Reverse Mortgage Demographics and Collateral Performance

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The HECM Problem

> Two elderly women are at a Catskills mountain resort, and one of them says,``Boy, the food at this place is really terrible.'' The other one says, ``Yeah, I know; and such small portions.'' – Annie Hall

- Reverse mortgages are theoretically important
    - Many older homeowners are house-rich cash-poor
    - Particularly in lower half of wealth distribution
- Total demand is small
    - US probably has best-developed market (HECM)
    - $\approx$ 3% of eligible participate
- But FHA as insurer has managed to lose $\approx$ \$1.5B
    - Prior research: very bad adverse selection
        - On origination timing
        - Interacted with origination metro areas
    - Also some counterparty risks borne out
        - pro-cyclical terminations
        - properties appear undermaintained

Research Questions

- Home Equity Conversion Mortgages (HECMs) in the 2000s:
    1. Were HECMs adversely selected within metro areas?
        - Neighborhood level?
        - Property level?
    2. If so, how much of this can possibly be explained by?
        - Minority population share (motivation to come)
        - Subprime propensity
        - Lagged capital gains (holding aside causality)?
- That is, might the "subprime cycle" mimic:
    - Conscious lemon selling ?
    - Moral hazard on maintenance?

Background: the Home Equity Conversion Mortgage

- Eligible population: US homeowners 62+
- Loan: a line of credit or increasingly lump sum
- Initial LTV rises in borrower age, falls in 10-year treasury
- Negative amortization: no repayment due until earliest of
    - Refinance
    - Default on property tax or insurance
    - Move out while alive or die
- FHA insures lenders get principal and interest at T
    - No regional or cyclical variation in pricing
    - Pricing modified in wake of crisis
- FHA/lender risks: highly challenging contracting problem
    - Longevity (Calment)
    - Moves and refinance (dynamic selection / moral hazard)
    - Procyclical credit line use
    - Price appreciation
        - Market (adverse selection?)
        - Borrower-specific (moral hazard?)
        - Property tax and insurance defaults

Background: Line of credit decomposition

1. Line of credit
   - Draws before T must be repaid
   - At loan interest rate
2. Exotic European Put

$$V(T) = \max\left(h(T) - b(T), l(T) - b(T)\right)$$

   - Debt paid either way

$$V(T) - [h(T) - b(T)] = \max\left(0, l(T) - h(T)\right)$$

   - Right to sell for credit limit at T
   - Limit grows at loan rate with time

- Put - fees puts lower bound on value to borrower
- Other work of mine: put commonly worth more than
  - FHA up-front premium
  - plus other closing costs

Background:the US Housing crisis

- Major expansion of nonprime lending
- Large price swings
  - Peak around 2006/2007,
  - Trough 2011/2012
  - Remarkably concentrated in 4 "Sand States"
- Within-metro distribution less studied
  - Mian-Sufi subprime neighborhoods more impacted
  - Some controversy over policy impacts
  - US has a troubled redlining history
- Data FHFA repeated sale at metro level
- Less used Zillow Zip Index
  - A bit of a black box
  - Looks reasonable to me
  - Trusted by at least one good economist

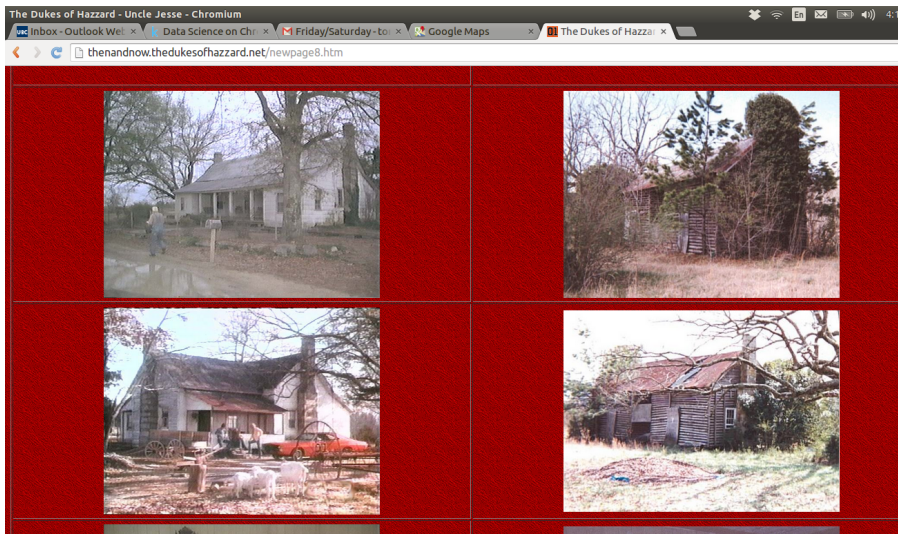# HECM and the Housing Crisis: Existing studies

