What is the micro-elasticity of mortgage demand to interest rates?

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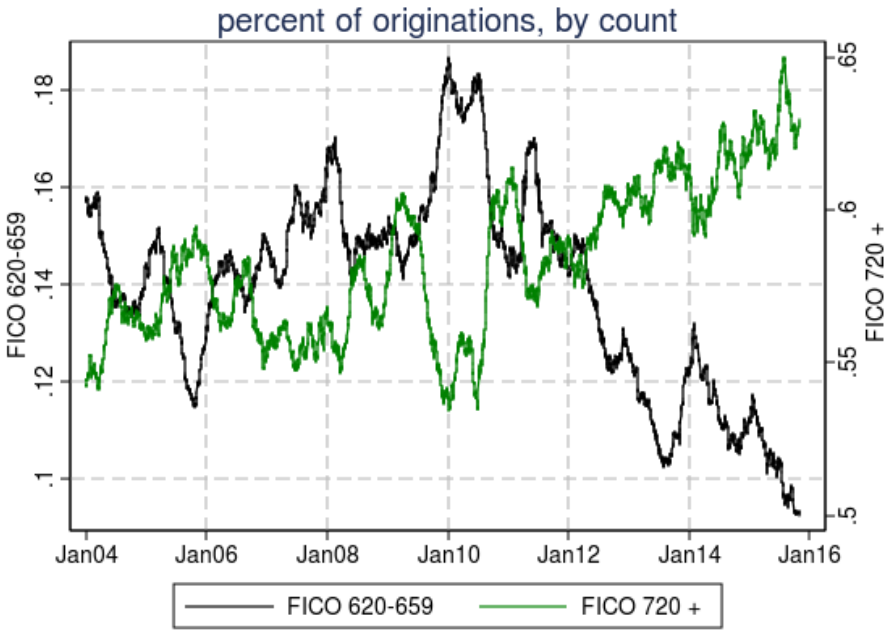
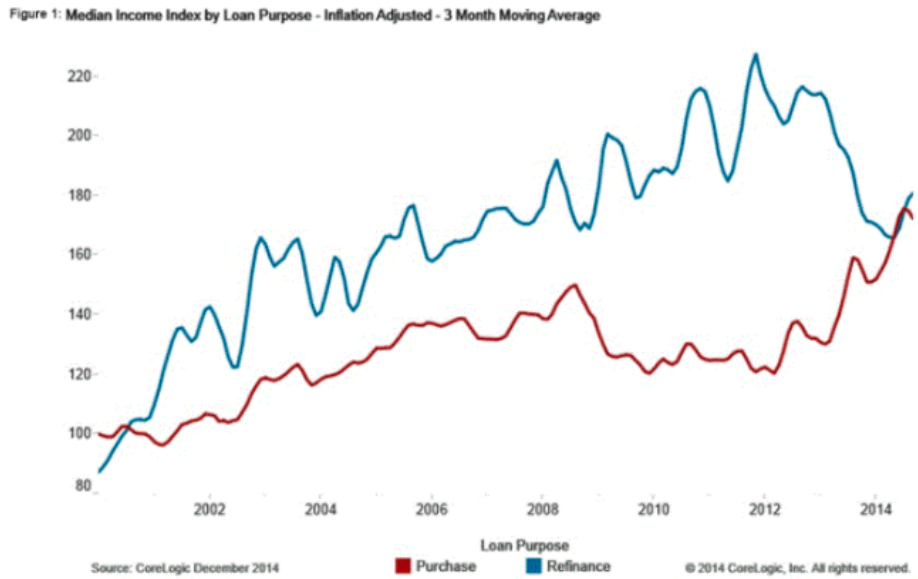
[1] Part of this work has been performed at the Federal Reserve Bank of Boston. The views expressed in this presentation are solely those of the author and not necessarily those of the Federal Reserve Bank of Boston or the Federal Reserve System.

