State Dependent Effects of Monetary Policy: The Refinancing Channel

Martin Eichenbaum, Sergio Rebelo, and Arlene Wong

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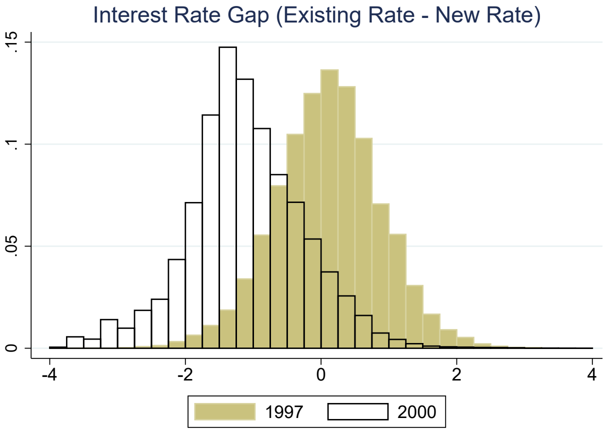
Document state dependent effects of monetary policy

- Context:
  - In the U.S., most mortgages have fixed rates.
  - Refi decision depends on potential interest savings vs. costs.
- Empirically show:
  - Refinancing and housing permit response to a given interest rate cut is larger when potential savings are higher.
  - Distribution of rate gap and potential savings varies over time.
- Develop a quantitative model that capture empirical findings:
  - Study decline in refi costs, motivated by Fintech lenders.

Data

- Core Logic Loan-Level data from 1995 to 2007.
- Consider two measures of potential interest savings:
  1. Simple interest rate gap relative to current mortgage rate;
  2. Present value of potential interest savings;
- In general, not sufficient statistics. But highly correlated with refinancing, and direct moments computed in model and data.
- Contribution of this paper: document state-dependent effects related to the distribution of potential interest savings.

Distribution of interest rate gaps in 1997 and 2000



State dependent effects of monetary policy

For county c in quarter t, we estimate

$$\rho_{c,t+4} = \beta_0 + \beta_1 \Delta R_t^M + \beta_2 \Delta R_t^M \times \psi_{c,t-1} + \beta_3 \psi_{c,t-1} + \eta_{ct}.$$

where $\psi_{c,t-1}$ is a moment of distribution (e.g. average rate gap).

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Potential challenges to identification:

- Potential shocks and unobservable variables affecting both refinancing propensities and mortgage rates.
- IV with high frequency data on Federal Funds futures and Treasury yields, and its interactions with $\psi_{c,t-1}$.
- Used in Kuttner (2001), Rigobon and Sacks (2004), Nakamura and Steinsson (2013), Gorodnichenko and Weber (2015), Gertler and Karadi (2015), etc.

Mortgage rates and monetary policy shocks

$$\triangle \text{Mortgage rate}_{t,t+k} = \alpha_0 + \alpha_1 \epsilon_t + \eta_t$$

Change in mortgage rate	30-year	15-year
	(I)	(II)
Shock based on Fed Funds Futures	0.599**	0.585**
	(0.281)	(0.249)

- Mortgage rates respond to identified shocks.
- F-statistic on first stage estimates exceed 20.

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IV with Fed funds futures shocks, and its interaction with ψ.

Refi over the year	**(I)**	**(II)**	**(III)**
ΔR(t)	0.062***	0.070*	0.083***
	(0.021)	(0.029)	(0.026)
ΔR(t) x Average rate gap	0.389***	0.479***	0.472***
	(0.075)	(0.109)	(0.102)
County Fixed Effects	Yes	Yes	Yes
SPF Controls		Yes	Yes
Additional county controls			Yes

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Average refi rate is 8.5%. Suppose mortgage rates fell by 25bp:

- If rate gap is -14bp (mean), refinancing increases by 0.13ppts ($\beta_1 \times 0.25 + \beta_2 \times 0.25 \times -0.14$).

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Average refi rate is 8.5%. Suppose mortgage rates fell by 25bp:

- If rate gap is -14bp (mean), refinancing increases by 0.13ppts.
- If rate gap is 56bps (mean+1sd), refinancing increases by 6.93ppts ($\beta_1 \times 0.25 + \beta_2 \times 0.25 \times 0.56$).

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- If rate gap is -14bp (mean), refinancing increases by 0.13ppts.
- If rate gap is 56bps (mean+1sd), refinancing increases by 6.93ppts.
- Marginal impact of a 1sd increase in rate gap is 6.8 ppts.

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- Results are robust to including controls, such as SPF expectations and county controls (lender competitiveness, home equity, house price accumulation, unemployment, manufacturing share, average age, share college edu, share ARM, etc).

Real outcomes: building permits

- Permits required for new privately-owned residential buildings. It is a leading economic indicator.
- Monthly county data from Census Building Permits Survey, aggregated to quarterly frequency, from 2000.
- Evidence of state-dependent effects of monetary policy, related to the distribution of existing rate gaps.