- ▶ Collateral underperforms metro average appreciation
- ▶ Adverse selection timing× region
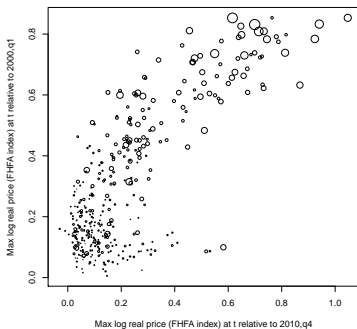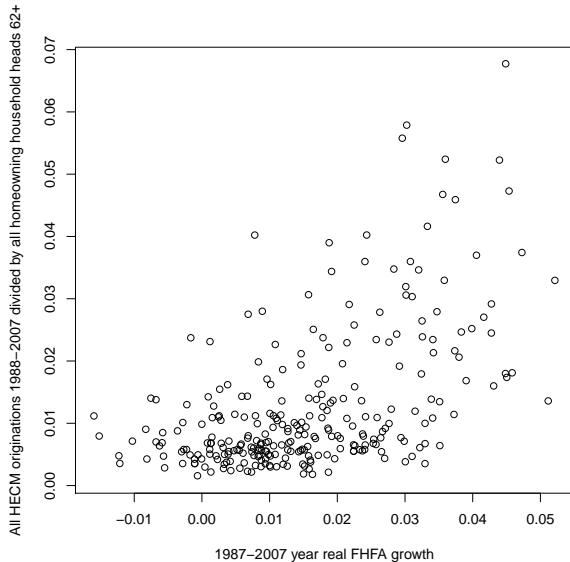

- ▶ But borrowers don't exploit "put:" conscious lemon selling??
- ▶ So what is driving the adverse selection?

Who really should have HECM LOCd:

Low growth markets: The Dog That Didn't Bark

Strategic put use offers high NPV if $\mu \approx 0$

Incidental adverse selection

- A problem with mortgages generally
- Home prices exhibit:
    - short run momentum,
    - long-run mean reversion
- Cyclical risk (e.g. rent/price) typically not priced
    - Would not be easy to do (Hurst et al wp)
- HECM liquidity demand $\sim \frac{\text{house value}}{\text{Resources}}$
    - So liquidity demand should rise near cycle peak
    - This can generate adverse selection even if no intent
    - Could also be adverse selection with intent (unpriced signal)
- Line of credit paper: no evidence of intent
    - Leaves open the reason for adverse selection
- This paper: explore evidence within metro areas
    - Cycle was more intense in poor neighborhoods?
    - **Can** this explain selection and "moral hazard?"
    - Non-barking "Uncle Jesse" dog adds causal plausibility

Regressions: cross sectional (Zip Codes)

$$\text{HECM penetration 2004-2007}_z = a + b_1 \text{crash}_z + b_2 \text{Liquidity Demand}_z$$

$$+ \sum_i \mathsf{d}_i Metro_{iz} + X_z \gamma + \epsilon_z$$

- ▶ Crash data: from Zillow: 1,2006/1,2011
- ▶ HECM penetration: Originations to 2010 estimated eligible
- ▶ "Liquidity demand"
  - ▶ Minority share (existing literature)
  - ▶ Poverty measures
  - ▶ 2000 median home value
  - ▶ Subprime exposure

