Consumption Dynamics, Housing Collateral and Stabilisation Policy

A Way Forward for Macro-Prudential Instruments?

Effective Macroprudential Instruments - CFCM-MMF-MMPM Conference

Jagjit S. Chadha
University of Kent

Kent.

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‘One Club’ monetary policy has not only insufficient to prevent booms and busts but may have played a role in nurturing volatility.

The newly formed FPC at the BoE has asked for extra instruments countercyclical capital, sectoral capital, leverage ratio.

No liquidity or LTVs, yet...

- See Chadha and Corrado (JBus 2012) and Chadha, Corrado and Meaning (BIS WP 66) on welfare and output enhancing role of liquidity because it can reduce the volatility of the external finance premium.

MPIs are ‘untested and with little evidence’ - no established models or data

House of Commons Treasury Committee Evidence, see http://www.publications.parliament.uk/pa/cm201213/cmselect/cmtreasy/writev/macropru/mpt13.htm

Square 1: consider role of bank behaviour and consumption-housing dynamics.
Consumption Dynamics

- Representative agent paradigm has difficulty dealing with financial frictions and asset prices.
- Kiyotaki-Moore emphasize the role of collateral constraints in investment cycles.
- Much current focus on banking, which intermediates between borrowers and savers and endogenizes the external finance premium, e.g., Christiano et al. (2007), Goodfriend and McCallum (2007), and Chadha et al. (2013) with some violation of Modigliani-Miller.
- Natural to consider heterogeneous agents who are either savers or borrowers.
- Use of micro-founded model allows some welfare analysis of monetary-fiscal-financial policies.
- Creditor-Borrower dynamics exacerbate intra and intertemporal volatility.
Main Results

- Chadha, Corrado and Corrado (2013) explore the link between house prices, borrower consumption, LTVs and the lending rate via collateral constraints NOT wealth or common shock
- We can match the house price-consumption correlation
- Higher order consumption processes for household type c.f. aggregate consumption
- Borrower-payback lending cycle for borrower households has spillovers for savers over time
- Consider the nexus of monetary-fiscal-financial policies
- A more restrictive set of rules for bank lending over the business cycle seem to reduce welfare losses

Corollary

Not clear that our commercial bank can arrive at the best set of intermediation policies for the representative household or creditor and borrower households in the absence of a policy intervention.
The Lucas Costs of Business Cycles

\[ U(\bar{c}) = \frac{\bar{c}^{1-\rho}}{1-\rho} \]

where \( \bar{c} = c + c^b \) and \( \rho \) is the CRRA parameter.

\[ E[U(\bar{c})] \approx \frac{\bar{c}^{1-\rho}}{1-\rho} - \frac{\rho}{2} \bar{c}^{-\rho-1} \sigma^2_{\bar{c}} \]

\[ \frac{\rho}{2} \left( \frac{\sigma_{\bar{c}}}{\bar{c}} \right)^2 = \frac{\rho}{2} \frac{\sigma_c + \sigma_{c^b} + 2\sigma_{c,c^b}}{\bar{c}^2} \]

- Obviously aggregate business cycle costs are small if covariances are negative.
- But what if this covariation drives the business cycle?
Real House Prices and Consumption (UK)

Chart 1
Real house prices (a) and consumer spending

Consumption and House Values

<table>
<thead>
<tr>
<th></th>
<th>Borrower</th>
<th>Saver</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels:*</td>
<td>0.709</td>
<td>-0.452</td>
<td>0.602</td>
</tr>
<tr>
<td>Growth:*</td>
<td>0.453</td>
<td>0.080</td>
<td>0.391</td>
</tr>
</tbody>
</table>

Sources: Nationwide and ONS.
(a) Nationwide house price index deflated by the consumer expenditure deflator.

