“Housing Markets and the Macroeconomy During the 2000s”

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Macro Effects of Housing Markets on US Economy During 2000s

- Masked structural declines in labor market
  - Charles, Hurst, and Notowidigdo 2016a, 2016b.

- Long lasting impact #1
  - Housing boom during 2000s discouraged schooling.
  - Left those treated with the housing boom with persistently lower levels of schooling.
  - Charles, Hurst, and Notowidigdo 2016c.

- Long lasting impact #2
  - Work in progress with Amit Seru
  - Housing/Finance boom on STEM jobs in early 2000s
  - Missing patents of young inventors (?)
  - Could affect productivity after housing/finance booms.
Mortgage Markets and Macro Stabilization

- Lack of spatial interest rate variation in GSE mortgage markets
  - Default risk varies spatially
  - Mortgage markets transfer resources across U.S. regions in state contingent ways.
  - Hurst, Keys, Seru and Vavra (2016)

- Collateral values affect stimulative effects of monetary policy
  - “Regional Heterogeneity and Monetary Policy”
  - Focus of my talk today.
  - New paper with Martin Beraja, Andreas Fuster and Joe Vavra
  - Part of a growing literature exploring effects of monetary policy through the mortgage/housing market.
Motivation

- Great Recession/Eurozone Crisis:
  - Unprecedented monetary policy actions to reduce long rates.
  - Large variation in real activity and house price growth across member regions (Nevada v. Texas; Spain v. Germany).

- Usually studied w/ representative agent DSGE NK models

- This paper, distribution of collateral matters for:
  - Aggregate spending response to monetary policy
  - Inequality across regions in response to monetary policy

- Aggregate and distributional effects of monetary policy (through housing market) vary across time.
  - During Great Recession – aggregate stimulus effect was small and regional inequality effects were large.
Monetary Policy-Region Interactions

- For the most part, monetary policy tools (rates, reserve requirements, etc.) constant across regions in a monetary union.

- However, strength of monetary policy transmission to real activity can differ across regions.

- Collateralized lending channel of monetary policy
  - Ability to borrow depends on collateral values $\rightarrow$ regional collateral values affect monetary transmission.
  - Regions with low collateral values may see less increase in borrowing in response to monetary expansion.
  - Non-linearities can lead to aggregate consequences
Specific Collateral Application

- **Our focus:** mortgage refinancing

- **In US most mortgages are long-term fixed rate mortgages**

- **When rates decline:**
  - Households can refinance to cut payments and reduce default risk
  - Households can extract housing equity ("cash out") at refinancing (potentially important channel of monetary policy)

- **Refinancing, however, requires equity in home**
  - Can’t refinance if LTV is too high
  - But only need to meet LTV if refinancing (or Debt-Income Ratio) – creates a non-linearity between LTV and refinancing response to policy.

- **Creates interaction between regional house price growth, refinancing activity and spending (with both aggregate and regional consequences)**
Overview of Paper

- Empirical (focus of talk today)
  - Do local conditions affect refi, cash-out and spending responses to QE1?
  - QE1 had stronger effects on areas with relatively high equity and low unemployment (likely amplified regional dispersion)
  - Explore patterns in 2001-2003 cycle. Draw a distinction between the two.

- Theoretical (touch on briefly today)
  - Incomplete markets hh model w/collateralized borrowing, costly refi, income and HP shocks disciplined by cross region evidence.
  - Use model to assess aggregate response of monetary policy during Great Recession in GE (who owns debt)
  - Counterfactuals: What features of the collateral distribution influence aggregate stimulus and regional inequality response to rate declines?
  - Conclusion:
    2008 – Modest aggregate effect of Fed policy (large regional dispersion)
    2001 – Large aggregate effects of Fed policy (small regional dispersion)
Empirical Evidence: Response to Fed’s large-scale asset purchases ("QE")

Study refinancing response to a specific episode of expansionary monetary policy: “QE1”

• Announcement on Nov 25, 2008: purchase $500 bn in MBS and $100 bn in agency bonds
  • Extended in March 2009
  • Subsequent rounds: Aug/Nov 2010, Sep 2012
• Stated goal: increase availability & reduce cost of mortgage credit; support housing markets and financial markets more generally
• Largely unanticipated before announcement
  • Use “event study” approach
  • Large effect on rates and quantities
Announcement effect on mortgage rates & applications

(little immediate effect on purchase mortgage applications)
Main data sources

- Want to measure at MSA level:
  - Monthly “refinance propensities” and cashout volumes
  - Borrower equity at onset of QE1
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- Equifax CRISM data. Mortgage servicing records matched to credit records. $\sim65\%$ coverage (starting mid-2005).
  - Can link borrowers over time (tracks households across multiple mortgages)
  - Measure refi propensity more precisely; also cashout conditional on refi
  - Can measure borrowers’ combined Loan-to-value ratio (including all liens)
CLTV distribution across MSAs

January 2007 (beginning of HP drop)
CLTV distribution across MSAs
November 2008 (when QE announced)
Unemployment increase vs. CLTV > 80% (N = 381 MSAs)
Results: Refi propensities around QE1 (CRISM data)
Top vs. bottom quartile of MSAs in terms of % borrowers with CLTV > 80.

Much more refinancing in high equity locations
Cash-out refinancing around QE1 (CRISM data in $)

$10bn more refinancing in high equity locations
Effects on durables spending: auto sales

Data source: R.L. Polk (as in Mian, Rao, and Sufi, 2013)
Regression analysis and summary of results around QE1

- Run regressions to formally assess significance + control for various confounding effects
  - Control for MSA: education, age, race, nationality, % homeowners, % w/ mortgage if homeowner

- Summary:
  - In MSAs where borrowers had less equity (and which had higher $\Delta U$):
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    - Refinancing increased by less following the announcement of QE1
    - Borrowers extracted less home equity
    - Auto sales increased less

⇒ Monetary policy action, at least through mortgage channel, may have increased inequality across regions
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Do the 2008 patterns hold in all recessions?