Pictures of demand by neighborhood

Chicago HECM penetration
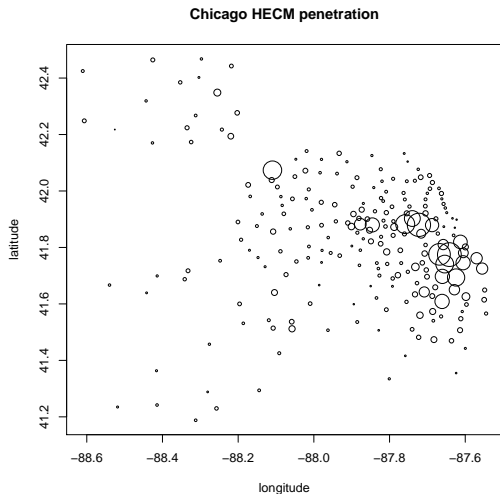
Washington HECM penetration
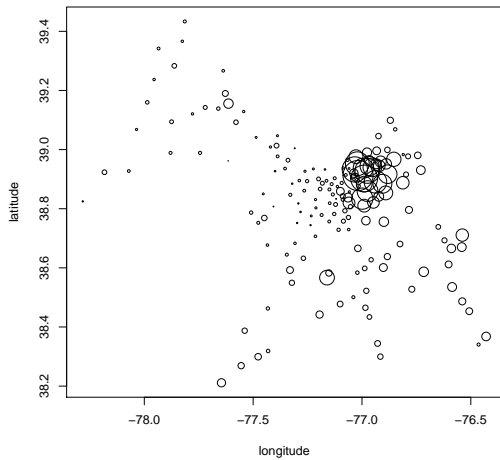
Lending trends by Sand/Not Sand

Year	Sand States Mean			Not Sand Mean		
	Minority	Med. Val 2000	N	Minority	Med. Val. 2000	N
1989	0.18	301677.8	9	0.15	109587.5	8
1990	0.26	196474.5	47	0.13	148943.4	205
1991	0.26	172152.8	362	0.14	163598.2	274
1992	0.25	185983.5	533	0.16	159276.4	1084
1993	0.24	189659.7	787	0.17	161510.7	2284
1994	0.24	184551.9	696	0.16	154591.7	3221
1995	0.27	174489.7	1188	0.15	148300.6	3129
1996	0.28	169749.9	1265	0.16	143702.7	4317
1997	0.29	161669.5	1604	0.19	136586.9	4522
1998	0.27	185686.3	1911	0.21	136236.7	5117
1999	0.27	197487.0	1422	0.20	139523.5	5683
2000	0.23	200919.5	2306	0.20	138819.2	4978
2001	0.26	187112.7	3643	0.21	140183.4	7647
2002	0.26	180600.0	9755	0.21	138179.9	9843
2003	0.30	171997.5	14234	0.20	135338.4	18655
2004	0.30	160069.7	22502	0.23	129169.7	22792
2005	0.29	145971.5	34108	0.22	129972.0	31867
2006	0.32	128020.2	37569	0.22	130033.8	47774
2007	0.35	133466.1	36558	0.23	121783.7	59298
2008	0.26	182291.4	26243	0.24	120554.6	69674
2009	0.25	193131.2	15023	0.21	132759.3	65650
2010	0.24	200870.8	10960	0.20	127831.4	49444

2002 HRS/AHEAD Homeowners 70-75

Might minority capture liquidity demand better than Census variables?

