Overborrowing, Financial Crises and ‘Macro-prudential’ Policy

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The case for macro-prudential policies

- Credit booms tend to be followed by deep recessions, asset price crashes, and often financial crises
  - Credit booms occurred with 2.2% frequency in 1960-2006, and about 1/2 ended in banking crisis (Mendoza & Terrones (08))
  - …in this sense the 2008-09 global crisis had a “typical” pattern
- Macro-prudential policy (MPP) has a clear goal: to prevent “overborrowing” at a macro level by affecting behavior ex ante
- …but specifics of MPP design are less clear
  - Overborrowing is vaguely defined or used as a value judgment
  - Normative/quantitative macro models of MP are scarce

Two key quantitative questions

- Can a micro-level financial friction cause systemic (macro) overborrowing?
  - Can it cause /explain financial crises or affect business cycles?
  - Sound MPP starts with a “good” model of crises
  - Similar question as in the broad literature on financial frictions
- Is macroprudential policy effective to prevent overborrowing and financial crises?
  - What are its main features?
  - How does it affect incidence and magnitude of financial crises?
  - What are its effects on asset pricing behavior (excess returns, Sharpe ratios, price of risk)?

What we do in this paper

- Answer the questions using a DSGE model with a collateral constraint that limits debt to a fraction of market value of assets.
  - Examine differences between a decentralized eq. (DE) and a social planner (SP) subject to IDENTICAL credit possibilities.

- The credit constraint plays two key roles:
  1. Triggers Fisher's debt-deflation feedback mechanism, which amplifies effects of negative shocks causing deep recessions
  2. Introduces a pecuniary externality via price of collateral assets (in "good times" agents do not internalize that lower leverage weakens Fisherian deflation in "bad times")

     ➢ A planner that reduces debt ex ante improves welfare.

Agents not internalizing home prices

Main findings

1. DE and SP yield similar average debt and leverage

2. …but crises are larger and more frequent in DE
   - Probability of financial crises increases by a factor of 3.
   - Asset prices fall 17 ppts more (24% v. 7% for SP).
   - Credit and consumption fall about 10 ppts more
   - Overall cyclical variability is also higher

3. Mean excess return and Sharpe ratio rise by factors of 6 and 10, and market price of risk increases 81%.

4. SP’s allocations implementable with state-contingent taxes on debt (1% on average, positively corr. with leverage) and on dividends (-0.4% on average)

Main elements of the model

- Inter-period non-state-contingent debt for smoothing & intra-period debt for working capital (WK)
- Collateral constraint limits total debt to fraction of market value of physical assets (in fixed supply)
- Production with labor and physical assets
- WK has zero financing cost but requires collateral
- Standard TFP shocks only (crises with realistic features result from endogenous amplification)
- GHH preferences remove wealth effect on labor supply

Representative firm-household problem in the decentralized economy

- Maximize:

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t - G(n_t^s)) \right]$$

s.t. budget constraint

$$q_t k_{t+1} + c_t + \frac{b_{t+1}}{R} = q_t k_t + b_t + w_t n_t^s + [\varepsilon_t F(k_t, n_t^d) - w_t n_t^d]$$

and collateral constraint

$$-\frac{b_{t+1}}{R} + \theta w_t n_t^d \leq \kappa q_t k_{t+1}$$

Asset pricing conditions

- Excess asset returns:

$$E_t[R^q_{t+1}] - R = \frac{\mu_t(1-\kappa) - Cov_t(\beta u'(t+1), R^q_{t+1} - R)}{\beta E u'(t+1)}$$

$$R^q_{t+1} \equiv \frac{\varepsilon_t f_k(\overline{K}, n_{t+1}) + q_{t+1}}{q_t}$$

- Forward solution for asset prices:

$$q_t = E_t \sum_{j=0}^{\infty} \left(\prod_{i=0}^{j} E_{t+i} \left[R^q_{t+1+i} \right]^{-1} \right) \varepsilon_{t+j+1} F_k(\overline{K}, n_{t+j+1})$$

Constrained Social Planner's problem

$$V(B,\varepsilon) = \max_{B',c,n} \left[u(c - G(n)) + \beta E_{\varepsilon'|\varepsilon} V(B',\varepsilon') \right]$$

$$c + \frac{B'}{R} = \varepsilon F(\overline{K}, n) + B$$

$$-\frac{B'}{R} + \theta w(B,\varepsilon) n \leq \kappa q(B,\varepsilon) \overline{K}$$

Taking as given $q(B,\varepsilon) = q^{DE}(B,\varepsilon)$,$w(B,\varepsilon) = G'(n)$