Overview

- What is the elasticity of mortgage demand to interest rates?
  - Hard to measure: interest rate movements and house demand both tied to macroeconomy
  - Important for understanding magnitude of monetary policy transmission
- I formulate a regression discontinuity (RD) design to measure the impact of interest rates on intensive and extensive margins of mortgage demand
  - I use a novel identification method, which features regulatory-induced breaks in mortgage rates across certain credit score thresholds
  - Rare administrative dataset on daily offered mortgage rates across borrower characteristics
  - Validity of RD shown using proprietary detailed mortgage data linked on the individual-level with credit bureau data

Economic Motivation: Inequality in New Mortgages





- Increased mortgage share to high-FICO and high-income individuals
  - Left: Post-crisis, low FICO individuals saw decreasing mortgage share
  - Right: Red line indicates that the median income index for purchase mortgages has risen drastically
- Research question: how much of this is due to increases in mortgage spreads?

Loan Level Price Adjustments and Policy Debate

- LLPAs are mortgage fees that vary by FICO at origination
- LLPAs were instituted in 2008 to help Fannie and Freddie "manage our credit risks, mitigate losses, and ensure an adequate capital position"
- LLPAs have come under fire:
  - "[Mortgage fees are] a potentially debilitating one-two punch for many borrowers and it raises serious questions as to the unintended consequences of these ambitious fee hikes ... The only known is that virtually all borrowers will soon face higher costs and rates, and **a fragile housing recovery will deal with yet another major challenge**." – Mortgage News Daily, December 2013
  - ""Eight years after the financial crisis, mortgage credit quality has improved dramatically and regulations have improved the industry's risk management practices. **We believe these changes justify eliminating LLPAs**" – Letter to FHFA director in 2016, co-signed by 25 groups
- Policy implications: Did LLPAs pose a risk to the fragile housing recovery?

Literature

- Elasticity of "housing" to interest rates
  - Glaeser Shapiro (2003): housing *demand* to interest rates on state-level home mortgage interest deduction; no significant response
  - Glaeser Gottlieb Gyourko (2012): house *prices* are less responsive to interest rates than standard model would predict
  - Fuster Zafar (2014): survey to measure sensitivity of housing demand to interest rates; low sensitivity
- Elasticity of mortgage demand
  - Best et al (2015): remortgagors bunch right below LTV "notches" in interest rate schedule
  - DeFusco Paciorek (2014): jumbo-conforming bunching
    - Find relatively small demand response (100 bp decr. in rates $\rightarrow$ 2-3 prct incr. in demand)
    - My measure has benefit of being more precise and allows for measure of extensive margin of demand
- Mortgage credit supply during the crisis
  - Goodman Li (2014); Anenberg et al (2015)

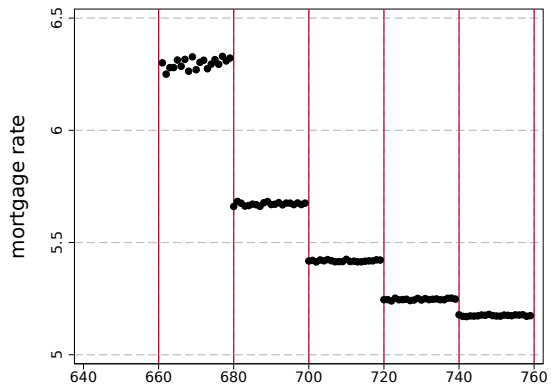
Preview of results

- I find the elasticity of mortgage demand to interest rates is large
- A 25 bp decrease in mortgage rates is associated with:
  - Intensive: an increase in loan size of $15k (approx. 10% of average origination volume)
  - Extensive: a 50% increase in likelihood of potential borrower to demand a loan
- I establish that these estimates are driven by demand-, not supply-, side factors
- I estimate that, had mortgage rates been the same across FICO 680-719 borrowers as FICO 720+ borrowers, there would have been much more mortgage borrowing (about $15B more than actual $43.5B)

