Money, Credit and Equilibrium Imperfectly Competitive Banking

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https://github.com/phantomachine/BJBANKS

Facts: Imperfect Competition in Banking

- For example, U.S.:
  - High profit margins: Markups (90%)
  - Imperfect interest-rate pass through: Rosse-Panzar H-statistic[1] (50%)
- Market share of top-3 banks: Portugal (89%), Germany (78%), the United Kingdom (58%), Korea (1998-2006: 80%-100%, post 2007: 50%), Japan (44%), United States (35%)
- Data source:
  - FDIC, Call Reports, U.S. Commercial Banks, 1984-2010
  - Bankscope
  - (Corbae and D'Erasmo, 2015; Corbae and D'Erasmo, 2018)

[1] Sum of the elasticities of a bank's total revenue with respect to that bank's input prices

Monetary Policy and Regulator Concerns

- Rod Sims (Chair of ACCC), *Committee Hansard*, 2016-10-14:

  There seems a lack of very robust competition in banking . . .

- Australian Productivity Commission Inquiry (No.89, 2018-06-29):

  [I]t is the way market participants gain, maintain and use their market power that may lead to poor consumer outcomes. . . . Reforms that alter incentives of ... banks, ... aimed directly at bolstering consumer power in markets, and reforms to the governance of the financial system, should be the prime focus of policy action.

- Carolyn Wilkins (Asst. Gov. BoC), *Why Do Central Banks Care About Market Power?*, G7 Conference at Banque du France (2019-04-08):

  Still-unanswered questions for central banks about implications for people, inflation dynamics, and monetary policy transmission.

What We Do

An equilibrium model of money and credit with endogenous market power in lending.

In this environment we ask:

How does imperfect competition among lenders affect

- the level and distribution of loan rates,
- the pass-through of bank costs to loan rates,
- the welfare effects of banking, and
- the design of cyclical policy in response to aggregate demand fluctuations?

What We Find I

1. U.S. Empirical Evidence / Model Validation ...

   Model fitted to macro-data on money demand and average markups

   - Predicts positive (negative) correlation between average markups and s.d. (c.v.) of loan rate markups.

   Micro and macro evidence:

   - state level data, controlling for fixed effects
   - national level data

What We Find II

2. Pass through ...

   For low inflation range, cutting inflation target leads to:

   - decreased dispersion of lending rates
   - increased average mark-up
   - less lending
   - Higher-then-lower bank expected profits

   For high inflation range, increasing inflation reduces the real values of loans and profits diminish along with welfare.

What We Find III

3. Essentiality (welfare-enhancing role) of banks ...

   The presence of banking may lower welfare:

   - Effect is worst at low inflation (away from the Friedman rule)
   - Also worse when aggregate demand is high

Benefit of banking:
Deposits interest on ex-post idle cash (insurance role)

$\updownarrow$

Costs:
Extraction of consumer surplus (lender market power)

What We Find IV

Low inflation ...

- Banks exploit more *intensive margin* markup channel
- This destroys welfare-gain from intermediation role of banks.

Higher inflation ...

- Equilibrium loan price dispersion rises
- Banks trade-off markup incentives (Intensive Margin) for making more loans (Extensive Margin) $\Rightarrow$ loan market more competitive

What We Find V

4. Optimal elastic-currency, demand stabilization policies:
   Given a long-run inflation target
   - When aggregate demand “heats up” ...
   - inject state-dependent liquidity (repo agreement)
   - Policy is beneficial not because it counters inefficient deposit rate movements as in Berentsen and C. J. Waller (2011), but because of its effects on the distribution of markups
   - Policy (needs to be) non-monotone in demand states — internalize IM-vs-EM trade-off of endogenously incompetitive banks!

Empirical Evidence

Empirical Evidence

Measurements

Bank-branch-level (b) markup over Fed Funds rate:

$$Markup_{b,i,c,s,t} = (Rate_{b,i,c,s,t} - FF_t)/(1 + FF_t)$$

- i commercial bank owning branch
- c county location of branch
- s state
- t day RateWatch reports branch rate information

Two *markup dispersion* definitions:

- Std Deviation of branch markups from state s in month t. (Also aggregate nationally.)
- Coefficient of variation (Std/Mean)

Empirical Evidence

Identification I – Local confounding factors

Branch level loan rate pricing behavior could also depend on *local* factors:

- socio-economic
- deposit market competition
- bank branch networks
- bank's characteristics