Pecuniary credit externality

- **DE's private marginal utility cost of borrowing:**

$$\beta E_t u'(c_{t+1})(1+r)$$

- **SP's social marginal utility cost of borrowing:**

$$\beta E_t u'(c_{t+1})(1+r) + \underbrace{\beta E_t \left[\mu_{t+1} \left(\kappa \overline{K} \frac{\partial q_{t+1}}{\partial b_{t+1}} - \theta n_{t+1} \frac{\partial w_{t+1}}{\partial b_{t+1}} \right) \right]}_{\text{Externality}}$$

where $\frac{\partial q_{t+1}}{\partial b_{t+1}} > 0$ amplifies and $\frac{\partial w_{t+1}}{\partial b_{t+1}} \geq 0$ mitigates effects of adverse shocks

Optimal macro-prudential policy

- Decentralize planner's eq. with state contingent taxes

- Tax on debt implements SP's bond decision rule:

$$\tau_t = \frac{E_t\left(\mu_{t+1}^{SP}\left(\kappa \overline{K}\frac{\partial q_{t+1}}{\partial b_{t+1}} - \theta n_{t+1}\frac{\partial w_{t+1}}{\partial b_{t+1}}\right)\right)(1+r)}{E_t u'(c_{t+1})}$$

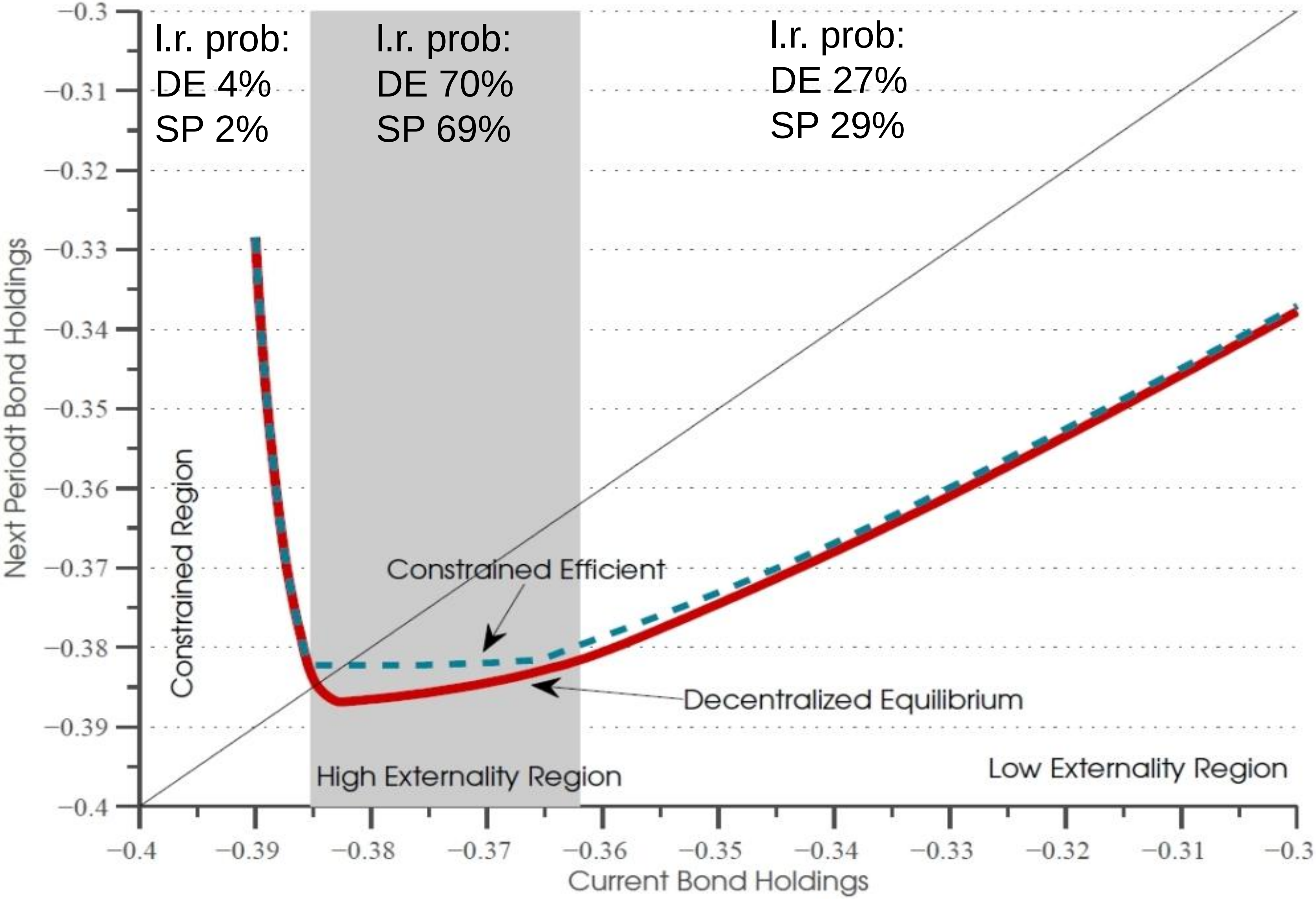
- Tax on dividends makes asset prices equivalent:

$$q_t^{DE}(u'(t) - \mu_t\kappa) = \beta E_t\left[u'(t+1)\left(\varepsilon_{t+1}F_k(k_{t+1}, n_{t+1})(1+\delta_t) + q_{t+1}^{DE}\right)\right]$$

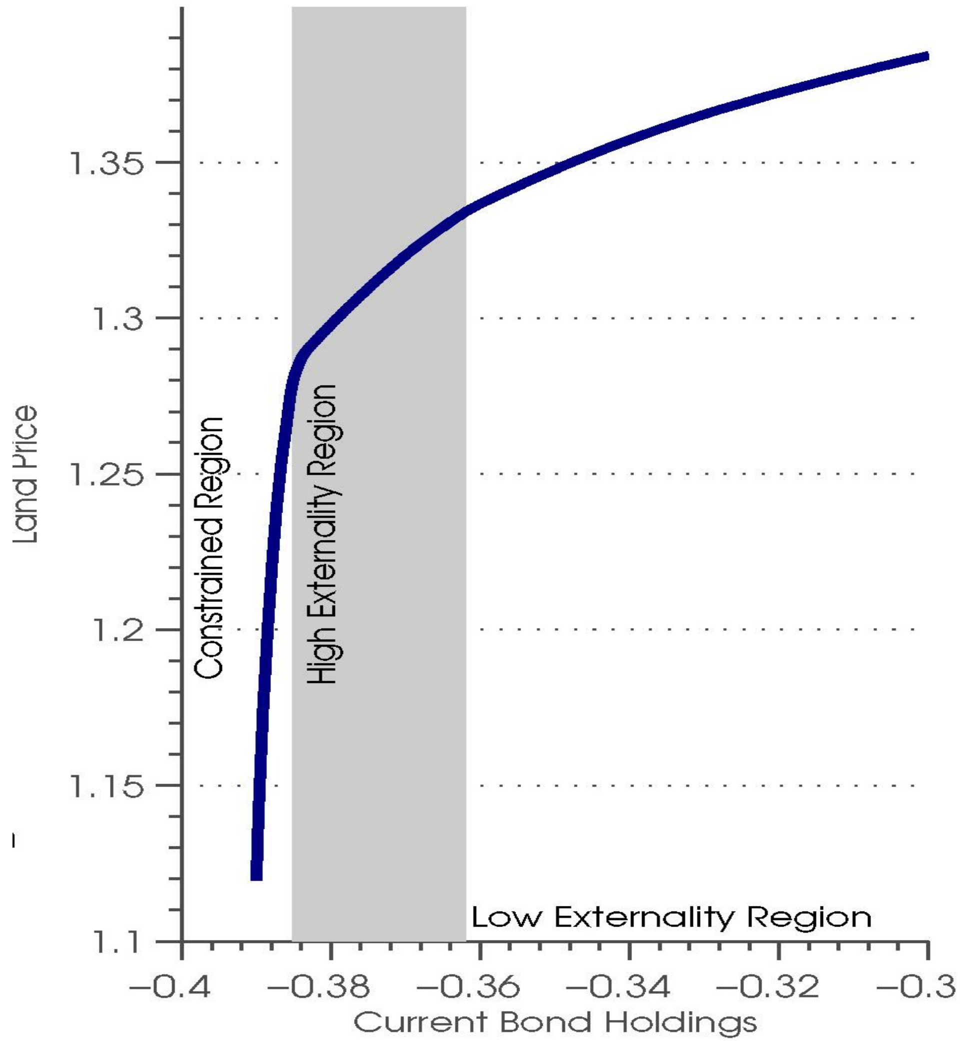
Calibration

		Source / target
Interest rate	$R - 1 = 0.028$	U.S. data
Risk aversion	$\sigma = 2$	Standard DSGE value
Share of labor	$\alpha_n = 0.64$	U.S. data
Labor disutility coefficient	$\chi = 0.64$	Normalization
Frisch elasticity parameter	$\omega = 1$	Kimball and Shapiro (2008)
Supply of land	$\bar{K} = 1$	Normalization
Working capital coefficient	$\theta = 0.14$	Working Capital-GDP=9%
Discount factor	$\beta = 0.96$	Debt-GDP ratio= 38%
Collateral coefficient	$\kappa = 0.36$	Frequency of Crisis = 3%
Share of land	$\alpha_K = 0.05$	Housing-GDP ratio = 1.35
TFP process	$\sigma_\varepsilon = 0.014, \rho_\varepsilon = 0.53$	Std. dev. and autoc. of U.S. GDP

