Housing Consumption and Investment:
Evidence from Shared Equity Mortgages

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Housing, Household Debt, and the Macroeconomy Conference
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Motivation

- **Homeownership $\leftrightarrow$ traditional mortgage contracts**
  - Non-diversified, levered position in real estate (Campbell and Cocco, 2003)
  - Household risk $\rightarrow$ macro-economic implications (Mian and Sufi, 2009, 2013; Corbae and Quintin, 2015)

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- **Hybrid products (Shiller, 1994)**
  - Reduce leverage, payoff contingent on future house values $\rightarrow$ risk sharing
  - Shared equity mortgages, housing partnership, continuous workout mortgages (Caplin et al, 1997,2007; Shiller et al, 2014; Greenwald et al, 2017; Piskorski and Seru, 2018)

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  - Demand side: housing investment, information and cognitive frictions...
  - Supply side: moral hazard, regulation, house price indexation...

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- **This paper: understanding (lack of) demand for equity loans (ELs)**
  - Affordability + macro prudential constraints and house price expectations
  - Housing consumption and housing investment

Related Literature

- **Mortgage Design and Financial Innovation**
  - Shiller (1994), Caplin et al (1997, 2007), Campbell and Cocco (2003), Piskorski and Tchistyi (2010), Campbell et al (2011), Cocco (2013), Campbell (2013), Shiller et al (2013), Agarwal et al (2014), Shiller (2014), Fuster and Zafar (2015), Best et al (2015), Badarinza et al (2017)

- **Homeownership, Refinancing and House Price Expectations**
  - Deng et al (2000), Flavin and Yamashita (2002), Sinai and Souleles (2005), Chambers at al (2009), Mayer et al (2009), Fuster and Zafar (2015), Agarwal et al (2015), Andersen et al (2015), Key et al (2016), Kuchler and Zafar (2017), Bailey at al (2017), Fuster et al (2018)

- **Macro Prudential Policy, Financial Stability and Macroeconomic Implications**
  - Mian and Sufi (2009, 2013), Eberly and Krishnamurthy (2014), Corbae and Quintin (2015), De Fusco and Paciorek (2016), Guren and McQuade (2016), De Fusco et al (2017), Greenwald et al (2017), Guren et al (2017), Ganong and Noel (2017)

Outline

Data

1. **Equity loans:** Help to Buy Equity Loan dataset
   - Universe of loans issued between April 2013 and March 2017 (120,874)
   - Terminations between April 2013 and September 2017 (11,596)

2. **Mortgages:** Administrative dataset from Financial Conduct Authority
   - All residential mortgages issued since April 2005

- Match 1 and 2 to get capital structure at the **individual** level

UK Mortgage Market

Preliminary Facts

- Short-term fixed rate mortgages (e.g. 2-5 years)
- Higher standard variable rates after fix period $\rightarrow$ refinancing incentives (Cloyne et al., 2018)
- Pricing based on product characteristics: lender, rate type, maximum loan-to-value
  - No price heterogeneity across borrowers conditional on product-market
- Loan interest rate increases with discrete jumps at LTV thresholds $\rightarrow$ borrowers bunching at thresholds (Best et al., 2018)

UK Mortgage Market

Affordability Checks

- Mortgages with a **LTV** higher than 95% are rare; almost non existent for new builds (typically 90% max)
- Only 15% of the new mortgages originated by each lender can have **LTI** > 4.5
  - Bank of England Financial Policy Committee (June 2014)
- Mortgage applicants: affordability assessment for **PTI**