- LHS: BoE QB and RHS: our calculations of correlation between house prices and consumption from BHPS
Model Structure

Stylised representation of the sectors in our model. [Many arbitrary choices!]
The Household Problem: Creditor

Creditor Household Utility

\[ \max U = E_0 \sum_{t=0}^{\infty} \beta^t \log C_t + \chi_B \log B_t \]

Resource constraint

\[ C_t + (\omega m_{t+1} + d_{t+1} + B_{t+1}) \pi_{t+1} = \omega m_t + R^D_t d_t + R^B_t B_t \]
\[ + q_t (H_t - H_{t-1}) + \Theta_t + \Pi_t - \text{Tax}_t \]

Cash-in-Advance constraint

\[ C_t \leq \omega m_t \]

Creditor Household Euler Equation and Bond Demand

\[ \frac{1}{C_t} = \frac{\beta R^D_t}{\pi_{t+1} C_{t+1}} \]
\[ \frac{\chi_B}{B_t} = \left( \frac{1}{C_t} - \frac{\beta R^B_t}{\pi_{t+1} C_{t+1}} \right) \]
The Household Problem: Workers (Borrowers)

Borrower Household Utility

$$\max U^b = E_0 \sum_{t=0}^{\infty} \beta^t \left[ \log C^b_t + \chi \log H_t - \frac{N_t^{1+\zeta}}{1 + \zeta} \right]$$

Resource Constraint

$$C^b_t + q_t (H_t - H_{t-1}) + (1 - \omega) m_{t+1} \pi_{t+1} + \frac{R^L_{t-1} l_{t-1}}{\pi_t}$$

$$= l_t + (1 - \omega) m_t + w_t N_t - \tau_h q_t H_t$$

Cash-in-Advance constraint

$$C^b_t \leq (1 - \omega) m_t + w_t N_t$$

Borrowing constraint

$$l_t \leq \kappa t q_{t+1} \pi_{t+1} H_t$$
Borrower Consumption Plans

Borrower Consumption Goods Demand

\[ \frac{\ddot{\beta}}{C_{t+1} \pi_{t+1}} - \frac{\ddot{\beta}^2 R^L_t}{C_{t+2} \pi_{t+2} \pi_{t+1}} = \nu_t \]

Residential Goods Demand

\[ \frac{\chi}{\ddot{\beta} H_t} = \frac{q_t}{C_{t+1} \pi_{t+1}} (1 + \tau_h) - q_{t+1} J(\bullet) \]

with \( J(\bullet) = \kappa_t \left( \frac{1}{C_{t+1}} - \frac{\ddot{\beta} R^L_t}{C_{t+2} \pi_{t+2}} \right) + \frac{\ddot{\beta}}{C_{t+2} \pi_{t+2}}. \) is the shadow price of housing demand in terms of consumption units.

Labor Supply:

\[ N^S_t C^b_t = w_t \]
Bank balancing constraint and critical threshold for house price:

\[ l_{j,t} \leq \delta \kappa_t q_t H_t \quad q_t = \frac{C_{t+1} b + \pi_{t+1}}{(1 + \tau_h)} \left( \frac{\chi}{\beta} + q_{t+1} \right) \]

Ex ante profits:

\[
\Pi_{j,t} = \int_0^{s(\bar{\kappa}_t)} \delta \kappa_t q_t H_t \phi(\kappa_t) d\kappa_t + \int_{s(\bar{\kappa}_t)}^{\infty} l_{j,t} R^L_{j,t} \phi(\kappa_t) d\kappa_t
\]

\[ - R^D_{j,t} d_{j,t} + R^M_{t} \rho \eta_{j,t} \]

Bank Balance Sheet:

\[ r_{j,t} + l_{j,t} = d_{j,t} \]

Price of Risk (where lambda is the failure rate priced into loans):

\[
\hat{R}^L_t = \hat{R}^M_t + \frac{\lambda}{1 - \delta} \left[ \hat{I}_t - \delta (\hat{\kappa}_t + \hat{q}_t + \hat{H}_t) \right]
\]
Macroprudential Instruments

**Definition**

time varying (state-contingent) requirements placed on financial intermediaries by the monetary authorities that constrain the scale or set of available tools

- E.g. capital requirements or leverage ratios or LTVs or liquidity covers
- We consider three that emerge from this model:
  1. $\lambda$ - the perception of the risk of loan default - benchmark 20%
  2. $\delta$ - the fraction collateral capital that can be seized in the event of default - can be interpreted as firesale value - 0.5
  3. $\kappa$ - the loan to value ratio limit to which banks can lend - 0.6
- A fourth is not considered here i.e. reserve requirements, $rr$, see Chadha and Corrado (2012).
Real Sector and Monetary-Fiscal Policy Rules

Phillips Curve:

\[ \hat{\pi}_t = \beta \hat{\pi}_{t+1} + \eta_w (\hat{\omega}_t + \hat{X}_\psi,t) - \eta_a A_t + \eta_y \hat{Y}_t \]

where \( \eta_w = \frac{1}{\varrho} \), \( \eta_a = \frac{1}{\varrho \gamma} \), \( \eta_y = \frac{1-\gamma}{\varrho \gamma} \).