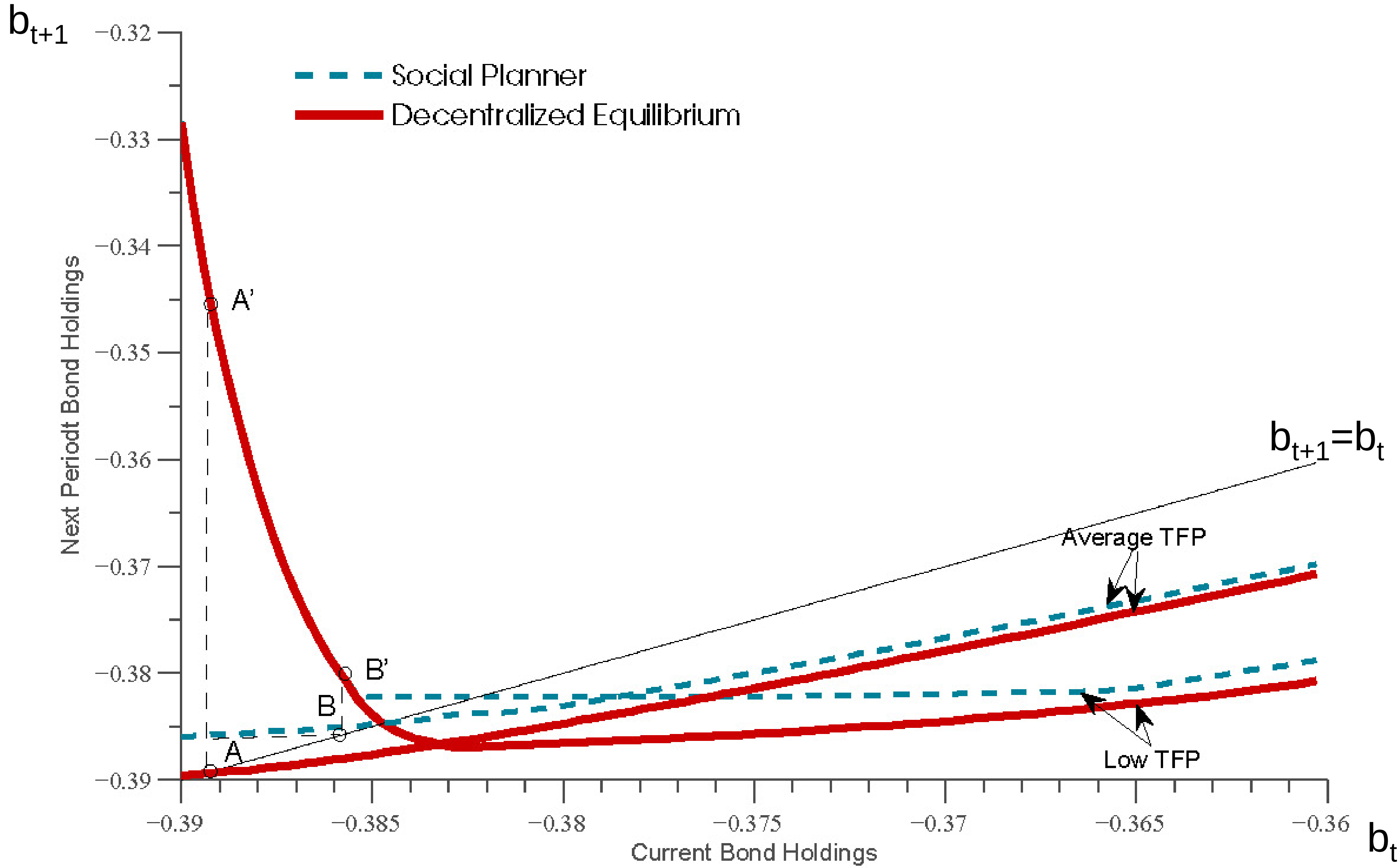
Decision rules for bonds in low TFP state