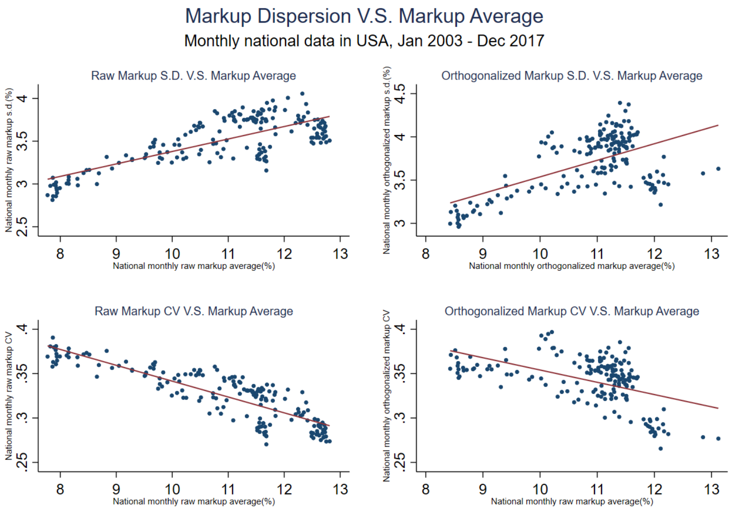
Orthogonalize the branch level markup on those potential factors:

$$Markup_{b,i,c,s,t} = a_0 + a_1 \underbrace{X_{b,i,c,s,t}}_{\text{Branch controls}} + a_2 \underbrace{X_{i,t}}_{\text{Owner-entity controls}} + a_3 \underbrace{X_{c,s,t}}_{\text{County controls}} + \underbrace{\epsilon_{b,i,c,s,t}}_{\text{Residual m/up}}$$

Residual markup is standardized to eliminate scale effects.

Empirical Evidence

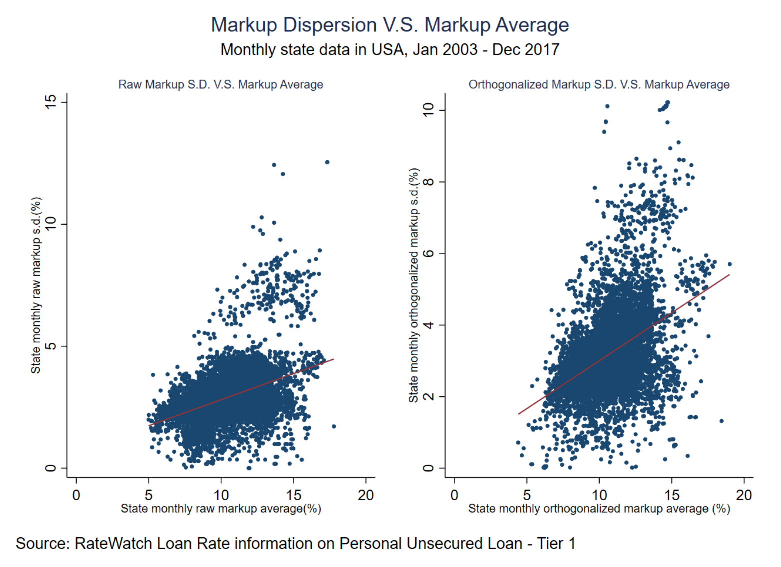
National level



Source: RateWatch Loan Rate information on Personal Unsecured Loan - Tier 1

Empirical Evidence

State level



Empirical Evidence

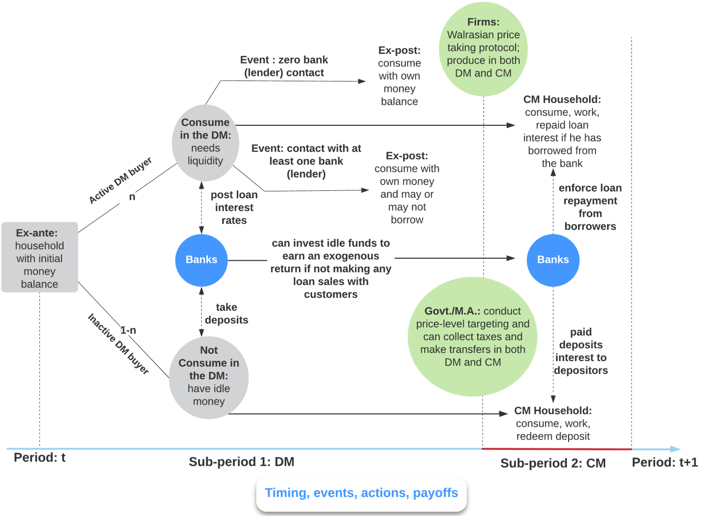
Intermezzo

- Micro (state-level) and macro/national-level evidence of corr$(M/up, SD) > 0$.
- Also, some strong (weaker) national-level (state-level) evidence of corr$(M/up, CV) < 0$.
- What might be a causal mechanism?
- We develop an equilibrium theory of banking and market power that rationalizes both pieces of (U.S.) empirical regularity.

