Macroprudential Policy: Promise and Challenges

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Macroprudential policy (MPP) aims to weaken credit booms in order to reduce frequency & severity of crises.

Rationale: Credit booms are infrequent, but end in deep, protracted crises. In Mendoza & Terrones (2012):
1. Credit booms occur with 2.8% frequency
2. 1/3\(^{rd}\) end in banking or currency crises.
3. After 3 years, GDP is still 5%-8% below trend

Fisherian models provide useful quantitative framework
1. Strong financial amplification captures nonlinearities & explains key features of credit booms/crisis
2. Externalities (market-failure) justify policy intervention
3. Toolbox for evaluation of optimal policy and simple rules
The challenges

1. **Nonlinearities & amplification**: A general case for global, nonlinear models of credit booms/crises and MPP (particularly Fisherian models)

2. **Complexity & credibility**: Optimal MPP follows complex rules and lacks credibility because of time-inconsistency

3. **Coordination failure**: Mismanaged interaction with monetary policy yields costly Tinbergen’s rule violations and strategic interaction
1. General case for nonlinear models
A “general theory” of risk pricing

Theoretical pricing function
What a model of MPP needs to do

Theoretical pricing function

financial distress

financial distress with MPP

regular cycle

local approximation

yield

liability position
2. Fisherian models, market failure and optimal MPP
Fisherian models

• Wide class of models in which market prices affect borrowing capacity (e.g. collateral, scoring, etc.)

• Occasionally binding credit constraints:

\[
\frac{b_{t+1}}{R_t} \geq -\kappa_t f(p_t)
\]

1. Debt-to-income (DTI) models:  
   \[ f(p_t^N) = y_t^T + p_t^N y_t^N \]

2. Loan-to-value (LTV) models:  
   \[ f(q_t) = q_t k_{t+1} \]

• Market price of collateral determined by aggregate allocations:  
  \[ f(p_t^N(C_t^T, C_t^N)), f(q_t(C_t, C_{t+1})) \]

• Pecuniary externality: Agents choose debt in “good times” ignoring price responses in “crisis times”
Where is the externality?

- Private agents’ Euler eq. for debt choice:

\[
\dot{u}(t) = \beta R_t E\left[ u'(t + 1) \right] + \mu_t
\]

- In normal times \( \mu_t = 0 \) => standard Euler equation

- But for a planner choosing debt internalizing the externality, the Euler eq. is:

\[
\dot{u}(t) = \beta R_t E\left[ u'(t + 1) + \mu_{t+1}^* \kappa_{t+1} f'(t + 1) \left( \frac{\partial p_{t+1}}{\partial \tilde{C}_{t+1}} \frac{\partial \tilde{C}_{t+1}}{\partial b_{t+1}} \right) \right]
\]

- **If** social MC of debt exceeds private MC, private agents “overborrow” in good times
Proving the social MC of debt is higher

- Higher social MC of debt requires:
  \[ f'(t+1) \left( \frac{\partial p_{t+1}}{\partial \tilde{c}_{t+1}} \right) \left( \frac{\partial \tilde{c}_{t+1}}{\partial b_{t+1}} \right) > 0 \]

- These are trivially positive: borrowing capacity rises with collateral values and consumption rises with wealth.

- But the sign of this is a key endogenous equilibrium outcome, which can be proven to be positive:

  **DTI setup:**
  \[ \frac{\partial p_{t+1}^N}{\partial \sigma_{t+1}^T} = -\frac{p_{t+1}^N u_{cT}(t+1)}{u_{cT}(t+1)} > 0 \]

  **LTV setup:**
  \[ \frac{\partial q_{t+1}}{\partial \sigma_{t+1}^T} = -\frac{q_{t+1} u_{ce}(t+1)}{u_{c}(t+1)} > 0 \]

- A large externality is implied if the model is able to generate large price drops during crises!
Optimal MPP

• An optimal “macroprudential debt tax” implements the planner’s allocations:

\[
\tau_t = \frac{E_t \left[ \mu_{t+1}^* \kappa_{t+1} f'(t+1) \frac{\partial p_{t+1}}{\partial \tilde{C}_{t+1}} \frac{\partial \tilde{C}_{t+1}}{\partial b_{t+1}} \right]}{E_t \left[ u'(t+1) \right]}
\]

– \( \tau_t > 0 \) only if the constraint is expected to bind with some probability at \( t+1 \).