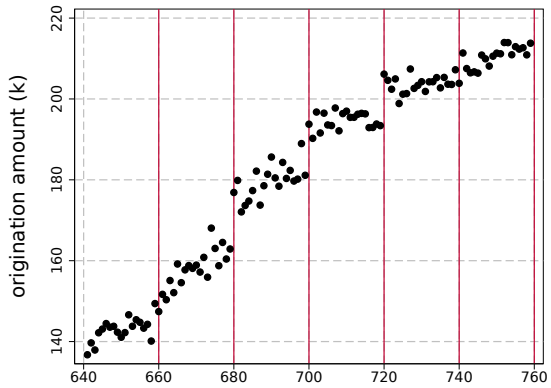
Plan

Credit score cutoffs matter

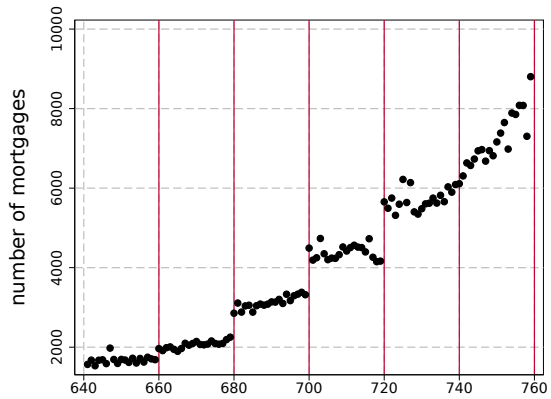
Mortgage Rates



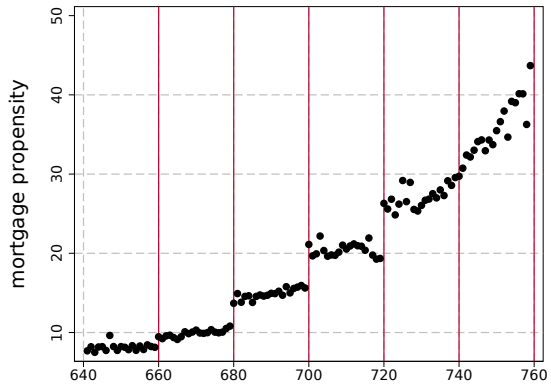
Orig. Amount



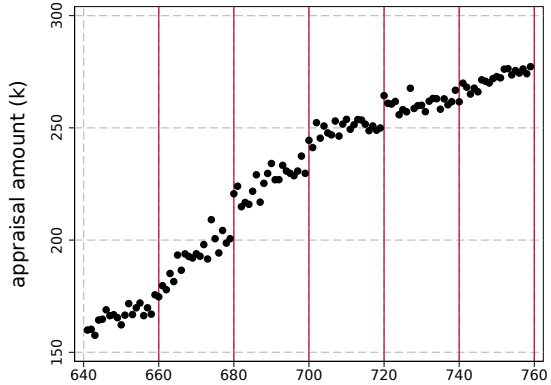
No. of Originations



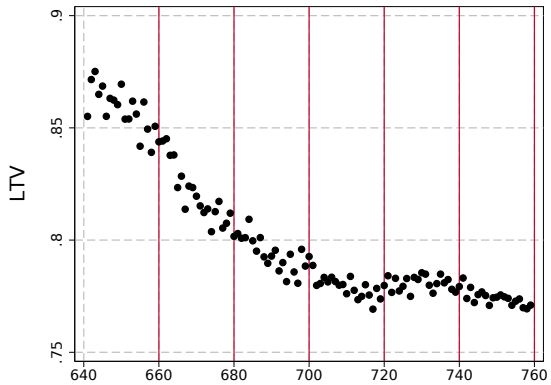
Orig. Propensity



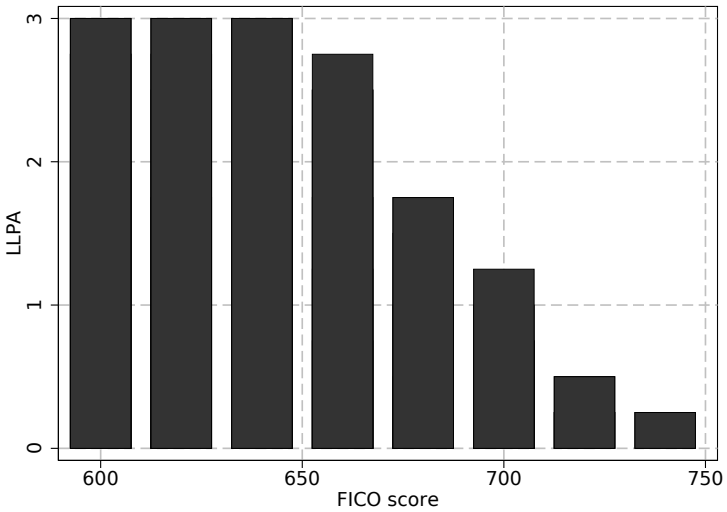
Appraisal Amount



LTV Ratio



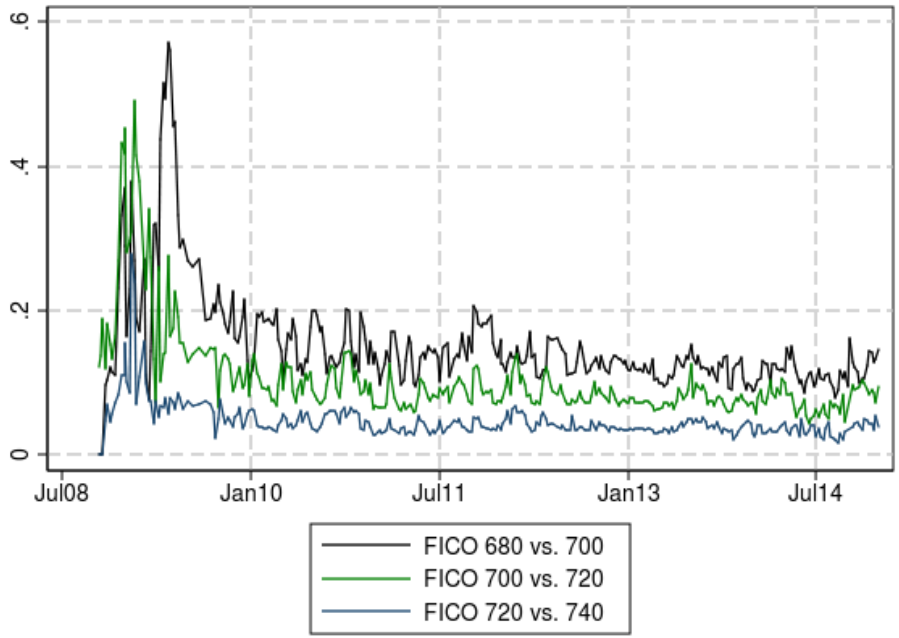