Panel regressions

Model

Overview



Lagos and Wright (2005), Berentsen, Camera, and Waller (2007), Burdett and Judd (1983)

Model: Households I

Second Market (CM)

Household's valuation of initial money balance (plus transfers) $m + \tau_2 M$, credit debt l, and deposit holding d, is

$$W(m + \tau_2 M, l, d) = \max_{x,h,m_{+1}} \left[U(x) - h + \beta V(m_{+1}) \right]$$

subject to

$$x + \phi m_{+1} = wh + \phi(m + \tau_2 M) + \phi(1 + i_d) d - \phi(1 + i) l + \Pi$$

Model: Households II

First Market (DM)

$$V(m) = n\Bigg\{\underbrace{\alpha_0 B^0(m)}_{\text{No bank}}$$

$$+\underbrace{\alpha_1 \int B(m;i)\,\mathsf{d}F(i) + \alpha_2 \int B(m;i)\,\mathsf{d}\left[1-(1-F(i))^2\right]}_{\text{At least 1 bank}}\Bigg\}$$

$$+(1-n)W(m+\tau_s M - d, 0, d)$$

where

$$B(m;i) = \max_{q_b, l \in [0,\infty]} \{u(q_b) + W(m+\tau_b M + l - pq_b, l, 0) : pq_b \leq m + l + \tau_b M\},$$

and,

$$B^0(m) = \max_{q_b} \left[u(q_b) + W(m+\tau_b M - pq_b, 0, 0) : pq_b \leq m + \tau_b M\right]$$

Firms

- Second market (CM):
  - Firms are perfectly competitive
  - linear production with labor
  - Profit-max strategy: $w = 1$
- First market (DM):

$$S(m) = \max_{q_s} \left\{ -c(q_s) + W(m + \tau_s M + pq_s, 0, 0) \right\}.$$

  - Walrasian price taking (variation: bargaining)
  - Cost of producing $q_s \mapsto c(q_s)$
  - Cost-min strategy: $c'(q_s) = \phi p (\equiv 1)$

Banks I

Split the banking system into two parts ...

Depository Institutions:

- Take deposits from households and commit to paying interest at rate i_d in the CM
- Lend to both loan agents and (possibly) the foreign capital market
- Perfectly competitive in all aspects

Loan agents:

- Acquire funds from depository institutions and/or the foreign capital market
- Post within-period "consumer loan" rates and match randomly with households
- Supply loans to meet demand
- Can enforce repayment of loans in the CM

Banks II

Loan agents ("banks")

- Ex-ante profit from posting loan price i:

$$\Pi(i) = n\left[\alpha_1 + 2\alpha_2(1 - F(i)) + \alpha_2\zeta(i)\right]R(i) \tag{1}$$

where

$$\zeta(i) = \lim_{\varepsilon \searrow 0}\left\{F(p) - F(p - \varepsilon)\right\} \tag{2}$$

$$R(i) = l^{\star}(m; i, p, M, \gamma)\left[(1 + i) - \left(1 + i^{d}\right)\right] \tag{3}$$

  - $n\alpha_2\zeta(i)$ is the measure of consumers contacting bank, when consumers also face the same price i from another bank
    - Customers randomize between them
    - In equilibrium probability two banks set same price is zero

Banks III

We can prove that:

1. Bank's faced with noisy-search loan customers earn maximal expected profit equal to monopolist's profit
2. Each bank (pricing at some $i \sim F$) trades off
   - intensive-margin profit $R(i)$

     — against —

   - extensive-margin loss: probability of agents showing up ("queue length") $\alpha_1 + 2\alpha_2(1 - F(i))$
3. All earn the same expected profit
4. If $\alpha_1 \in (0,1)$, there is a unique non-degenerate, posted-loan-rate distribution F. This distribution is continuous with connected support:

$$F(i) = 1 - \frac{\alpha_1}{2\alpha_2}\left[\frac{R\left(\bar{i}\right)}{R\left(i\right)} - 1\right],$$

   where $\text{supp}\left(F\right) = \left[\underline{i}, \bar{i}\right]$
5. As $\alpha_1 \to 0$, lending becomes competitive (Bertrand limiting case): $\max\{i\} \to i_d$ (BCW!)
   As $\alpha_1 \to 1$, lending becomes monopolistic: $\min\{i\} \to i^m$

SME

SME: Households I

Household optimizes

Assume $\sigma < 1$. Work with stationary variables:

- $\rho := \phi p$
- $z := \phi m$
- $Z := \phi M$
- $\xi := \phi l$

Then we have the ordering $0 < \tilde{\rho}_i < \hat{\rho}$ and $0 < \hat{i}$:

- Relative price above which DM liquidity not exhausted:
  $\hat{\rho} := \hat{\rho}(z; Z, \gamma) = [z + \tau_b Z]^{\frac{\sigma}{\sigma-1}}$
- Relative price below which DM liquidity binds with borrowing top-up:
  $\tilde{\rho}_i := \hat{\rho}\,(1+i)^{\frac{1}{\sigma-1}}$
- Bank-lending rate below which there is borrowing:
  $\hat{i} = \rho^{\sigma-1}\,[z + \tau_b Z]^{-\sigma} - 1 > 0$