Help To Buy Equity Loans

Details on the Scheme

- **Eligibility:**
  - Minimum 5% down payment
  - New build properties with a purchase price of £600,000 or less
  - Available to first-time buyers and home movers, not second homes or buy-to-let
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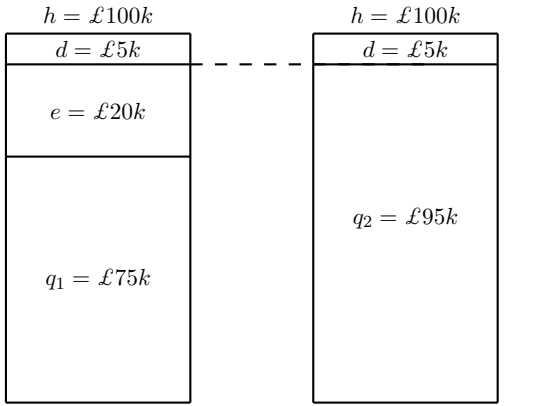
- **Key terms:**
  - Scheme provides up to 20% of property price (40% in London since 2016)
  - After 5 years, EL fee 1.75% of original EL value. Increase with inflation $+1\%$
  - 25 year maturity. Early Terminations:
    - Sale: 20% of the sale price is due to the scheme
    - Pre-payment: independent property valuation, no prepayment fee
    - Default: government position junior to lender