Aggregate Supply:

\[ \hat{Y}_t = \vartheta_{ya} A_t - \vartheta_{yc} \left[ \hat{C}_{t+1} + \hat{\pi}_{t+1} \right] \]

where \( \vartheta_{ya} = \frac{1+\zeta}{1+\zeta-\gamma} \) and \( \vartheta_{yc} = \frac{\gamma}{1+\zeta-\gamma} \).

Monetary Policy:

\[ \hat{R}^M_t = \rho \hat{R}^M_{t-1} + (1-\rho) [\alpha_\pi E_t \hat{\pi}_t + \alpha_y \hat{Y}_t] + \zeta_t \]

Fiscal Policy:

\[ \frac{B}{Y} \hat{B}_t = \frac{B}{Y} R^B \left( \hat{R}^B_{t-1} + \hat{B}_{t-1} - \hat{\pi}_t \right) + \frac{G}{Y} \hat{G}_t - \frac{T}{Y} \hat{T}_t - \frac{m}{Y} (\Delta \hat{m}_t + \hat{\pi}_t) \]
Welfare Criterion

Welfare function:

\[ U_t = \frac{C}{Y} (\log C_t + \chi B \log B_t) + \frac{C^b}{Y} \left( \log C^b_t + \chi \log H_t - \frac{N_t^{1+\zeta}}{1+\zeta} \right) + \frac{G}{Y} (\log G_t) \]

Second-order Taylor series expansion of \( U_t \) around steady-state \((C_t, C^b_t, H_t)\):

\[ (U_t - U) \approx \frac{1}{2} \begin{bmatrix} \left( 1 - \frac{1+\zeta}{1-\gamma} \right) \hat{Y}_t^2 - \left( \frac{C}{Y} \hat{C}^2_t + \frac{C^b}{Y} (\hat{C}^b_t)^2 + \frac{G}{Y} \hat{G}^2_t \right) \\ - \frac{C}{Y} \chi B \hat{B}^2_t - \frac{C^b}{Y} \chi \hat{H}^2_t - \frac{\psi}{\eta} \hat{\pi}^2 \end{bmatrix} + t.i.p. + O \left( ||a||^3 \right) \]

\[ E_0 \sum_{t=0}^{\infty} \beta^t (U_t - U) = - \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \left( \varphi_{Y} \sigma_Y^2 + \varphi_{C} \sigma_C^2 + \varphi_{C^b} \sigma_{C^b}^2 + \varphi_{G} \sigma_G^2 \right) + \varphi_{B} \sigma_B^2 + \varphi_{H} \sigma_H^2 + \varphi_{\pi} \sigma_{\pi}^2 + t.i.p. + O \left( ||a||^3 \right) \]
Solution Technique

\[ A E_t y_{t+1} = B y_t + C \varepsilon_t \quad \forall t \geq 0, \quad \text{(dynamic system)} \]

\[ y_t = \Pi s_t \quad \text{(state space form)} \]

\[ s_t = M s_{t-1} + G e_t, \]

\[ E_t y_{t+k} - E_{t-1} y_{t+k} = \Pi (E_t s_{t+k} - E_{t-1} s_{t+k}) = M^k G e_t. \quad \text{(Impulse Responses)} \]

\[ \text{vec} (V_{ss}) = (I - M \otimes M)^{-1} \text{vec} \left( G V_{ee} G^T \right). \quad \text{(Variances)} \]

\[ L = \phi_Y \sigma_Y^2 + \phi_C \sigma_C^2 + \phi_{Cb} \sigma_{Cb}^2 + \phi_G \sigma_G^2 + \phi_B \sigma_B^2 + \phi_H \sigma_H^2 + \phi_{\pi} \sigma_{\pi}^2 \quad \text{(Loss function)} \]
• creditors and savers are negatively correlated but average consumption is closely tied to house prices
unbundled Supply Shock - borrowers increase consumption now but pay back later...
unbundled demand shock - under lax regime is amplified
classical monetary policy shock - attenuated by offsetting sectors
- temporary impact on output growth but not permanent impact on level so subsequent negative adjustment
Cost Push