SME: Households II

Household optimizes

… and optimal DM loan demand is:

$$\xi^{\star}\left(z; i, \rho, Z, \gamma\right) = \begin{cases} \rho^{\frac{\sigma-1}{\sigma}}\left(1+i\right)^{-\frac{1}{\sigma}} - \left(z + \tau_b Z\right) & 0 < \rho \leq \tilde{\rho}_i \text{ and } 0 \leq i < \hat{i} \\ 0 & \tilde{\rho}_i < \rho < \hat{\rho} \text{ and } i \geq \hat{i} \\ 0 & \rho \geq \hat{\rho} \text{ and } i \geq \hat{i} \end{cases} \tag{4}$$

SME: Households III

Household optimizes

There is an equilibrium upper and lower bound on the support of the equilibrium loan interest-rate distribution F:

- $\bar{i} := \min\left\{i^m, \hat{i}\right\}$
- $\underline{i} > \gamma/\beta - 1$

where

- i^m is a well-defined monopoly price
- $\underline{i} < \bar{i} \leq i^m$

SME: Households IV

Household optimizes

Perfect Competition (BCW):

$$\underbrace{\frac{\gamma-\beta}{\beta}}_{\text{MC of extra dollar}} = \underbrace{(1-n)i_d}_{\text{[A]: MB, idle funds}} + \underbrace{ni}_{\text{[B]: MB, less borrowing, PC } (i\nwarrow i_d)} \equiv i \tag{5}$$

No-bank, self-insurance (BCW, us):

$$\underbrace{\frac{\gamma-\beta}{\beta}}_{\text{MC of extra dollar}} = \underbrace{n[u'(q_b)-1]}_{\text{[C]: MB, liquidity premium}} \tag{6}$$

Perfect-competition banking

If money yields lower return than other risk-free assets (not at Friedman rule) ...

BCW: Banks always improve on allocations/trade and thus welfare.

SME: Households V

Household optimizes

Our setting, non-degenerate F: Consider equilibria with positive *ex-post* loans demand and *ex-ante* money demand ($\alpha_0 \neq 0$) ...

Optimal money demand satisfies Euler functional equation:

$$1 = \underbrace{\frac{\alpha_0 \left(u^{'}[q_b^0(z)] - 1 \right)}{i_d}}_{\text{Ex-ante self-insurance}}$$

$$+ \underbrace{\int_{\underline{i}(z)}^{\bar{i}(z)} \mathbb{I}_{\{0 \leq \rho < \tilde{\rho}_i\}} \underbrace{\left[\alpha_1 + 2\alpha_2 \left(1 - F\left(i; z, \gamma \right) \right) \right]}_{\text{Extensive margin}} \underbrace{\left(\frac{i}{i_d} \right)}_{\text{Intensive margin}} \mathrm{d}F(i; z, \gamma).}_{\text{Ex-ante markup}} \tag{7}$$

SME: Banks

Banks optimize

Distribution of loan rates F:

$$F\left(i; z, \rho, Z, \gamma\right) = 1 - \frac{\alpha_1}{2\alpha_2}\left[\frac{R\left(i^m\right)}{R\left(i\right)} - 1\right], \tag{8}$$

- $\text{supp}\left(F\right) = \left[i_{\min}, i_{\max}\right]$
- given monopoly price i^m and max. willing to pay $\hat{i}$, $i_{\min}$ solves:

$$R\left(i_{\min}\right) = \frac{\alpha_1}{\alpha_1 + 2\alpha_2} R\left(i_{\max}\right) \tag{9}$$

where

$$R\left(i\right) \equiv R\left(i; z, \rho, Z, \gamma\right) = \left[\rho^{\frac{\sigma-1}{\sigma}}\left(1+i\right)^{-\frac{1}{\sigma}} - \left(z + \tau_b Z\right)\right]\left(i - i^d\right) \tag{10}$$

is (real) bank profit per customer served

SME: Firms and Markets

Firms optimize, goods markets clear, loans feasible

DM sellers optimize and the Walrasian price-taking DM market clears:

$$
\begin{aligned}
q_s(z, Z, \gamma) &\equiv c'^{-1}(\rho) \\
&= n\alpha_0 q_b^{0,\star}(z; \rho, Z, \gamma) \\
&+ n\left[\int_{\underline{i}}^{\bar{i}} [\alpha_1 + 2\alpha_2 - 2\alpha_2 F(i)]\, q_b^{\star}(z; \rho, Z, \gamma)\, \mathsf{d}F(i)\right]
\end{aligned} \tag{11}
$$

(CM also clear ...)