LLPAs drive mortgage rate differentials across borrowers



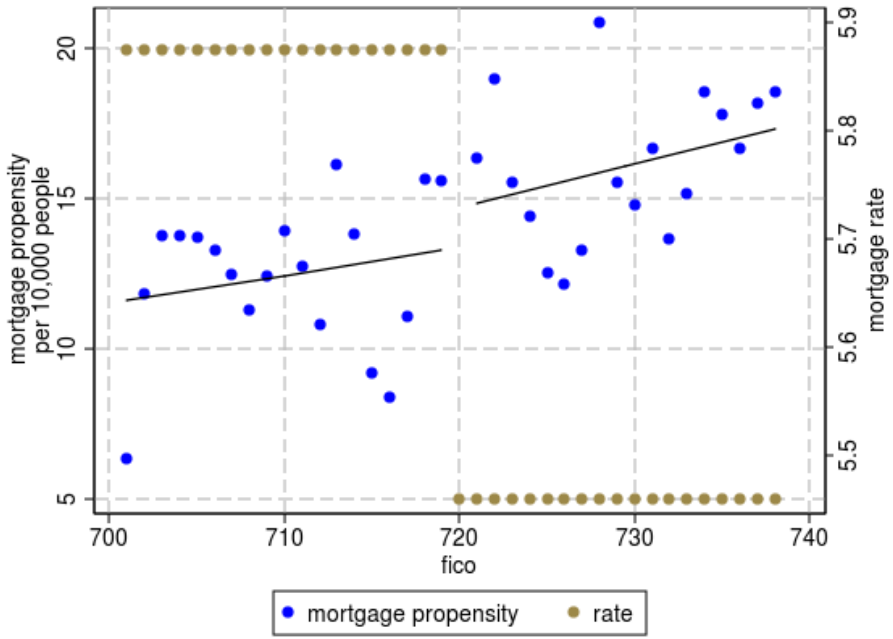
- In December 2007, GSEs imposed upfront-fees called LLPAs
  - Can think of as additional insurance premia
  - Vary by discrete credit score bins (i.e. 680-699, 700-719, etc.)
- While technically paid by banks at closing, I show evidence that these are fully passed on to consumers
- Serve as an exogenous wedge in interest rate across borrowers (even though lenders see same rate)