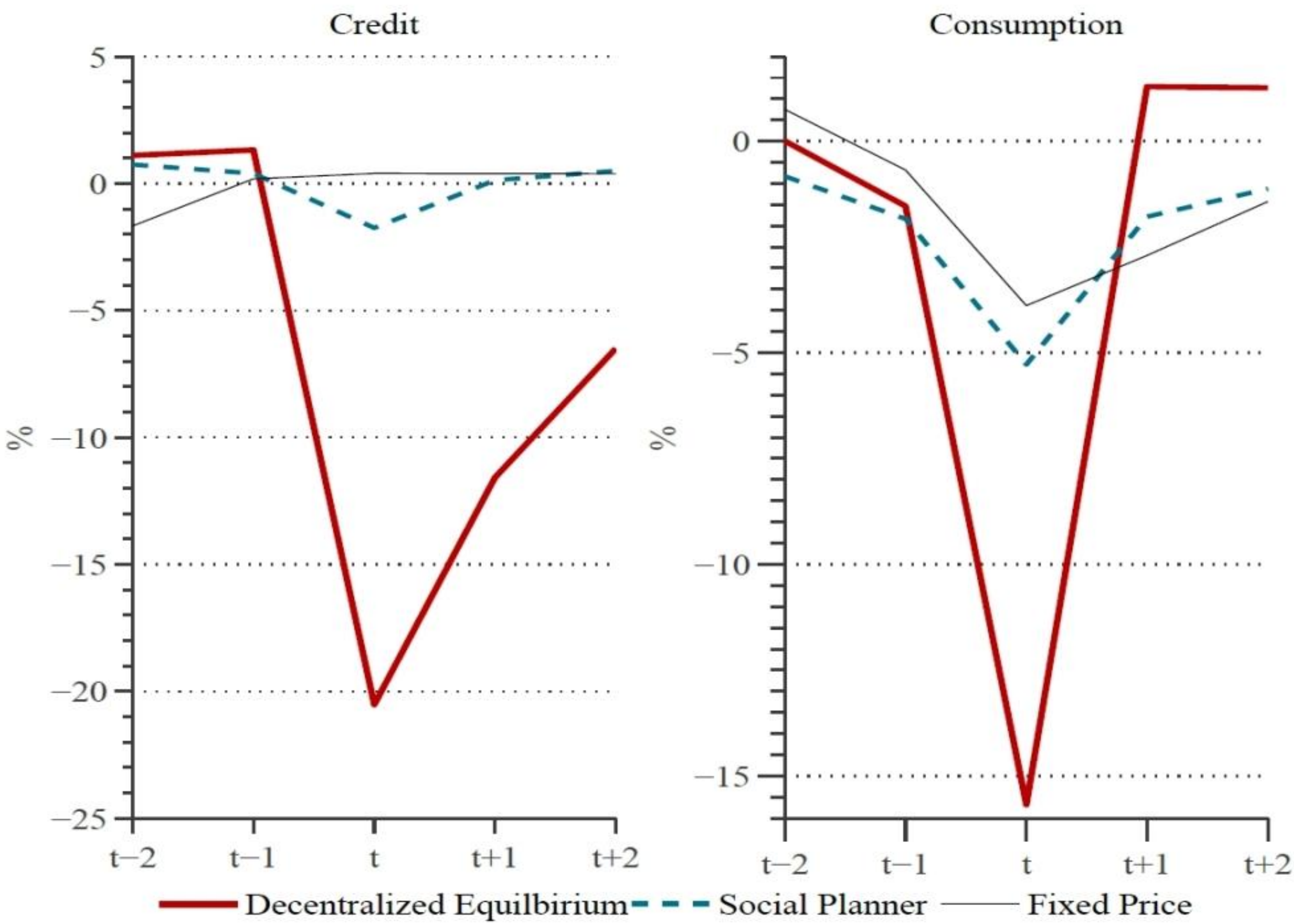


Equilibrium land prices in low TFP state

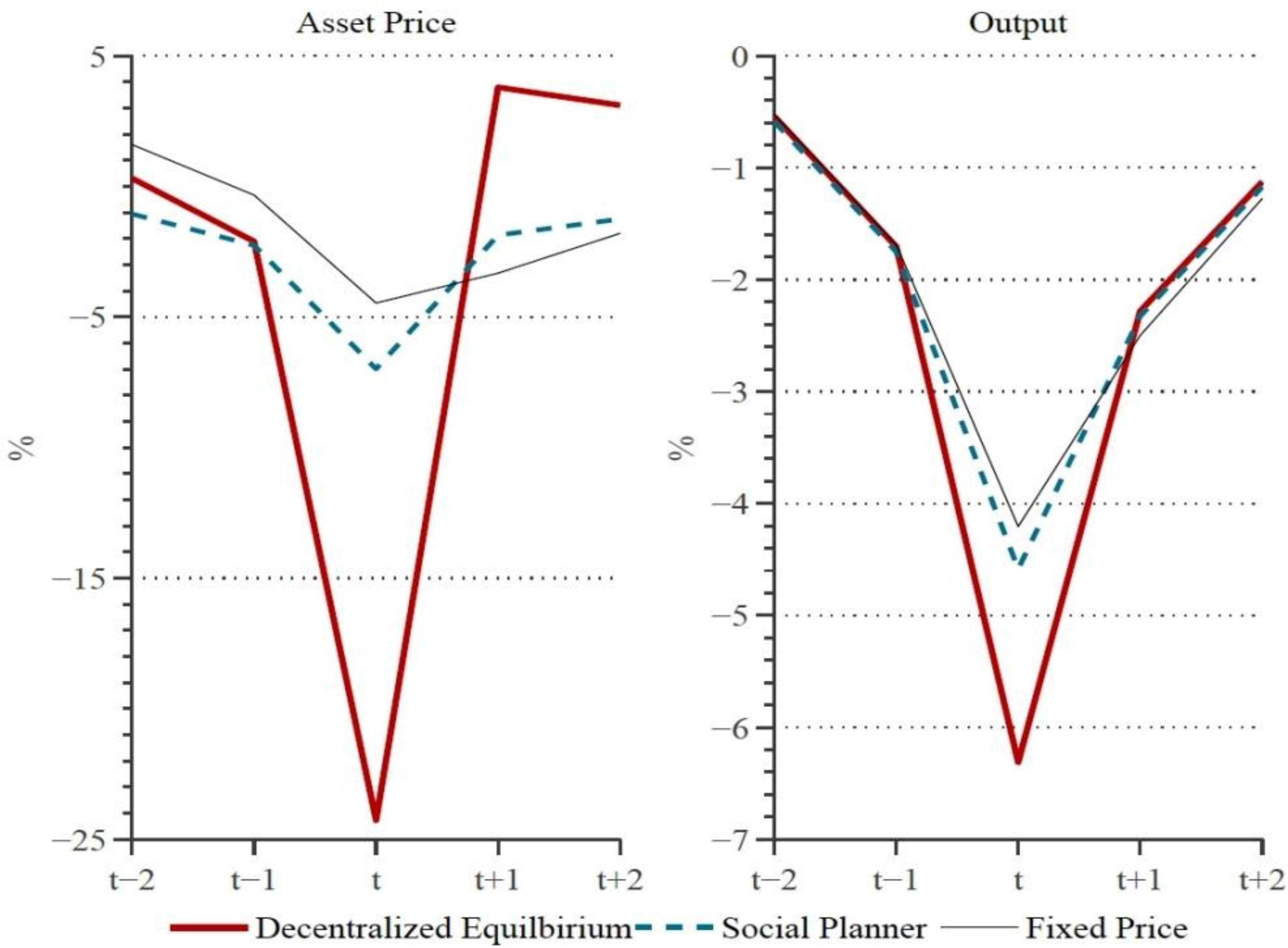


Debt dynamics: amplification effects

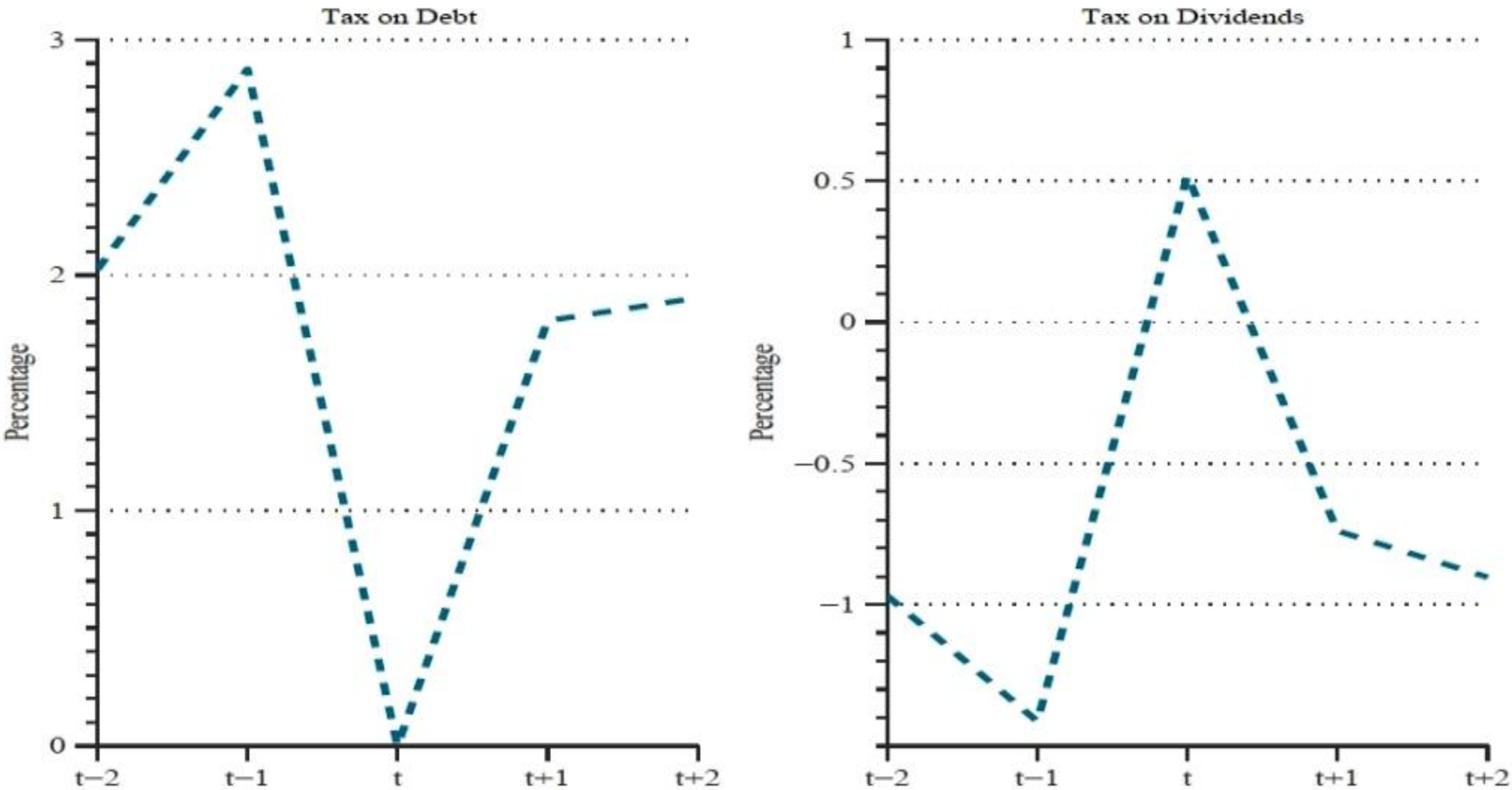




Credit
Consumption
5
0
−5
−10
−15
−20
−25
%
−5
−10
−15
t−2
t−1
t
t+1
t+2
Decentralized Equilibrium
Social Planner
Fixed Price



Asset Price
5
−5
−15
−25
%
t−2
t−1
t
t+1
t+2
Output
0
−1
−2
−3
−4
−5
−6
−7
%
t−2
t−1
t
t+1
t+2
Decentralized Equilbirium
Social Planner
Fixed Price



Tax on Debt
Percentage
3
2
1
0
t−2
t−1
t
t+1
t+2
Tax on Dividends
Percentage
1
0.5
0
−0.5
−1
t−2
t−1
t
t+1
t+2

