentage point decrease in the nominal interest rate for one quarter (annualized). All responses are reported in annualized terms.

Results of Joint Optimal Policies

Away from a liquidity trap

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$$\tau_t = \frac{1}{\beta R_t^* E_t \frac{z_{t+1}}{z_t} u_T(t+1)} \left\{ -(1+\Theta)\frac{\xi_t}{\gamma c_t^T} + \beta R_t^* E_t \frac{z_{t+1}}{z_t} \left[\frac{\xi_{t+1}}{\gamma c_{t+1}^T} \right] \right\}$$

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$$\frac{\xi_t}{\gamma c_t^T} = \frac{1 - \tilde{\omega}_t}{\tilde{\omega}_t} \psi_t u_T(t)$$

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Two powerful results on the desirability of coordination

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Intuition:

All countries apply the subsidies $\Rightarrow$ rise in the risk-free rate

$\Rightarrow$ more monetary space to close the output gap

back

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Two powerful results on the desirability of coordination

i) *The ZLB never binds in a coordinated capital control regime*

ii) *In a state in which the ZLB does not bind in the uncoordinated solution for any country, there are no gains from coordination.*