- may want relaxed MPIs in case of cost-push shocks
small output response.
## Model Moments

### Table 4. Moments

<table>
<thead>
<tr>
<th>Benchmark Policy</th>
<th>Rel stdev (Y)</th>
<th>Corr (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C^*$</td>
<td>1.18</td>
<td>0.99</td>
</tr>
<tr>
<td>$C$</td>
<td>2.50</td>
<td>-0.61</td>
</tr>
<tr>
<td>$C^b$</td>
<td>3.81</td>
<td>0.90</td>
</tr>
<tr>
<td>$G$</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>$l$</td>
<td>1.91</td>
<td>0.40</td>
</tr>
<tr>
<td>$R^L$</td>
<td>0.71</td>
<td>0.43</td>
</tr>
<tr>
<td>$R^M, R^D$</td>
<td>0.59</td>
<td>0.24</td>
</tr>
<tr>
<td>$EFP$</td>
<td>0.69</td>
<td>0.24</td>
</tr>
<tr>
<td>$q$</td>
<td>2.05</td>
<td>0.45</td>
</tr>
<tr>
<td>$\pi$</td>
<td>1.16</td>
<td>0.01</td>
</tr>
</tbody>
</table>

- All shocks and standard calibration. Note procyclical EFP. High volatility of households consumption cf aggregate.
Table 5. Optimal Policy Parameters

<table>
<thead>
<tr>
<th>Default Rate</th>
<th>Optimal Policy Parameters</th>
<th>( f_y )</th>
<th>( f_T )</th>
<th>( f_m )</th>
<th>( \alpha_q )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \lambda = 1 )</td>
<td>Fiscal Policy</td>
<td>(-1.02)</td>
<td>(1.03)</td>
<td>(0.10)</td>
<td>(-)</td>
</tr>
<tr>
<td></td>
<td>Monetary Policy</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0.1)</td>
</tr>
<tr>
<td>( \lambda = 5 )</td>
<td>Fiscal Policy</td>
<td>(-1.06)</td>
<td>(1.27)</td>
<td>(0.10)</td>
<td>(-)</td>
</tr>
<tr>
<td></td>
<td>Monetary Policy</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0.3)</td>
</tr>
</tbody>
</table>

Higher perception of default imply more active fiscal policy (more countercyclical) and a greater role for monetary policy to offset house prices (collateral).
## Table 6. Welfare Losses

<table>
<thead>
<tr>
<th>Regime</th>
<th>Loss</th>
<th>Benchmark Policy</th>
<th>Monetary Policy</th>
<th>Fiscal Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lax Regime</td>
<td>$\lambda = 1$, $\delta = 0.9$, $\kappa = 0.9$</td>
<td>0.0628</td>
<td>0.0586</td>
<td>0.0631</td>
</tr>
<tr>
<td>Restrictive Regime</td>
<td>$\lambda = 5$, $\delta = 0.2$, $\kappa = 0.4$</td>
<td>0.0531</td>
<td>0.0529</td>
<td>0.0543</td>
</tr>
</tbody>
</table>

- A given monetary-fiscal nexus leads to lower losses under more restrictive MPIs.
Main Results

- When we split up consumption into saver and borrower households - we clearly locate consumption cycles
- Borrowers use houses as collateral and are able to smooth shocks and experience similar levels of volatility as savers
- Savers observe standard Euler equations but also face spillovers as they fund borrower demand
- The bank perception of risk, increases consumption variance, as the EFP becomes more sensitive to the loans function
- When banks do not price risk, welfare can be enhanced by more active fiscal policy
- Monetary policy can stabilise inflation (price of money) but fiscal policy has a role in pricking excessive bank lending (quantities)
- In general MPIs seem to lead to a more efficient outcome in terms of volatility frontier.