Equity Loans: Debt Structure



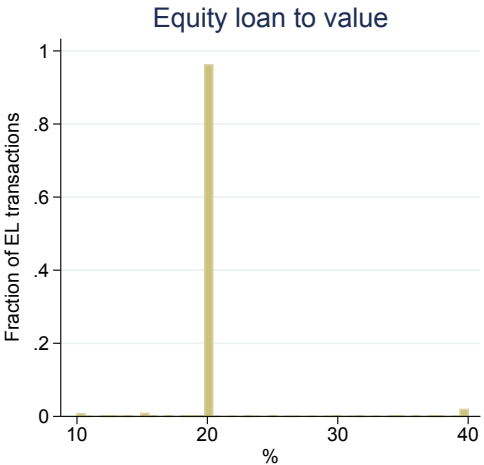
q: loan size

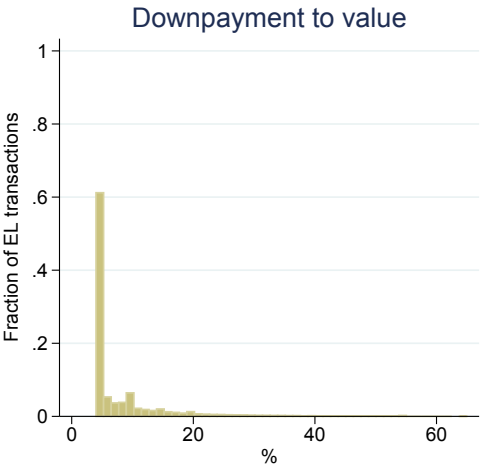
h: house value

d: down payment

e: equity loan

Down Payment-To-Value and EL-To-Value Distributions

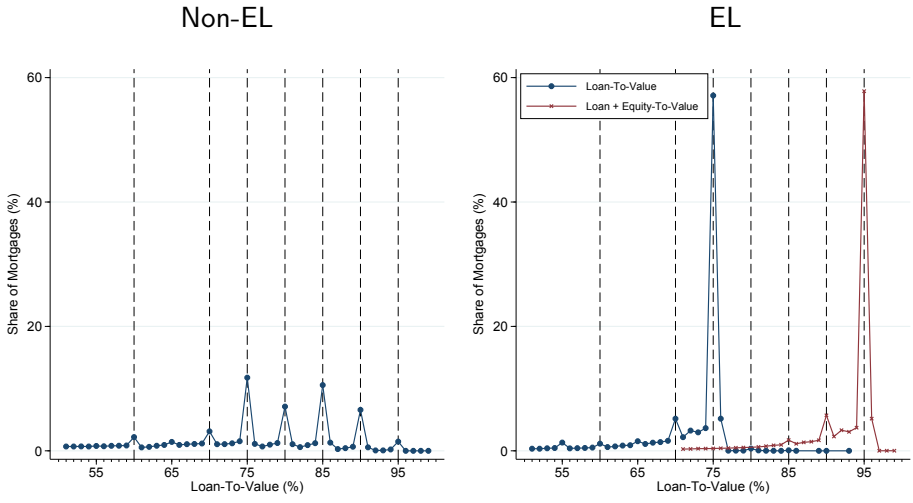




Outline

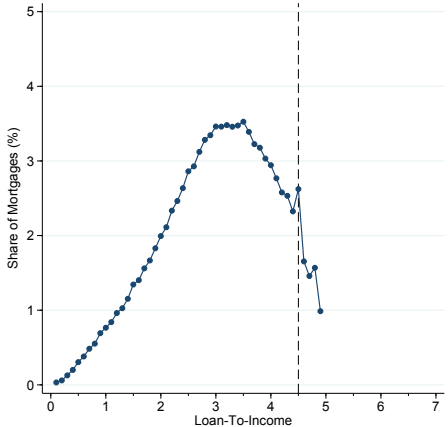
1a) Evidence on Affordability Constraints

Borrowers Use EL to Overcome LTV Constraints...

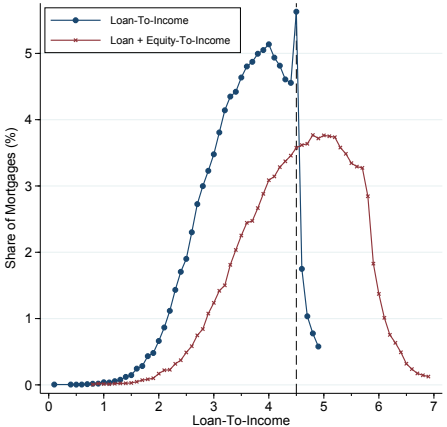


... and LTI Constraints.

Non-EL



EL



PTI distributions | Maturity distributions | Expenditures

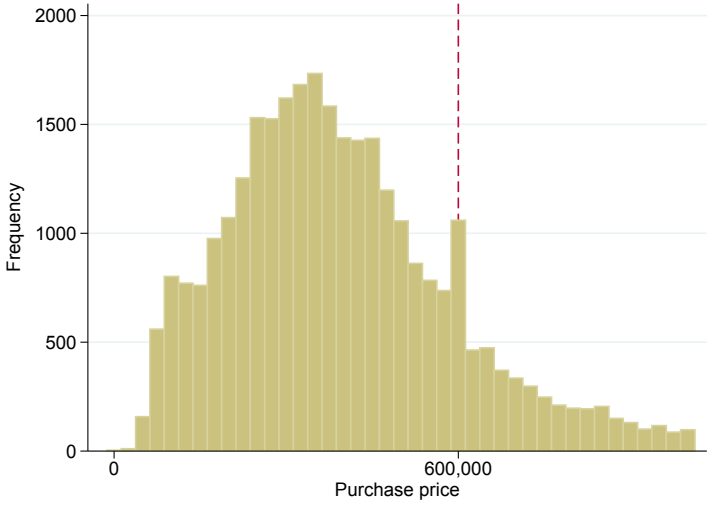
Putting LTV and LTI Constraints Together

- We estimate that 8% of EL borrowers would have been able to buy the *same* property with:
  - Cumulative LTV $\leq$90%
  - Cumulative LTI $\leq$4.5