State dependent effects: Other moments

- Median savings.
- Average positive savings.
- Fraction of loans with positive savings.
- Fraction of loans above the ADL threshold.

Household model: set-up

1. Life-cycle
2. Idiosyncratic income risk and aggregate shocks
3. Assets: - liquid one-period asset
   - illiquid housing and fixed rate mortgage
4. Fixed cost of adjusting the mortgage and housing
   - F: calibrated to match average refi rate.
5. Borrowing constraints: short-term constraint; mortgage LTV constraint

Value function and budget constraints

$$V(z) = \max\{V(z)^{\text{own \& adjust}}, V(z)^{\text{own \& noadjust}}, V(z)^{\text{rent}}\}$$

where

$$V(z)^k = \max u(c, h^k) + \beta E\left[V(z')\right] \quad s.t.$$

- Own home and adjust loan:
  - balance and mortgage rate can adjust
  - housing owned can adjust
  - pay cost F
- Own home and do not adjust loan
- Rent

State Variables

$$z = \{a, \eta, K, S\}$$

- a, η, K: age, idiosyncratic labor income, and asset holdings.
- K: short-term assets, housing stock, mortgage balance, and existing mortgage rate.
- S: aggregate state $[\log Y, \log(p), \log(r)]$

State Variables

- Aggregate states: $S = [\log Y, \log(p), \log(r)]$

$$S_t = A_0(Z_{t-1}) + A_1(Z_{t-1}) \cdot S_{t-1} + u_t$$

where Z_{t-1} includes S_{t-1} and the distribution of individual states across households.

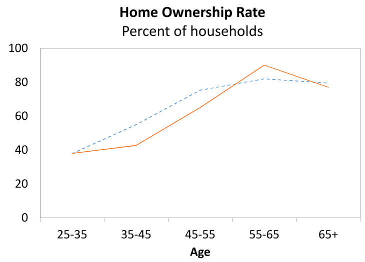
- Approximate the process with

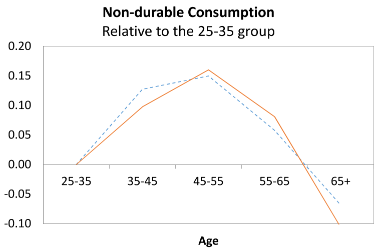
$$S_t = a_0 + a_1 S_{t-1} + a_2 \psi_{t-1} + a_3 S_{t-1} \cdot \psi_{t-1} + u_t$$
$$\psi_{t-1} = b_0 + b_1 S_{t-1} + b_2 \psi_{t-1} + b_3 S_{t-1} \cdot \psi_{t-1} + \nu_t$$

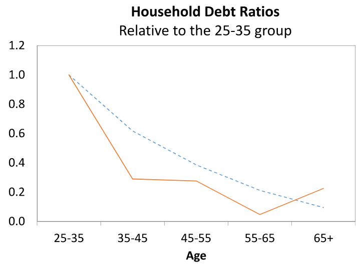
where ψ_t denotes the log of average savings.

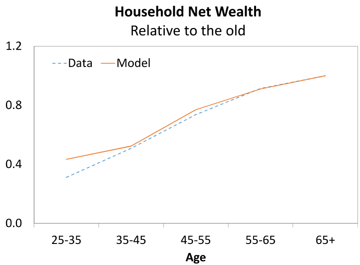
- Mortgage rate: $r^M = f^M(S)$
- Rental rate: $p^R = f^R(S)$

Model fit: life-cycle moments





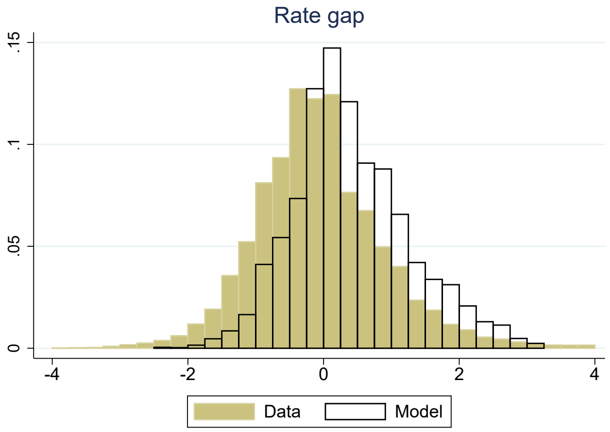




Model fit: state dependent effects of monetary policy

- Start the simulation in 1994, where agents have the distribution of assets, liabilites and mortgage rates that we observe in the data.
- Feed in actual prices and real variables from 1995 to 2007.
- Compute household's decisions.