Mortgage rate differences across time

- Lenders price the upfront LLPA they pay into mortgage rate
  - Magnitude of rate impact depends on MBS spreads, prepayment forecasts, etc.
- Mortgage rates differences are fairly small on average (27 bp for FICO 680-700, 90th percentile = 47 bp)



Example of RD



- Mortgage rates discretely jump up at 720 but are constant within-bin for 700-719 and 720-739
  - Driven by LLPAs
- Mortgage propensity also has break in trend at this cutoff
- I define elasticity as this jump, ∂N, over the change in rate, ∂r

Plan

Base RD results

	(1) 660	(2) 680	(3) 700	(4) 720
Origination amount	53198.0***	52384.9***	78886.0***	29012.9
	[39846.5,66549.4]	[35044.0,69725.8]	[60119.6,97652.4]	[-8994.4,67020.3]
Base origination amount	174044.9	190357.9	200912.6	207352.7
Appraisal amount	46611.3***	46340.8***	63180.6***	-5841.7
	[26945.0,66277.7]	[15933.3,76748.3]	[36835.4,89525.7]	[-71197.7,59514.4]
Base appraisal amount	217942.7	242577.5	257840.3	273459.8
Loan-to-value ratio	0.0135	0.00148	0.0352***	0.0334
	[-0.00451,0.0315]	[-0.0176,0.0205]	[0.0140,0.0564]	[-0.0246,0.0913]
Base loan-to-value ratio	0.80	0.78	0.78	0.76
Mortgage propensity	21.58***	21.78***	37.70***	29.25***
	[19.48,23.69]	[19.53,24.03]	[34.13,41.26]	[19.63,38.88]
Base mortgage propensity	14.04	18.46	22.62	28.32

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- Interpretation is change across threshold per 100bp change in interest rates
- FICO 700 likely most reliable estimate

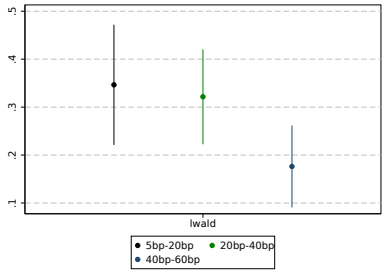
Sanity check / back-of-envelope on payment implications

- Suppose borrower starts with 5% 30-yr FRM, $200k origination amount
  - Monthly payment is $1073
- Suppose interest rates fall to 4%
  - Holding monthly payment constant:
    - Can now have origination amount of $226k
  - Holding origination amount constant:
    - Monthly payment falls to $954
- The magnitude of my estimates implies borrowers spend *more* than just the constant-payment strategy would imply
  - $52-$80k incr in origination amount, vs. constant-payment-implied $26k
  - substitution toward debt

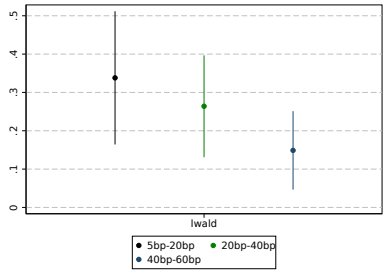
Intensive elasticity estimates, by size of rate spread