- Can’t measure CLTV before 2005, but can measure state-level HP growth (highly correlated with CLTV) and unemployment back to 1976
Do the 2008 patterns hold in all recessions?

Average House Price Growth:

![Graph showing average house price growth from 1970 to 2020 with recessions highlighted.](image-url)
Do the 2008 patterns hold in all recessions?

Cross-State SD of House Price Growth:
Do the 2008 patterns hold in all recessions?

Response of House Price Growth to Urate

![Graph showing the response of house price growth to urate](image.png)
Changing HP-Urate relationship matters for refi patterns

Compare 2007-2009 to 2001-2003:

- 2007-9: refi propensities by top/bottom unemployment quartiles – similar to earlier results
Changing HP-Urate relationship matters for refi patterns

Compare 2007-2009 to 2001-2003:

- 2001-3: opposite pattern – higher U MSAs have higher refis
- Overall refi levels substantially higher ⇒ transmission channel stronger
Part 2
Quantitative Model
Quantitative model

- **Goal:** Broader insights about interplay between monetary policy and regional heterogeneity

- **Match cross-region evidence from QE1** and then explore aggregate implications

- **Counterfactuals:**
  - Vary cross-region distribution of collateral values and income as in earlier recessions

- To study how this matters for
  1. Aggregate transmission of monetary policy
  2. Effect of monetary policy on regional inequality

- What features of distribution matter and why?
Model setup (Sketch)

- Borrowers solve saving problem w/ borrowing constraints + mortgages
- Stochastic exogenous income
- Endowed with house w/ stochastic regional price shocks + trend growth
  - Cannot buy or sell, but can borrow against value using interest only mortgage at current rate $r^m$
  - Can be refinanced at any time by paying fixed cost
- Baseline: full cash-out mortgages, so when refinancing:
  - $M' = \gamma P$ where $\gamma$ is max LTV and $P$ is current price
  - New payment is $r^m M'$
  - Cash-out amount is $\gamma (P - P_0)$
- Can save in risk-free asset $a \geq 0$ with interest rate $r$
- PIH representative lender to account for equilibrium effect of reduced mortgage payments on lender consumption
Model Parameterization

- Income and house prices random walks with common drift
  - Eliminates $P$ as state-variable, equity $x$ becomes relevant state
  - House price drift means $x$ grows on average
  - Refi policy follows an (income, asset, interest rate dependent) threshold rule:
    - When equity low, not worth fixed cost to refi
    - When equity high enough, pay fixed cost, extract equity and refi

- Annual model, most parameters calibrated at standard values
Defining regions, baseline calibration and experiment

- Baseline impulse response:
  - Assume $r^m$ constant forever
  - 1-time unanticipated permanent decline from 6% to 5%
- Assume shocks to house prices and income across regions uncorrelated on average (i.e. when solving hh problem)
- But explore impulse responses after different realizations of shocks
  - i.e. interpret different recessions as lucky or unlucky realizations of HP shocks, not permanent changes in process
- Calibrate baseline distribution of economic activity to match observables just prior to QE1:
  - Aggregate house price decline of 12.5%
  - Large variance of house prices
  - House price and income shocks highly correlated
Using our empirical evidence

- Calibrate fixed costs to match empirical refinancing activity across regions before and after QE1

- Then look at implications for aggregates and inequality which can’t be measured directly in data
Baseline Results: Stimulus vs Inequality

![Graph showing Aggregate C IRF and Regional Consumption Variance IRF](image-url)
Effects of 2008 Distribution

- Compare IRF in 2008 to IRF in stochastic-steady state
Understanding Role of Distribution

Stochastic Steady-State

Equity distribution

Vavra (U Chicago)  Regional Heterogeneity & Monetary Policy  September 29, 2016  26 / 30
Understanding Role of Distribution

2008

Vavra (U Chicago) Regional Heterogeneity & Monetary Policy September 29, 2016 26 / 30
How Do Different Moments of Distribution Matter?

Changing Average Collateral

- Little refinancing or cash-out when equity low
Changing Regional Variance of Collateral

- **Non-linearity**: high equity hh respond more, underwater hh respond 0
How Do Different Moments of Distribution Matter?

Changing Correlation of Collateral and Income

- If high equity have lowest income, inequality reduced.
Robustness Summary

- Empirically ARM share larger in low equity regions during QE1
  - Results robust to including ARMs, matching empirical shares
- Robust to stochastic $r^m$ with AR process
- Robust to endogenizing cash-out decision
- Robust to various assumptions on lender/GE side
Model takeaways

- To understand consequences of monetary policy for aggregate spending and inequality need to know (time-varying) collateral distribution
  - 2008 distribution $\implies$ drag on aggregate monetary policy and amplification of inequality
  - But not true in general, e.g. different patterns in 2001
- Joins growing literature showing even if just care about aggregate stimulus, need to look at micro data
Conclusion

- Important to understand interaction between collateral distribution and monetary policy
- Our data is US mortgages, but importance of collateral channel is broader
  - Same forces should apply to other collateralized lending
  - Europe has seen similar regional patterns
- Due to regional heterogeneity, QE exacerbated inequality, had more limited aggregate effects
- Does that mean should do less monetary accommodation? Arguably no, because aggregate transmission weaker
  - But tradeoffs with inequality worse
- Interplay with fiscal policy – in this example government refi program (HARP; introduced in 2009 but not very effective until 2012)