Total deposits weakly exceed total loans:

$$
\begin{aligned}
(1-n)\delta^{\star}(z, Z, \gamma) \equiv (1-n)\left(\frac{z + \tau_b Z}{\rho}\right) \\
\geq n\left\{\int_{i_{\underline{i}}}^{\bar{i}} [\alpha_1 + 2\alpha_2 - 2\alpha_2 F(i)]\, \xi^{\star}(z; i, \rho, Z, \gamma)\, \mathsf{d}F(i)\right\}
\end{aligned} \tag{12}
$$

Unique SME w/ Money and Banking

Proposition

Assume loan contracts are perfectly enforceable. If $\gamma > \beta$, $0 < z^\star < \left(\frac{1}{1+\bar{i}(z^\star)}\right)^{\frac{1}{\sigma}}$, and n satisfies an endogenous lower bound such that $n \geq N(z^\star) \in [0,1]$ and $z^\star$, then there exists a unique SME with co-existing money and credit.

SME: Market Power and Inflation Targeting

Lemma

In an SME, $F(z')$ stochastically dominates $F(z)$, for $z' < z$.

Proposition

For high-enough long-run inflation target τ (or γ) ...

- Real money demand z falls.
- Stochastic dominance result $\Rightarrow$ agent-z more likely to draw lower ex-post markups.
- Banks tend to care more about customers showing up, mark up less (i.e., tends toward Bertrand competition).

Proposition

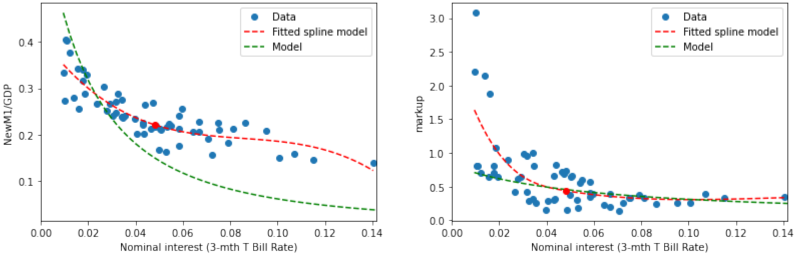
Under regularity conditions—equilibrium support not too wide and min loan rate not too high above cost of funds—equilibrium *average markup falls with inflation*.

Empirical Validation

Statistical calibration

Some parameter can be externally calibrated from long run data statistics.

Method of Simulated Moments (min. weighted L^2-norm):



to pin down preference (B, σ_{DM}) and BJ contact rates (α_0, α_1).

Data: Lucas-Nicolini New M1 series;
Bank Prime Loan Rate/3 month TB rate

External validity

$X \in \{\text{Markups SD}, \text{ Markups CV}\}$

Table: corr(X, Average Markup)

Data	$X = SD$	$X = CV$
State, raw	0.40	-0.15
State, orthogonalized	0.41	-0.05
National, raw	0.75	-0.86
National, orthogonalized	0.51	-0.58
Model	0.98	-0.99

- Personal unsecured loan (Tier 1) rates (RateWatch, USA)
- National level statistics for dispersion vs average (percentage) markups
- Raw data and residualized (orthogonalized) markups

Comparative Steady States

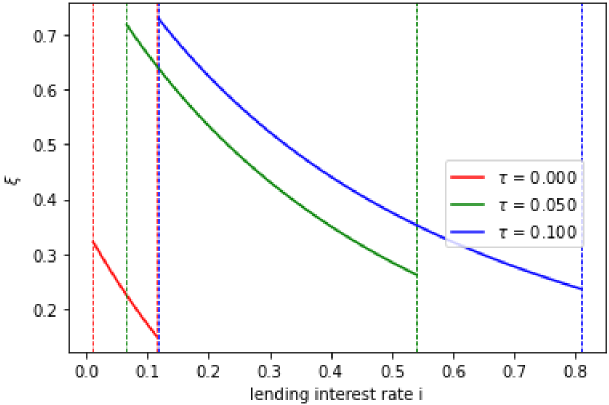
Comparative Steady States

- Consider a set of economies, each distinguished by their long-run inflation rates, τ
- Questions to ask:
  - Inflation tax and demand for loans
  - Inflation tax and bank profits: intensive vs. extensive margins
  - When are banks essential?

c.f., Berentsen, Camera, and Waller (2007)

Comparative Steady States

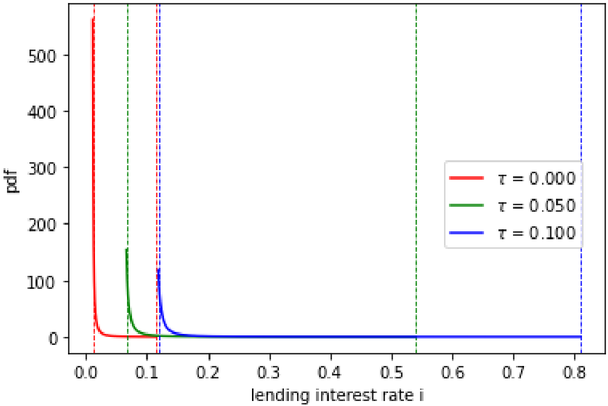
DM demand (credit line): partial equilibrium thinking