Per basis point of rate spread

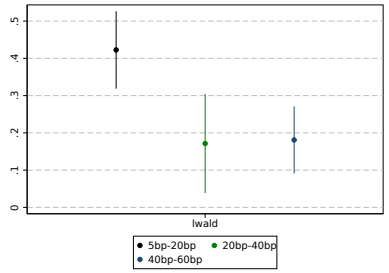
FICO 680



FICO 700

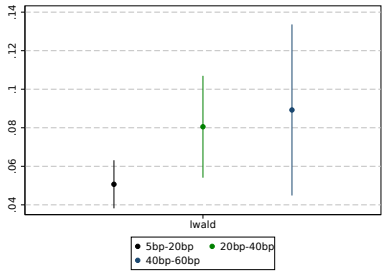


FICO 720

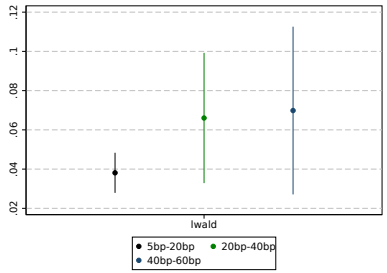


Aggregate effect

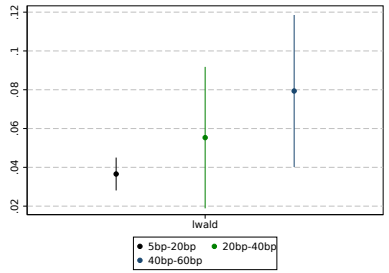
FICO 680



FICO 700



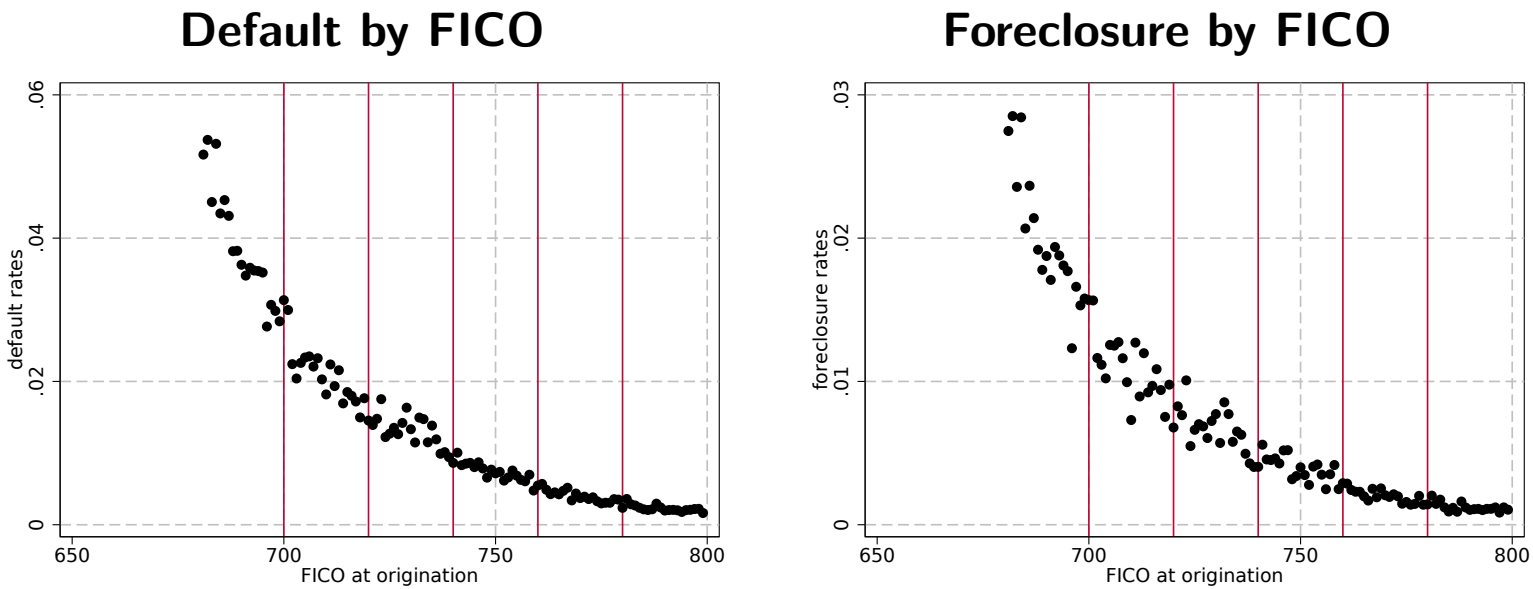
FICO 720



- Declining marginal responsiveness per basis point rate spread

Plan

Supply side does not seem to be driving the results



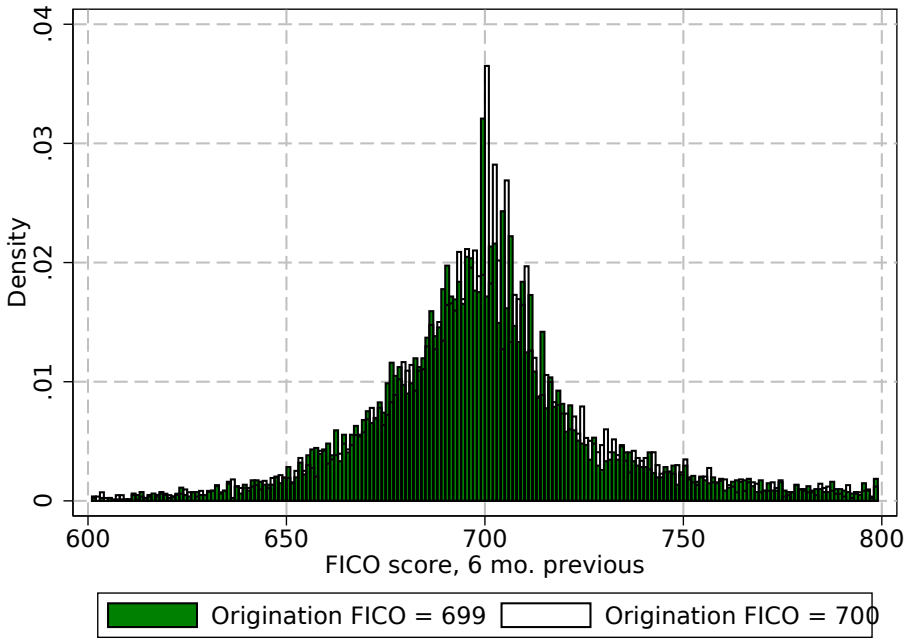
- One might worry that lenders also use rule-of-thumb for rejecting mortgages, so that credit *supply* is looser above threshold, therefore inducing more and larger mortgages above cutoff
- I argue this is not a concern for high FICO scores:
  - There is no incentive for this $\rightarrow$ securitization rates do not vary discretely across cutoff
  - If this is the case, you would expect higher default rates right above the cutoff

Securitization and default propensities

	680	700	720
P(securitization)	0.00251**	-0.0000809	0.000591
	[0.000524,0.00450]	[-0.00244,0.00228]	[-0.00119,0.00237]
P(default)	-0.00269	-0.000688	-0.000579
	[-0.00659,0.00122]	[-0.00187,0.000492]	[-0.00149,0.000329]