Variable Median	Black or Hispanic	Not
Non-housing wealth/Home Equity	.13	1.05
Mortgage debt/home value	.16	.08
Home Value	75,000	125,000

- ▶ Census has income at zcta5 level
  - ▶ A poor poverty measure for seniors
- ▶ Census has home value at zcta5 level
  - ▶ Within metro areas demand ↑ or ↓ in value?
  - ▶ Find ↑ across metros, ↓ within

Poor white Zip Codes don't use HECM
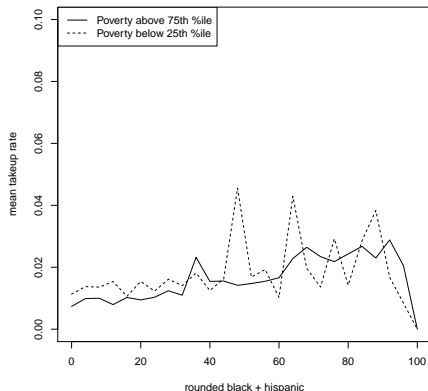
- ▶ Put value very high in Appalachia if credit used ruthlessly
- ▶ Note absence of low poverty minority neighborhoods

Zip Code Level Summary Statistics

Loans through 2010 w/both Zillow and FHFA price data

Variable	Obs	Mean	Std. Dev	Min	Max
Zip Code Level					
$\dfrac{\text{Originations 2004-2007}}{\text{Owners 65+ in 2010}}$	6,832	0.016	0.016	0	0.168
$\dfrac{\text{Originations 1989-2011}}{\text{Owners 65+ in 2010}}$	6,832	0.04	0.03	0.002	0.3
$\dfrac{\text{Originations 2004-2007 - Originations 1989-2003}}{\text{Owners 65+ in 2010}}$	6,832	0.01	0.013	-0.036	0.137
Poverty Rate among owners 65+ in 2000	6,832	0.121	0.083	0	0.657
Black+Hispanic share of all owners 2000	6,832	0.156	0.199	0.002	0.986
Median Home Value	6,832	150,621	96,471	22,000	995,200
25th%ile Home Value	6,832	120,930	76,138	11,200	795,200
Single Family %	6,832	0.872	0.129	0.012	1
Homeowners 65+, 2010	6,832	1,428	1,107	31	12,564
Homeowners 65+, 2000	6,832	1,262	1,104	14	13,834
Log Price 2006/2002	6,832	0.433	0.255	-0.205	1.274
Log Price 2006/2011	6,832	0.246	0.263	-0.404	1.206
Sand State (CA, AZ, FL, NV)	6,832	0.252	0.434	0	1
First year draw data					
appraisal	317,258	238,328	156,463	17,500	999,999
credit limit	317258	139,098	68,730	8399	485,957
First yr. credit/appraisal	317,258	0.662	0.277	0	1
Terminated Loans Data					
$\dfrac{\text{Outstanding Balance}}{\text{Zip indexed value}}$	91,152	.497	.307	5.74e-07	3.3357
$\dfrac{\text{Outstanding Balance}}{\text{FHFA metro indexed value}}$	116,111	.495	.271	-2.146	2.537
$\dfrac{\text{Outstanding Balance}}{\text{Zip lower tercile indexed value}}$	91,654	.501	6.389	-1,931	4.453
Shortfall claim	116,111	.075	.263	0	1

Main regression: Dependent variable is log(06/11) bust

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
constant	-0.1326**	1.0089**	0.534**	0.559**	0.431**	0.7125**	0.2408
	(0.0027)	(0.1942)	(0.1669)	(0.167)	(0.1681)	(0.188)	(0.1537)
share	3.676**	2.5409**	1.8301**	1.8362**	1.7505**	2.2163**	0.7779*
	(0.3984)	(0.4062)	(0.4592)	(0.4597)	(0.4435)	(0.3967)	(0.4288)
star_ratio		-60.6266*	-73.5834*	-74.4824*	-76.9149**	-69.5459*	-82.1977**
		(31.5001)	(32.5423)	(32.4124)	(32.2056)	(31.4247)	(31.1008)
sf		0.0918**	0.0515*	0.0496*	0.0379	0.0589*	0.0441
		(0.0274)	(0.0273)	(0.0275)	(0.0277)	(0.0273)	(0.0272)
lmedinc		0.0022	0.0158*	0.0148*	0.017*	0.0079	0.0139*
		(0.0084)	(0.0081)	(0.0084)	(0.0081)	(0.0083)	(0.0078)
old_poverty		-0.2243**	-0.3226**	-0.3114**	-0.2835**	-0.1892**	-0.2543**
		(0.0451)	(0.0455)	(0.0451)	(0.045)	(0.0448)	(0.0429)
lmed_value		-0.1093**	-0.0771**	-0.0783**	-0.0688**	-0.0871**	-0.0541**
		(0.0184)	(0.0156)	(0.0155)	(0.0154)	(0.0172)	(0.0138)
minority			0.1823**	0.1841**	0.1506**		0.1461**
			(0.0334)	(0.0332)	(0.035)		(0.0312)
served				-0.0093			
				(0.0071)			
Subprime					0.0639**	0.102**	0.0816**
					(0.0113)	(0.0126)	(0.0108)
grow_peak							0.518**
							(0.05)
Adj. R-sq.	0.84	0.86	0.87	0.87	0.87	0.86	0.88
deg.freedom	7419	7414	7413	7412	7412	7413	7411