Model fit: mortgage rate gap distribution (1995-2007)



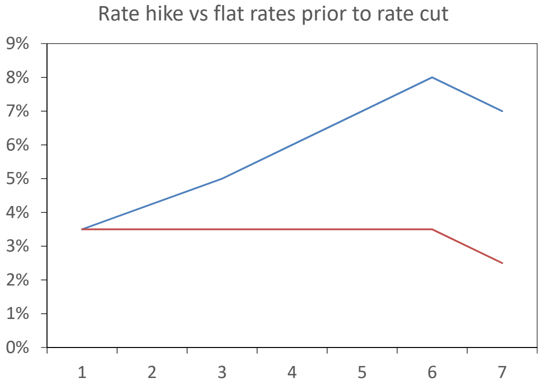
Model fit: state dependent effects of monetary policy

- Compute same regressions in model, given the agents' choices:

	Data	Model
ΔR(t)	0.062***	0.038
	(0.021)	
ΔR(t) x Average rate gap	0.389***	0.299
	(0.075)	

Larger refi response for given rate cut, when rate gap is higher.

Alternative interest rate paths



Refi and consumption respond > 5 times more under red path Expectations

Experiment: Lower transaction costs

	Fixed cost	
	\$2.1K	\$1K
Effect on refinancing:		
Overall effect of a 25 bp fall in rates	2.76%	4.02%
$\beta_1 \Delta R_t$	0.95%	2.90%
$\beta_2 \Delta R_t$ times mean(φ_t)	1.81%	1.12%
Effect on consumption:		
Overall effect of a 25 bp fall in rates	1.03%	1.30%
$\beta_1 \Delta R_t$	0.60%	0.88%
$\beta_2 \Delta R_t$ times mean(φ_t)	0.42%	0.36%

Lower transaction costs lead to:

- Higher overall response to lower rates, given an initial rate gap
- Less state-dependent effects (average rate gap is lower).

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Consumption response and constrained households

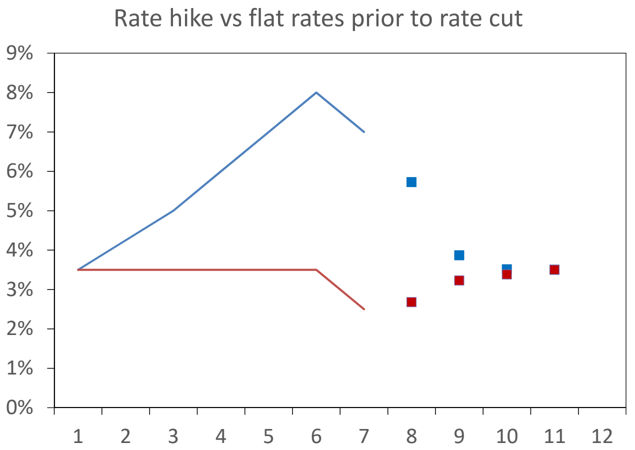
- Consumption rises by 1% over the year after a 25bp rate cut.
- Driven by constrained households (40% of all households).
- Of those who refinance, 80% engage in cash-out refinancing
  - in line with evidence from Chen, Michaux, and Roussanov (2013).
- If R_t fell by 25bps, balances rise by about 4% for cash-out refinances
  - in line with evidence from Bhutta and Keys (2016)

Conclusion

- Distribution of rate gaps and potential savings varies over time.
- Refinancing and permits response is larger when potential savings is higher.
- Lower transaction costs leads to more refinancing and smaller state dependent effects of monetary policy.

Spare slides

State dependent effects of monetary policy



Back

Demographics and preferences

- Households can live up to $T = 60$ periods: Work for 40, retired for 20. Probability of survival π_a.
- Preferences

$$\frac{\left(c_{jat}^{\alpha} \cdot h_{jat}^{1-\alpha}\right)^{1-\sigma} - 1}{1-\sigma}$$

Bequest motive

$$B\left(W_{jat}^{1-\sigma} - 1\right)/(1-\sigma)$$

Back

Labor income

- Labor income process for household j of age a at time t:

$$\log(y_{jat}) = \chi_{ja} + \eta_{jat} + \phi_a(y_t/y)$$

χ_{ja} = age-dependent component and η_{jat} = idiosyncratic component

$$\eta_{jat} = \rho_\eta \eta_{j,a-1,t-1} + \psi_{jt}$$

- Retirement income modeled as in Guvenen and Smith (2014).

Back

Structure of fixed-rate mortgages

Household j who enters a loan at age a in date 0:

- Has a fixed rate R_{ja0} and payment M_{ja0}.
- Principal evolves as: $b_{j,a+1,t+1} = b_{jat}(1 + R_{ja0}) - M_{ja0}$.
- Mortgages are amortized over remaining life of the individual.
- Maximum allowable mortgage: $b_{ja0} \leq (1 - \phi)p_0 h_{ja0}$.
- Fixed cost F applies to refinancing and new loans. Back

Borrowing constraints

Short-term asset constraint

$$s' \geq 0$$

Mortgage constraint

$$b' \geq -(1-\phi)ph'^{o}$$

which applies if loan is new or refinanced Back