• Equivalent instruments: capital requirements, regulatory LTV or DTI ratios.
3. Complexity and time-inconsistency
1. RBC-SOE model with Fisherian constraint
2. Production w. intermediate goods that require working capital (credit-induced output drop)
3. Rep. firm-household uses assets in fixed supply as collateral for debt and working capital
4. Planner internalizes asset prices (Euler eq. becomes implementability constraint)
5. Shocks: TFP \( (z_t) \), world interest rate \( (R_t) \), and regime-switching LTV or global liquidity \( (k_t) \).
6. Calibrated to U.S. and OECD data
Rep. firm-household problem

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

\[
u(c - G(h)) = \frac{\left( c - \chi \frac{h^{1+\omega}}{1+\omega} \right)^{1-\sigma} - 1}{1 - \sigma} \quad \omega > 0, \sigma > 1
\]

s.t.

\[
q_t k_{t+1} + c_t + \frac{b_{t+1}}{R_t} = q_t k_t + b_t + [z_t F(k_t, h_t, v_t) - p_v v_t] \quad (\lambda_t)
\]

\[
- \frac{b_{t+1}}{R_t} + \theta p_v v_t \leq \kappa_t q_t k_t \quad (\mu_t)
\]
Optimality conditions

\[ z_t F_h(k_t, h_t, v_t) = G''(h_t) \]

\[ z_t F_v(k_t, h_t, v_t) = p_v (1 + \theta \mu_t / u'(t)) \]

\[ u'(t) = \beta R_t \mathbb{E}_t [u'(t + 1)] + \mu_t \]

\[ q_t u'(t) = \beta \mathbb{E}_t [u'(t + 1) (z_{t+1} F_k(k_{t+1}, h_{t+1}, v_{t+1}) + q_{t+1}) + \kappa_{t+1} \mu_{t+1} q_{t+1}] \]
Commitment & time inconsistency

• When $\mu_t > 0$, the planner views the effects of the choice of $b_{t+1}$ on $C_{t+1}$, and hence on $q_t$, differently depending on its ability to commit.

• *Commitment:* Promise lower $C_{t+1}$, to prop up $q_t$, because $q_t(C_t, C_{t+1})$ is decreasing in $C_{t+1}$, but at $t+1$ this is suboptimal=> time inconsistency.

• *Discretion:* The planner of date $t$ considers how its choices affect choices of the planner of $t+1$ => Markov stationarity eq. is time-consistent.
Time-consistent social planner

\[
V(b, \varepsilon) = \max_{c, b', h, m} \left[ \left( c - \chi \frac{h^{1+\omega}}{1 + \omega} \right)^{1-\sigma} \frac{1}{1 - \sigma} + \beta E \left[ V(b', \varepsilon') \right] \right]
\]

s.t.

\[
c + \frac{b'}{\theta} = b + \left[ z' \alpha_k m^{\alpha m} h^{\alpha h} - p^{m m} \right]
\]

\[
\frac{b'}{\theta} - \theta p^{m m} \geq -\kappa q
\]

\[
q u_c \left( c - \chi \frac{h^{1+\omega}}{1 + \omega} \right) = \beta E \left[ u_c \left( \hat{c}' - \chi \frac{\hat{h}^{1+\omega}}{1 + \omega} \right) \left( z' F_k (1 \hat{m}', \hat{h}') + \hat{q}' \right) + \kappa \hat{\mu} \hat{q}' \right]
\]
1. Macroprudential component (tackles standard pecuniary externality when $\mu_t = 0$ and $E_t[\mu_{t+1}] > 0$):

$$\tau_{t}^{MP} = \frac{E_t \left[ -\kappa_{t+1} \mu_{t+1}^* \frac{u_{cc}(t+1)}{u_c(t+1)} Q_{t+1} \right]}{E_t \left[ u_c(t+1) \right]}$$

2. Ex-post component (effects on future planners & incentive to prop up value of collateral when $\mu_t > 0$)

$$\tau_{t}^{FP} = \frac{E_t \left[ \frac{\kappa_t \mu_t^*}{u_c(t)} \Omega_{t+1} \right]}{E_t \left[ u_c(t+1) \right]} + \frac{\kappa_t \mu_t^* \frac{u_{cc}(t)}{u_c(t)} q_t}{\beta R_t E_t \left[ u_c(t+1) \right]}$$
Complexity

(a) Tax Schedule in Good States

(b) Tax Dynamics around Crises
Optimal (TC) policy & simpler rules

<table>
<thead>
<tr>
<th></th>
<th>Decentralized Equilibrium</th>
<th>Optimal Policy</th>
<th>Best Taylor</th>
<th>Best Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare Gains (%)</td>
<td>–</td>
<td>0.30</td>
<td>0.09</td>
<td>0.03</td>
</tr>
<tr>
<td>Crisis Probability (%)</td>
<td>4.0</td>
<td>0.02</td>
<td>2.2</td>
<td>3.6</td>
</tr>
<tr>
<td>Drop in Asset Prices (%)</td>
<td>−43.7</td>
<td>−5.4</td>
<td>−36.3</td>
<td>−41.3</td>
</tr>
<tr>
<td>Equity Premium (%)</td>
<td>4.8</td>
<td>0.77</td>
<td>3.9</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Text Statistics

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<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>–</td>
<td>3.6</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Std relative to GDP</td>
<td>–</td>
<td>0.5</td>
<td>0.2</td>
<td>–</td>
</tr>
<tr>
<td>Correlation with Leverage</td>
<td>–</td>
<td>0.7</td>
<td>0.3</td>
<td>–</td>
</tr>
</tbody>
</table>