- Higher inflation τ, support of $F \sim i$ shifts right
- Also z falls with higher τ
- Loan demand $\xi^{\star}(z, \cdot; \tau)$ shifts right: Self-insurance by holding money more costly

Comparative Steady States

Lending rates

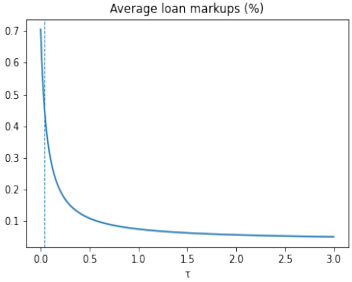


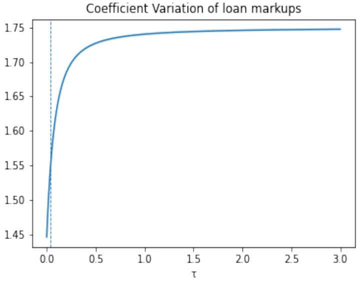
- $F(i, \tau')$ FOSD $F(i, \tau)$, $\tau' > \tau$
- Mass shifts rightward:

  Tension between markup (intensive margin) and potential loss of loan customers (extensive margin)

Comparative Steady States

Markups





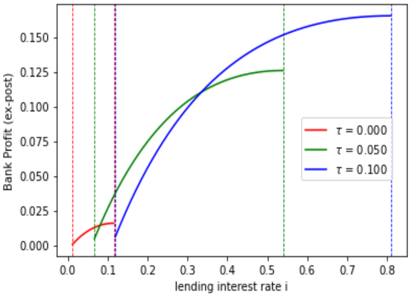
Tension resolves:

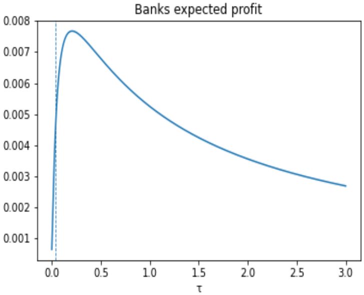
- the equilibrium support of $F \sim i$ shifts right, and is wider
- the probability mass shift to the tails of F

- At low enough τ banks tend to exploit the intensive (markup) channel
- At high enough τ extensive margin dominates

Comparative Steady States

DM banks' intensive vs. extensive profit

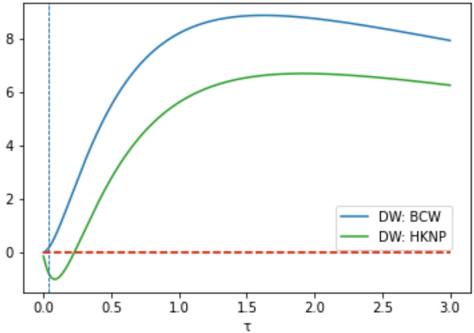




- Higher inflation τ, marginal cost $i_d \equiv (1+\tau)/\beta$ higher
- Eventually erodes expected profit as competition (via extensive margin) drives $\bar{i} \searrow i_d$.

Comparative Steady States

Welfare difference: Banks vs. no banks



- Low τ: Banks exploit more *intensive margin* markup channel
- High τ: Equilibrium loan price dispersion rises, loan quantity *extensive margin* dominates, loan market more competitive, approaching BCW's original insight.

Comparative Steady States

Welfare difference: Discussion

In BCW, banking improves welfare by insuring households against being stuck with unwanted cash in the DM (w.p. $1-n$).

- The higher inflation the better it is (to a point)
- The lower aggregate demand (n), the better it is

Here, the banking system plays the same insurance role as in BCW.

But, borrowing is more expensive here due to *imperfect competition*.

Welfare and Policy Implications

Policy Implications I

Perfectly competititive banking ($\alpha_0 = \alpha_1 = 0$, $\alpha_2 = 1$):

1. Away from the Friedman rule, financial intermediation improves welfare.
2. Due to payment of interest to depositors. Insuring idle funds.

Imperfectly competitive banks $\alpha_1 \in (0, 1]$:

1. Away from the Friedman rule, financial intermediation does not necessarily improve welfare.
2. Expected gain from insurance role lost through price dispersion ($\equiv$ banks extract borrowers' surplus)

Additional redistributive/liquidity policies can improve welfare towards Berentsen, Camera, and Waller (2007) ideal

Optimal Stabilization Policy I

Active vs. Passive: n aggregate demand shock

Berentsen and C. J. Waller (2011): In BCW, a temporary aggregate demand reduction (n) causes:

- deposits to rise and DM consumption/output to fall
- the deposit rate (equal to their loan rate) to fall as well

This is bad, because it diminishes the insurance the banking system can provide:

> Insurance (via bank deposits) has a low return precisely when households expect to need it.