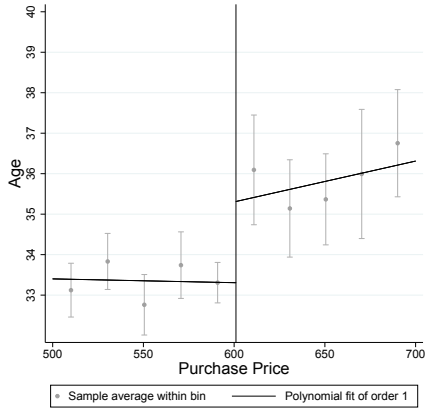
Combined cLTV and cLTI

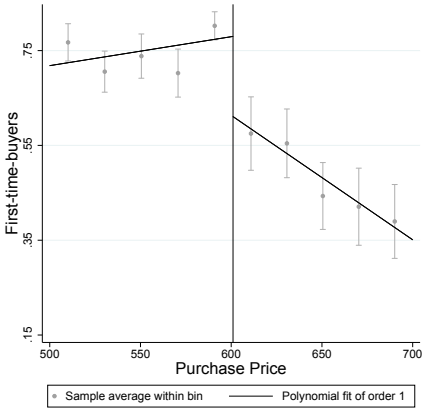
1b) Maximum House Value at £600K

Bunching in London

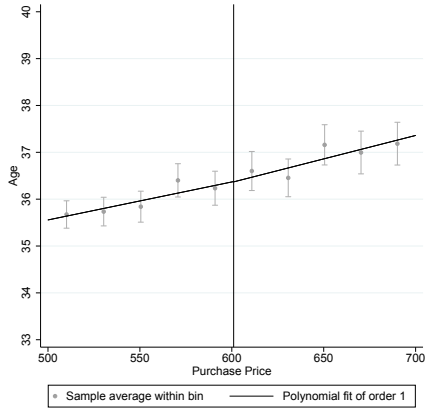


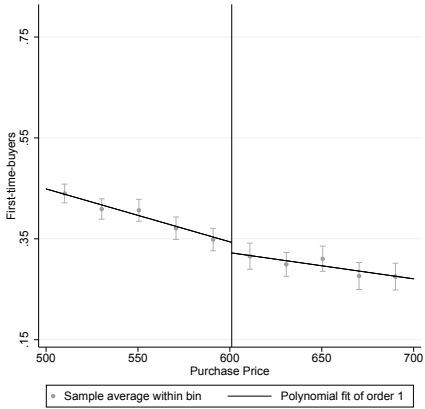
Younger Borrowers and More First-Time-Buyers...



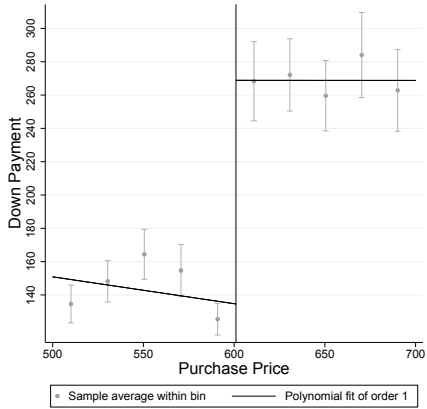


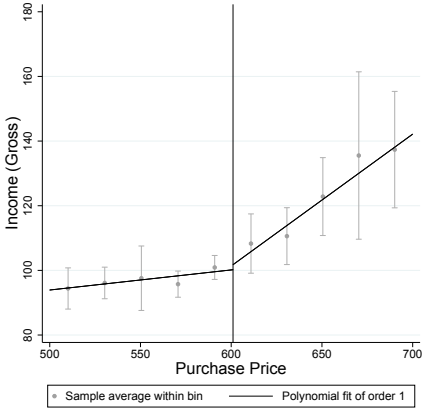
... and No Difference for Old Houses (Placebo)





Lower Down Payment and Correlation House Value with Income...