Financial Taylor Rule: \( \tau = \max[0, \tau_0 (b_{t+1}/\bar{b})^{\eta_b} - 1] \)
Simple rules: constant taxes

(a) Crisis Probability

(b) Welfare Gains

Welfare-reducing constant taxes
Effects of simple policies on magnitude of crises

(a) Credit/GDP

(b) Asset Price

- Decentralized Equilibrium
- Optimal Tax
- Simple Rule
- Fixed Tax
4. Coordination failure in the interaction with monetary policy
Policy interactions in NK-BGG model

• Carrillo et al. (18) model:
  1. BGG model with risk shocks (Christiano et al. (14))
  2. Calvo pricing=> inefficiencies in goods markets
  3. Costly monitoring=> inefficiencies in credit-capital market

• Risk shocks (fluctuations in variance of entrepreneurs’ returns) strengthen financial transmission

• MP instrument is the nominal interest rate, FP instrument is a subsidy to intermediaries (lowers “efp”)

• MP (FP) instrument affects target and payoff of FP (MP)

• Two forms of coordination failure: Tinbergen’s rule violations and strategic interaction
Policy interactions in response to risk shocks

Credit-capital market

Aggregate supply & demand
Policy regimes

- **STR**: Simple Taylor rule, no financial policy rule
  \[ R_t = R \left( \frac{1 + \pi_t}{1 + \pi} \right)^{a_\pi} \]

- **ATR**: Augmented Taylor rule ("leaning against the wind"), no financial policy rule
  \[ R_t = R \left( \frac{1 + \pi_t}{1 + \pi} \right)^{a_\pi} \left( E_t \left\{ \frac{r_{t+1}^k}{r_t} \right\} \right)^{-a_{rr}} \]

- **DRR**: Dual rules regime, STR + financial rule:
  \[ R_t = R \left( \frac{1 + \pi_t}{1 + \pi} \right)^{a_\pi} \tau_{f,t} = \tau_f \left( E_t \left\{ \frac{r_{t+1}^k}{r_t} \right\} \right)^{a_{rr}} \]
Relevance of Tinbergen’s rule

<table>
<thead>
<tr>
<th>Regime</th>
<th>ce v. DRR</th>
<th>$a_\pi$</th>
<th>$a_{rr}$</th>
<th>$\dot{a}_{rr}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRR (Best Policy)</td>
<td>–</td>
<td>1.27</td>
<td>2.43</td>
<td>-</td>
</tr>
<tr>
<td>Augmented Taylor Rule</td>
<td>-138 bps.</td>
<td>1.27</td>
<td>-</td>
<td>0.36</td>
</tr>
<tr>
<td>Standard Taylor rule</td>
<td>-264 bps.</td>
<td>1.75</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- STR & ATR yield large welfare losses
- Policy rules are “too tight” with STR & ATR
- Larger effects from risk shocks under STR & STR
Effects of risk shocks & policy regimes

Consumption and investment: $c + c^e + i$

Aggregate demand: $y$

Inflation: $\pi$

Households’ consumption: $\sigma$

Investment: $i$

Capital stock: $k$

External finance prem.: $rr$

Tobin’s Q: $q$

Nominal interest rate: $R$

Financial instrument: $\tau_f$

Argument of utility fn.: $(c - hc)^{\nu}(1 - \nu^h)^{1-\nu}$

- Standard Taylor Rule
- Augmented Taylor Rule
- Baseline (Dual Rules)
Smoothing consumption under policy regimes

Note: Sources of disposable income measured as weighted deviations from det. steady state (bars add up to percent deviations of consumption in IRF).
Strategic interaction

- MP and FP have sum-of-variances payoffs
- Strategy space is over policy rule elasticities
Relevance of strategic interaction

• Cooperation dominates Nash significantly
• Policies again too tight
• ...but even Nash is better than STR & ATR

<table>
<thead>
<tr>
<th>Regime x v. regime y</th>
<th>ce bps. diff</th>
<th>$a_{\pi}$</th>
<th>$a_{rr}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nash v. Best Policy (BP)</td>
<td>30</td>
<td>2.12</td>
<td>1.69</td>
</tr>
<tr>
<td>Cooperative ($\phi = 0.5$) v. BP</td>
<td>4</td>
<td>1.41</td>
<td>2.67</td>
</tr>
<tr>
<td>Cooperative (optimal $\phi$) v. BP</td>
<td>1</td>
<td>1.33</td>
<td>2.10</td>
</tr>
<tr>
<td>Simple Taylor rule v. Nash</td>
<td>234</td>
<td>1.75</td>
<td>-</td>
</tr>
<tr>
<td>Dual rules regime v. BP</td>
<td>—</td>
<td>1.27</td>
<td>2.43</td>
</tr>
</tbody>
</table>
Conclusions

• **Promise**: Progress in developing quantitative models of fin. crises and MPP, with results showing that it can be a very effective policy

• **Challenges**: Complexity, credibility, coordination. Careful quantitative evaluation is necessary to avoid outcomes worse than without MPP.

• **Additional challenges**: fin. innovation, information, heterogeneity, int’l coordination, securitization, interconnectedness