- ▶ Standard errors clustered at metro level
- ▶ Expensive cities, but cheap neighborhoods
- ▶ Minority % of owners
  - ▶ Explains a lot of within share effect
  - ▶ Does not explain across metro

Credit use: innocuous explanation

	(1)	(2)	(3)
constant	1.4991**	0.4669**	1.0118**
	(0.3345)	(0.19)	(0.2113)
minority	0.2877**	0.2659**	0.2763**
	(0.0228)	(0.0247)	(0.0173)
llower_quartile	-0.0535**	-0.0559**	-0.0505**
	(0.0102)	(0.0106)	(0.0135)
lappraisal	-0.0334*	0.4567**	0.4504**
	(0.0151)	(0.0314)	(0.0427)
llimit	-0.0916**	-0.5372**	-0.5549**
	(0.0213)	(0.0323)	(0.0424)
old_poverty	0.1203	0.1402*	0.2866**
	(0.0747)	(0.0755)	(0.1037)
grow_from_start			0.1108**
			(0.0211)
Adj. R-sq.	0.11	0.11	0.09
deg.freedom	316287	207646	129631

Allow different effects in Sand/other states

Sketchy?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
constant	0.2955**	3.4073**	3.3948**	2.7767**	2.6022**	3.0289**	1.1948
	(0.0113)	(0.3041)	(0.2866)	(0.34)	(0.3481)	(0.2977)	(0.348
share	5.383**	2.8948**	2.8924**	2.1299**	1.6307**	1.972**	0.8514
	(0.6148)	(0.5754)	(0.5827)	(0.5878)	(0.6055)	(0.5599)	(0.437
star_ratio		-5.86	-5.0113	-3.2437	9.0393	5.0251	40.231
		(55.0181)	(54.6456)	(55.8237)	(54.6501)	(54.4405)	(46.45
sf		0.1451**	0.1455**	0.0529	0.0368	0.0859**	0.0204
		(0.0382)	(0.0384)	(0.0342)	(0.0331)	(0.0356)	(0.037
lmedinc		-0.0056	-0.0051	0.0033	0.0022	-0.007	0.0126
		(0.0198)	(0.0192)	(0.0186)	(0.0177)	(0.0183)	(0.013
old_poverty_owners		-0.1661	-0.1699	-0.3976**	-0.3557**	-0.1736	-0.1971
		(0.1284)	(0.1278)	(0.1246)	(0.1175)	(0.1152)	(0.094
lmed_value		-0.2504**	-0.2499**	-0.2031**	-0.1863**	-0.2142**	-0.1203
		(0.0285)	(0.0283)	(0.0301)	(0.0286)	(0.0256)	(0.026
served			0.0028	-0.0219*			
			(0.0126)	(0.0119)			
minority				0.2972**	0.2095**		0.159*
				(0.0522)	(0.0458)		(0.052
Subprime					0.178**	0.231**	0.1783
					(0.0308)	(0.029)	(0.032
grow_peak							0.6754
							(0.071
Adj. R-sq.	0.69	0.76	0.76	0.79	0.8	0.79	0.84
deg.freedom	1759	1754	1753	1752	1752	1753	1751