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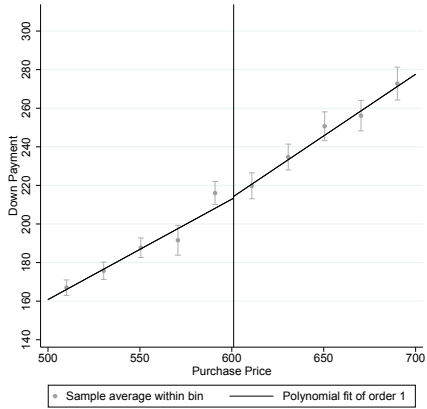
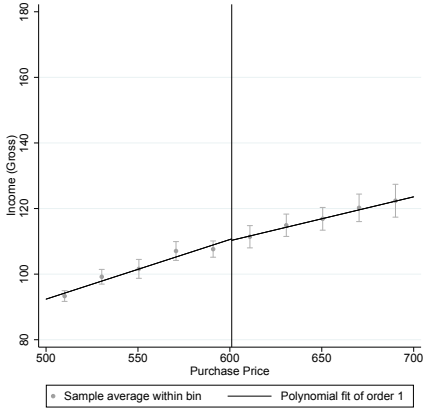
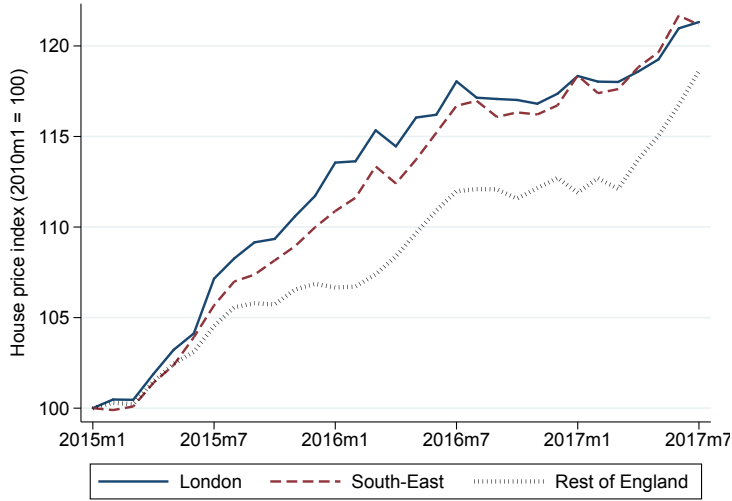




1c) London Increase in EL Limit from 20% to 40% in 2016

Difference-in-Difference: London VS South-East



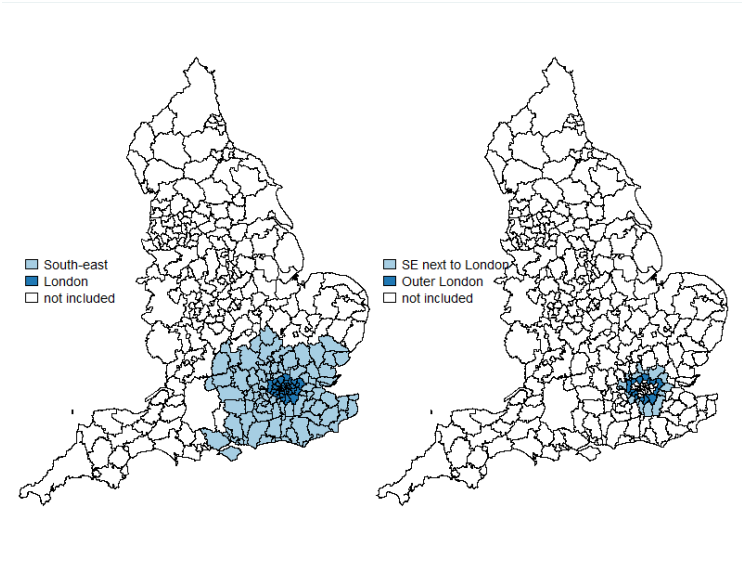
Property Value ↑, Mortgage Size ∼

$$y_{it} = \alpha_0 + \alpha_1 \text{London}_i + \alpha_2 \text{PostJan2016}_t + \alpha_3 \text{London}_i \times \text{PostJan2016}_t + \beta x_{it} + \epsilon_{it}$$

	(1) Equity loan	(2) Purchase price	(3) Down payment	(4) Mortgage amount	(5) Deflated purchase price	(6) Square meters
London × Post Jan 2016	37.24***	34.82***	1.27	-3.69	29.61***	6.31*
	(5.93)	(8.77)	(2.18)	(3.60)	(8.14)	(3.22)
London	7.51***	41.16***	10.85***	22.80***	40.69***	-21.39***
	(1.75)	(8.57)	(2.68)	(4.50)	(8.47)	(3.01)
Post Jan 2016	-5.84***	-8.98**	-1.70	-1.44	-8.50**	2.10
	(1.30)	(4.15)	(1.42)	(2.43)	(4.03)	(1.82)
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Regional house price index	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.45	0.56	0.12	0.62	0.55	0.18
N	10,037	10,037	10,037	10,037	10,037	9,858