- For FICO 700 and 720, 95% CIs of RD discontinuity in the probability of securitization and probability of default include 0
- Base securitization rate (within first 36 months) is around 50% – discontinuity magnitude is small
- Base default rate is about 3%, and discontinuity statistically indistinguishable from 0

FICO scores are virtually impossible to manipulate



- Credit scores often move +/-20 points over the course of 6 months
- While some individuals may try to manipulate FICO scores,
  - credit scoring is a "black box"
  - there are a lot of moving parts
- Imperfect control implies RD should be valid a la Lee (2008)

Borrowers just across FICO breakpoints are identical

	(1)	(2)	(3)	(4)
	680	700	720	740
Bankcard balance, current	17.09	-24.78	-46.18*	-26.32
	[-27.38,61.55]	[-73.38,23.82]	[-100.2,7.858]	[-73.61,20.98]
Base amount, bankcard balance	7542.8	8110.6	8505.3	8275.9
Car debt, conditional on having car debt	-15.84	-50.66	-74.92	22.17
	[-144.7,113.0]	[-147.2,45.91]	[-174.4,24.57]	[-69.48,113.8]
Base amount, car debt	15716.2	15274.9	15099.3	14947.3
Credit utilization	-0.442	0.0444	0.157	0.106
	[-1.172,0.289]	[-0.165,0.254]	[-0.122,0.437]	[-0.0987,0.311]
Base amount, credit utilization	0.689	0.628	0.584	0.551