- ▶ Most cor(share,crash) disappears with liquidity measures
- ▶ Capital gains to peak particularly hard to interpret

Not Sand States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
constant	-0.1192**	0.6314**	0.1327	0.1652	0.0703	0.3832*	0.035
	(0.0028)	(0.1829)	(0.1385)	(0.1457)	(0.1433)	(0.1731)	(0.1489)
share	1.7096**	0.8433**	-0.1064	-0.0951	-0.1056	0.6394**	-0.6347
	(0.413)	(0.358)	(0.3764)	(0.375)	(0.3716)	(0.3522)	(0.4355)
star_ratio		-58.182*	-75.4371**	-75.5386**	-78.1954**	-68.1192**	-91.3819**
		(31.0122)	(31.8329)	(32.0553)	(31.7267)	(31.2274)	(33.0476)
sf		0.0987**	0.068**	0.0659*	0.0598*	0.0736**	0.0655*
		(0.0318)	(0.0283)	(0.0289)	(0.0298)	(0.0311)	(0.0295)
lmedinc		6e-04	0.0156**	0.0144*	0.0167**	0.0062	0.0132**
		(0.0073)	(0.0061)	(0.0067)	(0.0062)	(0.0071)	(0.0057)
old_poverty		-0.1866**	-0.2638**	-0.2485**	-0.2411**	-0.1525**	-0.2418**
		(0.0438)	(0.0436)	(0.0419)	(0.0442)	(0.0438)	(0.0428)
lmed_value		-0.0738**	-0.0415**	-0.0433**	-0.0368**	-0.0561**	-0.0338**
		(0.0166)	(0.0127)	(0.0127)	(0.0131)	(0.0157)	(0.0129)
minority			0.1822**	0.1834**	0.1647**		0.1665**
			(0.0374)	(0.037)	(0.0405)		(0.0371)
served				-0.0121			
				(0.0079)			
Subprime					0.0334**	0.0751**	0.0459**
					(0.0117)	(0.0114)	(0.0106)
grow_peak							0.3258**
							(0.0574)
Adj. R-sq.	0.74	0.75	0.77	0.77	0.77	0.76	0.79
deg.freedom	5659	5654	5653	5652	5652	5653	5651

Is the minority effect CRA?

- No.
- Wouldn't income matter too, then?
- Add underserved indicator
  - For 2008 or 2004
  - Max underserved tract within Zipcode
  - Data from HUD PD&R
- No effect on minority coefficient
  - Economically
  - Statistically
  - Different signs '04 vs '08

Collateral performance: insurance claims on FHA
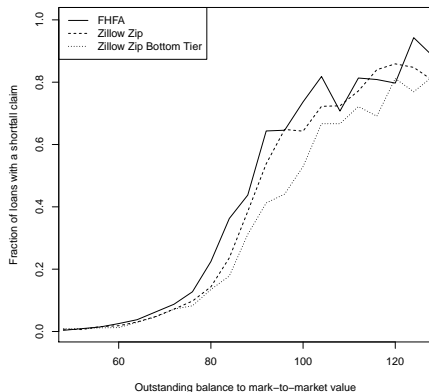
- Using local vs metro eliminates ≈ 1/3 of 75-90 LTV shortfalls
  - More when limit to bottom tercile homes

Conclusions

- Nasty adverse selection *within* metros
    - Echoes cross-metro selection
    - Most explained by Zip Code demographics
    - Could have been strategic lemon selling
        - on particular unpriced info
        - less plausible having seen demographics' role
- $\approx 1/3$ of excess insurance claims explained
    - Maintenance contracting an issue
- Aggressive lending as cause of both:
    - Boom-bust geography
    - HECM demand
    - Problem: different personnel
- Targeting
    - 50s nostalgia and Southern law and order??
    - Minority *per se* seems to matter more than poverty
- Home equity growth and the lifetime income distribution
    - Within metros here
    - More extraction
    - Much bigger crashes