Parallel trends

Difference-in-Difference: Border Analysis



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	(1) Equity loan	(2) Purchase price	(3) Down payment	(4) Mortgage amount	(5) Deflated purchase price	(6) Square meters
London × Post Jan 2016	37.80***	40.89***	3.35	-0.27	36.54***	6.14
	(7.71)	(13.07)	(3.16)	(6.13)	(12.35)	(6.95)
London	3.57	20.94*	6.25*	11.12	20.70*	-14.68**
	(2.69)	(12.48)	(3.64)	(7.05)	(12.35)	(6.14)
Post Jan 2016	-10.38**	-0.54	1.95	7.89	0.71	-7.51
	(4.44)	(11.97)	(3.38)	(7.26)	(11.50)	(7.88)
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Regional house price index	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.38	0.49	0.11	0.55	0.48	0.17
N	2,020	2,020	2,020	2,020	2,020	1,979

Outline

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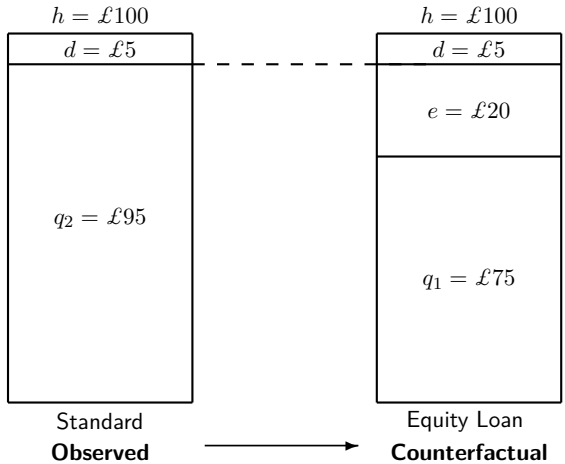
- **Empirical Strategy:**
  - Measure based on expected growth rate of house price appreciation (1&2)
  - Comparison non-takers and takers (1&2)
  - Repayment behavior of initial takers (1 only)

2a) A Simple Break-even Rate of Expected House Price Growth

Eligible Borrowers **Without EL**: Constructing the Counterfactual



Alternative counterfactual

Equity Loans VS Standard Mortgages: Cash Flows

Period:	0	t	$T = 2years$
EL (**counterfactual**)	$-d$	-$mp_{1,t}$	$0.8h_T - q_{1,T}$
Standard (**observed**)	$-d$	-$mp_{2,t}$	$h_T - q_{2,T}$
Δ (**'money left on the table'**)	0	$mp_{2,t} - mp_{1,t}$	$0.2h_T - (q_{2,T} - q_{1,T})$

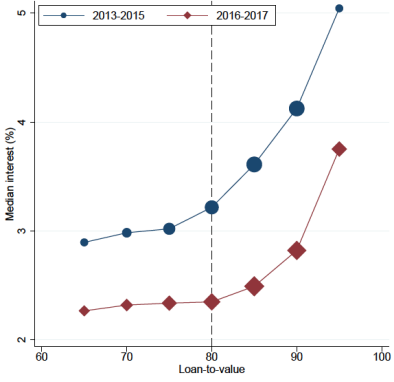
d: down payment; mp: monthly mortgage payment; q: mortgage balance; h: house value

- Break-even house price appreciation: property value increase that makes money left on the table equal to zero

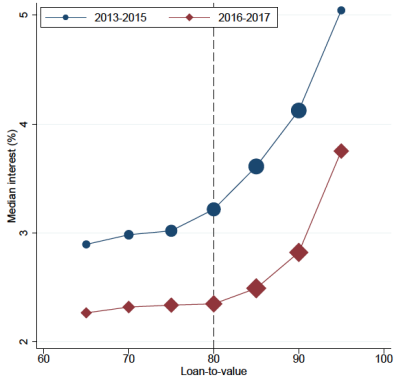
$$h_T^* \quad \longleftrightarrow \quad \Delta = 0$$