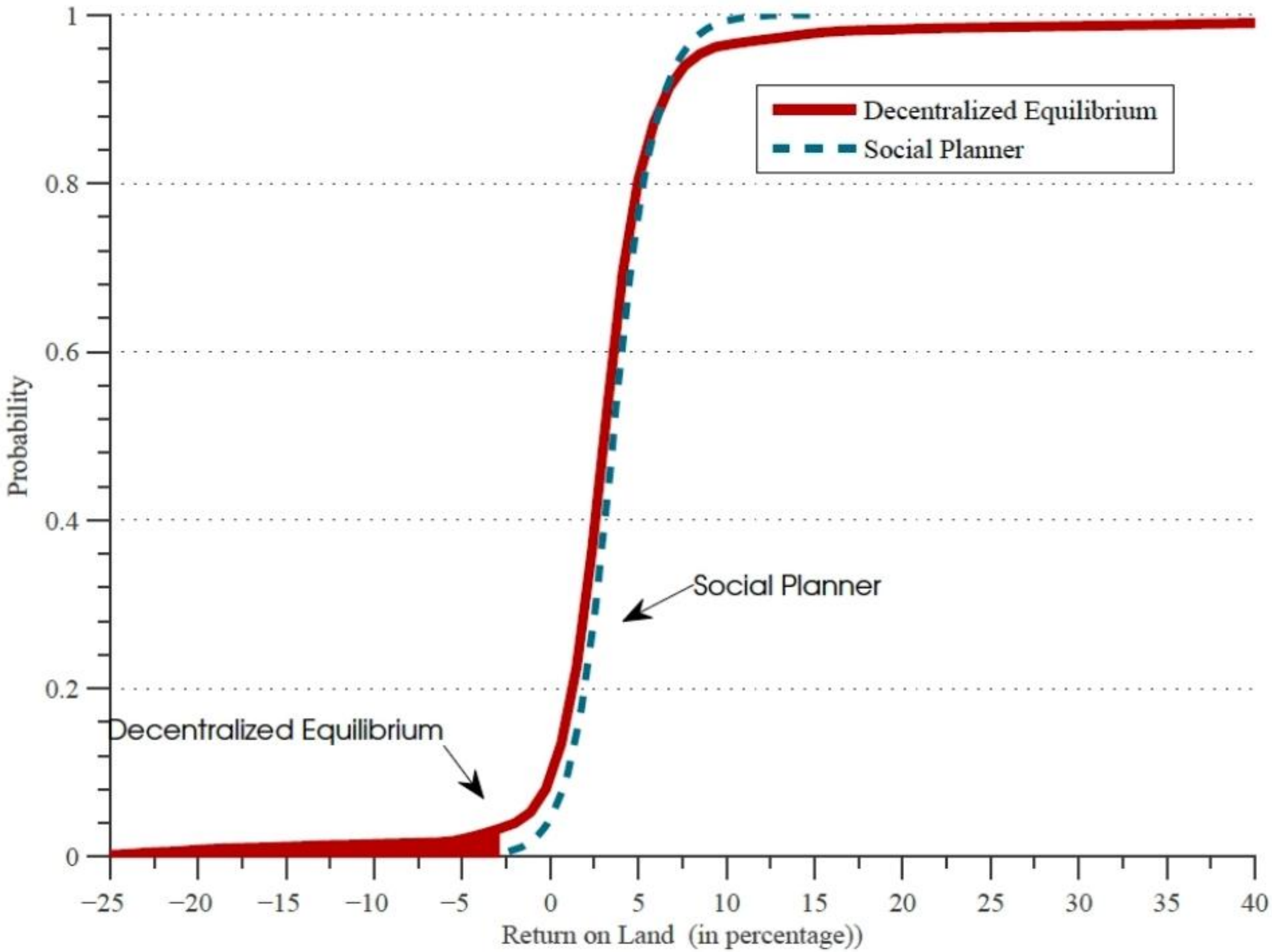
Table: Long Run Moments of Macro-prudential Policies

	Average		Standard Deviation		Correlation with Leverage	
	Debt Tax	Dividend Tax	Debt Tax	Dividend Tax	Debt Tax	Dividend Tax
Unconditional	1.07	-0.46	1.41	0.62	0.73	-0.64
Constrained	0.09	0.52	0.41	0.04	0.0	0.0
Unconstrained	1.09	-0.49	1.40	0.61	0.81	-0.79

Asset pricing moments

	Excess Return	Direct Effect	Covariance Effect	s_t	$\sigma_t(R^q_{t+1})$	S_t
Decentralized Equilibrium						
Unconditional	1.09	0.87	0.22	5.22	3.05	0.79
Constrained	13.94	13.78	0.16	4.05	2.71	11.75
Unconstrained	0.23	0.00	0.23	5.3	3.08	0.05
Constrained-Efficient Equilibrium						
Unconditional	0.17	0.11	0.06	2.88	1.85	0.08
Constrained	4.86	4.80	0.06	3.02	2.07	2.38
Unconstrained	0.06	0.00	0.06	2.86	1.84	0.03

Endogenous "fat tails" in CDF of returns



Conclusions

- Study of overborrowing, credit externalities and macro-prudential policy in DSGE model of business cycles and asset prices.

- Collateral constraint introduces systemic credit externality that increases magnitude and incidence of financial crises, mean excess returns, volatility of returns and Sharpe ratios

- Optimal taxes on debt and dividends neutralize credit externality, but implementation is likely to be difficult:
  - State-contingent policies that require detailed information on debt and leverage of a large set of economic agents
  - Taxing dividends during crises politically difficult, but selective implementation reduces welfare