Welfare can be improved by:

- Committing to an inflation target (really a price path)
- Injecting money in the DM when deposits are low (high n) and (if possible) removing it when deposits are high (low n)

Optimal Stabilization Policy II

Active vs. Passive: n aggregate demand shock

Here, we deliberately turn off BW's mechanism by having $i_d = \tau/\beta - 1$ constant and equivalent to BCW/BW's benchmark.

But, a similar policy can improve welfare. In our case, the optimal policy affects banks' markups and takes into account markup endogeneity:

- Commitment to state-contingent transfers in the DM $\tau_1(\omega)$.
- $\omega = \{\epsilon, n\}$ is an aggregate random variable.
- Only transfers are permitted in the DM: $\tau_1(\omega) \geq 0$ for all ω. (Anonymity; not incentive compatible.)
- State-contingent injections of liquidity in the DM followed by transfers/taxes in the CM (repo):

  $$\tau_2(\omega) = -\tau_1(\omega), \text{for all } \omega$$

  so that $\tau = M_{+1}/M = \phi/\phi_{+1}$ (price-level target is met in the long run).
- A stationary equilibrium with i.i.d. aggregate demand shocks, with five states $\{n_1 < \cdots < n_5\}$.

Optimal Stabilization Policy III

Active vs. Passive: n aggregate demand shock

Active central bank

$$\max_{\{q_b^0(\omega),\ q_b^1(\omega),\tau_b(\omega)\}_{\omega\in\Omega}} U\left(x\right) - x - c(q_s)$$
$$+ \int_{\omega\in\Omega} n\alpha_0 \epsilon u\left[q_b^0\left(z;\rho,Z,\gamma,\tau_b,\omega\right)\right]\psi\left(\omega\right)\mathsf{d}\omega$$
$$+ \int_{\omega\in\Omega} n \int_{\underline{i}}^{\bar{i}} \left[\alpha_1 + 2\alpha_2\left(1 - F\left(i;z,\gamma,\tau_b,\omega\right)\right)\right]$$
$$\times\, \epsilon u\left[q_b^1\left(z;i,\rho,Z,\gamma,\tau_b,\omega\right)\right]\mathsf{d}F\left(i\right)\psi\left(\omega\right)\mathsf{d}\omega$$

subject to:

- optimal money demand (Euler condition) $\hookrightarrow z^{\star}(\tau)$
- credit search and bank profit max $\hookrightarrow F(\cdot,\tau,\omega)$
- goods markets clearing $\hookrightarrow x^{\star}, (q^0, q^1)(z^{\star}(\tau),\omega)$
- Aggregate loan feasibility
- Policy commitment: $\frac{\gamma-\beta}{\beta} = \tau + \tau_1(\omega) + \tau_2(\omega)$ and $\tau_1(\omega) = -\tau_2(\omega)$

Optimal Stabilization Policy IV

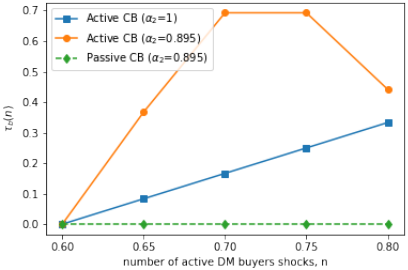
Active vs. Passive: n aggregate demand shock

Passive central bank

- Policy constrained by $\tau_1(\omega) = \tau_2(\omega) = 0$ for all ω.
- The outcomes will be very similar to our deterministic, baseline SME.

Optimal Stabilization Policy V

Active vs. Passive: n aggregate demand shock



Passive policy sets $\tau_1(n)$ for all n.

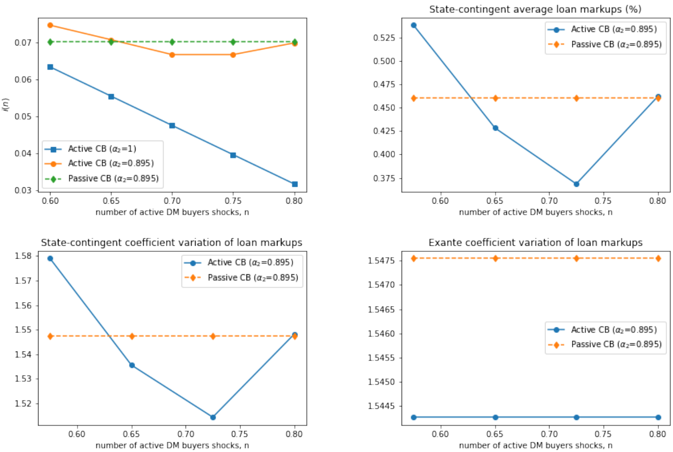
- $\alpha_2 = 1$ here is the perfect-competition BCW case (we allow the deposit rate to vary)

Optimal active: More transfers in high-demand state (relative to passive policy)