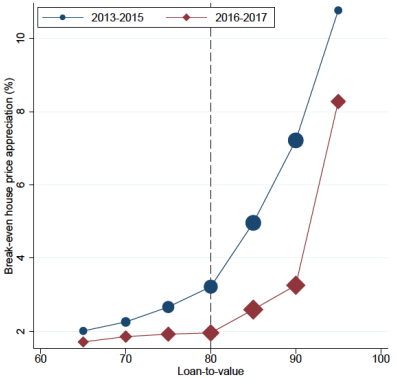
Interest rate gains with EL | Counterfactual Monthly Payments

Interest Rates



Interest Rates and Break-even Rates





- Median break-even house price appreciation for high LTV: 7.7%
- Smaller credit spread for high LTV $\rightarrow$ crowd out demand for EL

2b) Comparing Non-takers and Takers

Comparing Non-takers and Takers

	Non-EL borrowers				EL
	1st quartile	2nd quartile	3rd quartile	4th quartile	borrowers
Break-even hp appreciation (%)	0.66	3.01	5.10	9.32	

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First time buyers (%)	0.31	0.32	0.43	0.47	0.69
Age (Years)	39.51	39.97	35.85	34.15	32.20
Gross income (£.000)	65.06	52.52	58.72	53.01	47.03

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Gross income (£.000)	65.06	52.52	58.72	53.01	47.03
Combined LTV	60.26	57.25	72.12	84.08	91.71
Combined LTI	3.28	2.95	3.03	3.27	4.40
Property value (£.000)	317.41	238.21	212.94	198.07	215.33

- High break-even non EL borrowers and EL borrowers:
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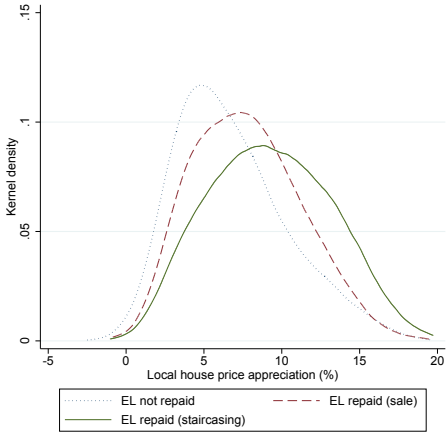
Housing consumption to income	5.76	5.50	4.17	3.96	4.88
Housing exposure to income	5.76	5.50	4.17	3.96	3.91

- High break-even non EL borrowers and EL borrowers:
  - Need external financing (high LTV-LTI, external equity)
  - $\sim$ housing investment, but EL higher housing consumption

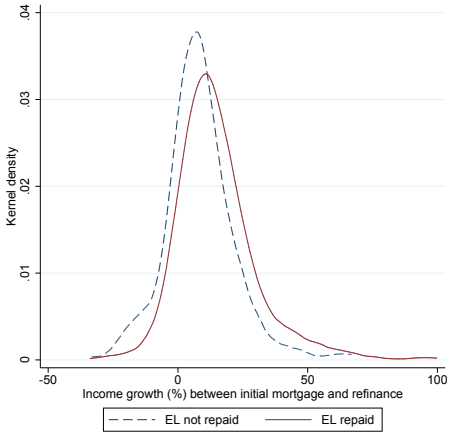
2c) Equity Loan Repayment Behavior

Borrowers Repay EL When:

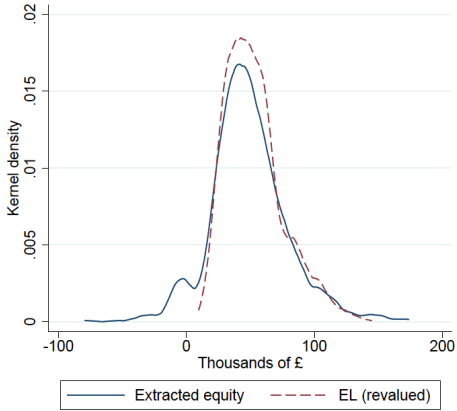
- Δ house price relaxes LTV constraint



- Δ income relaxes LTI constraint



To Repay, EL Borrowers Refinance and Extract Equity



- Equity extraction = New loan balance - previous loan balance $\sim$ equity loan
- Increase housing investment (not finance non-housing consumption)