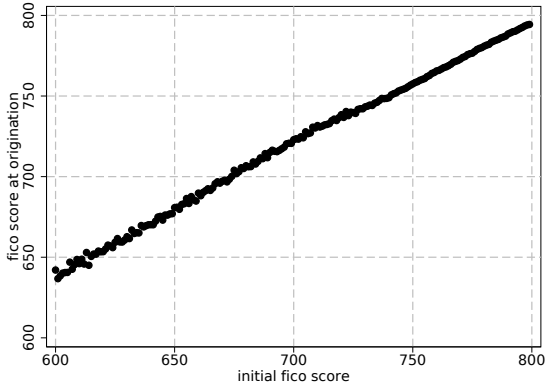
95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

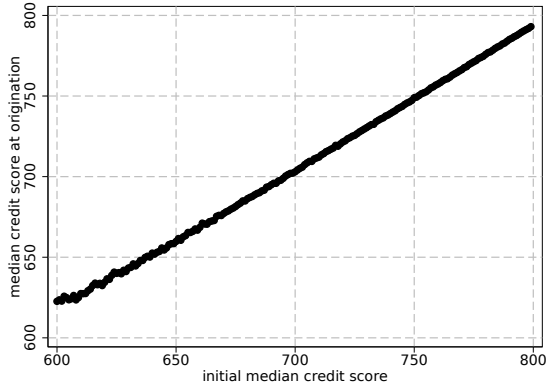
- FICO cutoffs for credit variables, such as bankcard debt, car debt, and credit utilization (as percent of limit) are not statistically significantly different from 0
  - Estimates noisy due to noisy data

Results not driven by differential mortgage shopping

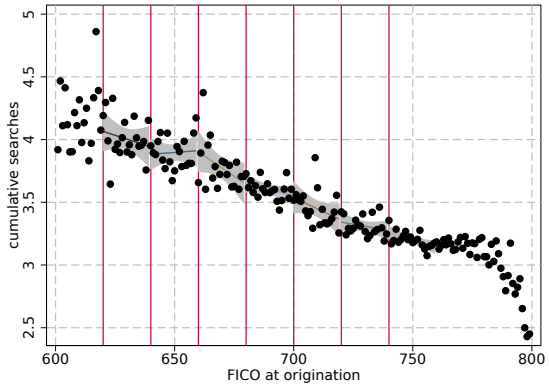
A. Search vs. orig: FICO



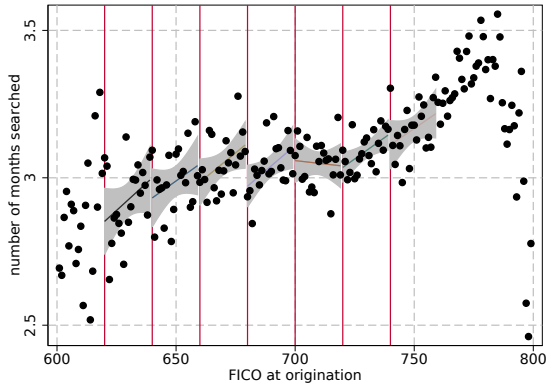
B. Search vs. orig: median credit score



C. Number of mortgage inquiries



D. Number of months searched



- No discrete breakpoints in mortgage shopping behavior or search vs. originated credit score

Plan

Economic Implications

- Suppose, over the sample period (Oct08 - Dec14), there were no differential LLPAs across 680 and 720 FICO scores
- Then, FICO 680-719 borrowers (about 20 MM Americans) would:
  - have faced interest rates that were on average 10-25 basis points lower
  - have demanded approximately 25% more mortgages total
  - would have originated mortgages about $11k larger each
- Potential increase in total mortgage demand of $15 B (off actual new mortgage debt of $43.5 B)
  - About $10 B from new mortgage debt and $5 B from increased size of existing mortgage debt
- Overall effect could of course be larger, taking into account lower FICO-score borrowers

Plan

Conclusion

- Novel identification method to measure microelasticity of mortgage demand to interest rates
  - High FICO borrowers
  - Regulatory "wedge" in interest rates faced across thresholds $\rightarrow$ regression discontinuity
  - Demand, not supply, driven
- Borrowers' demand for debt is sensitive to interest rates; 25 bp decrease in interest rates associated with:
  - Intensive: increase in loan size of \$15k (approx. 10% of average origination volume)
  - Extensive: 50% increase in likelihood of potential borrower to demand a loan
- Implications for "missing" mortgage demand post-crisis and efficacy of monetary policy