- when $\alpha_2 = 1$, policy to offset deposit rate movements
- when $\alpha_2 < 1$, policy to rectify/modify markup behaviors

Optimal Stabilization Policy VI

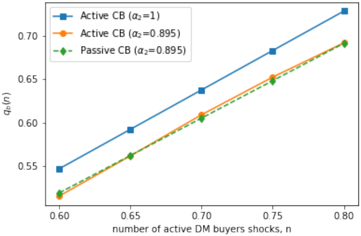
Active vs. Passive: n aggregate demand shock

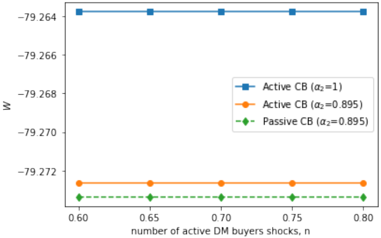


- Higher $\tau_1(n)$ lowers real balances, inducing higher dispersion, but
- higher $\tau_1(n)$ directly lowers both dispersion and the average markup by reducing the monopoly rate.

Optimal Stabilization Policy VII

Active vs. Passive: n aggregate demand shock





This induces more (less) consumption and loans in state with more (less) active buyers, relative to passive policy regime.

Thus active "demand-side stabilization policy" through liquidity provision results in higher ex-ante welfare for agents.

Punchline I

Pass-through and welfare

With information frictions, banks can be shown to be essential under perfect competition (Berentsen, Camera, and Waller, 2007).

When market power of banks is endogenous to policy:

1. equilibrium imperfect competition renders an otherwise *essential* banking system detrimental, when
   - trend inflation is low, or
   - aggregate demand is high

   This will occur when the reduction in real balances (lower surplus share in monetary trades due to market power of lenders) outstrips the need for insurance.
2. Pass-through of monetary policy (cost of funds variation) to lending interest rates
   - positive relationship between the average markup and the dispersion of lending interest rates

Punchline II

Optimal stabilization policy

Given a commitment to long-run trend inflation ...

There is a role for stabilization policy, but it must internalize endogenous response of banking market power to policy:

Relative to passive policy, the optimal policy tolerates higher markups (and dispersion) when demand is low, and lowers them when it is high.

References I

Berentsen, Aleksander, Gabriele Camera, and Waller (2007). "Money, credit and banking". In: *Journal of Economic Theory* 135.1, pp. 171–195.

Berentsen, Aleksander and Christopher J. Waller (2011). "Price-Level Targeting and Stabilization Policy". In: *Journal of Money, Credit and Banking* 43.s2, pp. 559–580.

Burdett, Kenneth and Kenneth L. Judd (1983). "Equilibrium Price Dispersion". In: *Econometrica* 51.4, pp. 955–969.

Corbae, Dean and Pablo D'Erasmo (2015). "Discussion of "Large Banks, Loan Rate Markup, and Monetary Policy"". In: *International Journal of Central Banking* June, pp. 1–14.

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Empirical Evidence

Identification II – Macro confounders

OLS:

- markup dispersions on average markups
- controlling for state fixed effects and time fixed effects

Focus on estimator of b_0 in the following specification

$$Dispersion_t = b_0 + b_1 \overline{Markup}_t + \epsilon_t$$

We cluster the standard errors by

- s: state
- t: month

Empirical Evidence

Result – State Level

Table: OLS: State markup S.D. and average markup, Jan-2003 to Dec-2017.

	Markup dispersion: $Dispersion_{s,t}$					
	Raw markup			Orthogonalized markup		
	(1)	(2)	(3)	(4)	(5)	(6)
	State FE	Time FE	Both FE	State FE	Time FE	Both FE
$\overline{Markup}_{s,t}$	0.179^{***}	0.290^{***}	0.353^{***}	0.220^{***}	0.304^{***}	0.286^{***}
	(6.06)	(3.08)	(4.56)	(3.99)	(3.86)	(3.42)
State fixed effects	X		X	X		X
Time fixed effects		X	X		X	X
N	8237	8237	8237	7463	7463	7463
adj. R^2	0.618	0.178	0.646	0.538	0.203	0.577

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Return

Empirical Evidence

Result – National Level

Table: Regression for markup dispersion at national level

	Markup dispersion: $Dispersion_t$			
	Raw Markup		Orthogonalized markup	
	(1)	(2)	(3)	(4)
	SD_t	CV_t	SD_t	CV_t
$\overline{Markup}_t$	0.146^{***}	-0.018^{***}	0.192^{***}	-0.014^{***}
	(41.56)	(-56.61)	(18.70)	(-17.31)
Constant	1.924^{***}	0.520^{***}	1.621^{***}	0.492^{***}
	(49.09)	(136.80)	(14.57)	(55.55)
N	180	180	180	180
adj. R^2	0.554	0.733	0.333	0.259

Note: $^{*}\ p < 0.1$; $^{**}\ p < 0.05$; $^{***}\ p < 0.01$

Return