Outline

Macro-Pru Rules & House Inflation $\rightarrow$ Narrower Path to Ownership

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- **Affordability considerations behind demand for ELs in UK**
  - EL buyers are younger, FTB and unlikely to purchase same house without scheme
  - Increase in EL limit in London $\rightarrow$ more expensive houses, not lower leverage

Macro-Pru Rules & House Inflation → Narrower Path to Ownership

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- **A significant proportion of eligible buyers have not used EL**
  - High house price expectations (in a boom?) rationalize choice of high LTV buyers
  - Low rate spreads for high LTV reduce benefits of EL (crowd out product innovation)

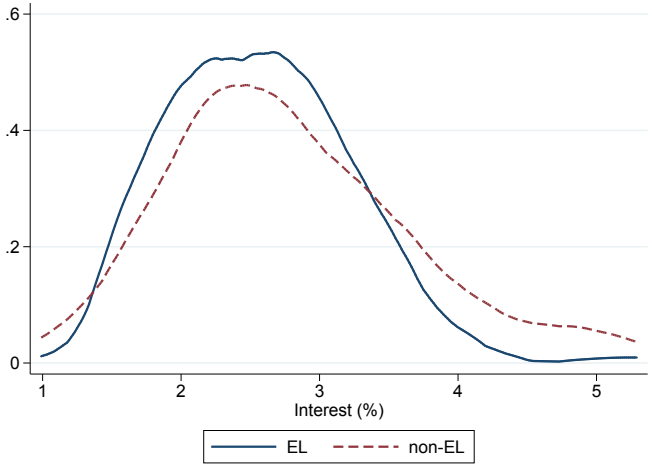
Macro-Pru Rules & House Inflation → Narrower Path to Ownership

- **Affordability considerations behind demand for ELs in UK**
  - EL buyers are younger, FTB and unlikely to purchase same house without scheme
  - Increase in EL limit in London → more expensive houses, not lower leverage
- **A significant proportion of eligible buyers have not used EL**
  - High house price expectations (in a boom?) rationalize choice of high LTV buyers
  - Low rate spreads for high LTV reduce benefits of EL (crowd out product innovation)
- **Government takes risks**
  - Better position to absorb losses?
  - EL viable alternative to subsidizing high LTV mortgages (e.g. FHA loans in US)

Appendix

Interest Rate Distribution

Non-EL right tail is fatter and mean interest rate is higher



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Summary statistics: EL vs. non-EL borrowers

First time buyers only

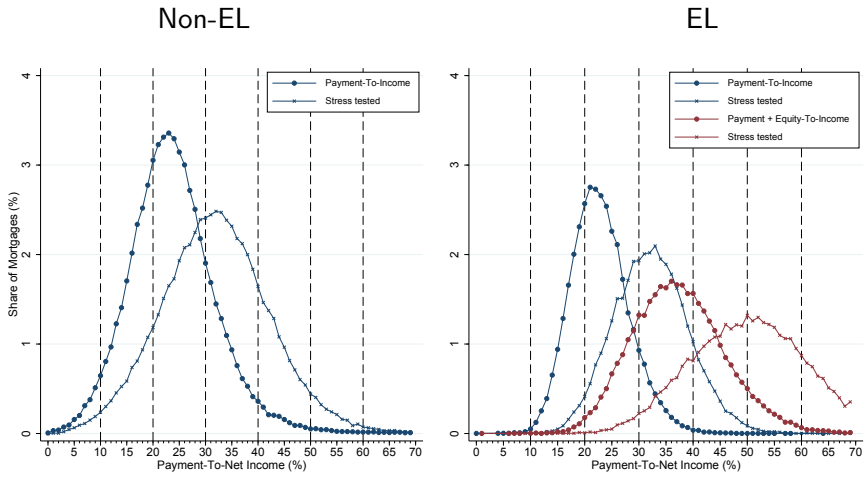
	EL		Non-EL		
	Mean	SD	Mean	SD	Difference
Age (Years)	30.27	(6.48)	31.42	(7.61)	-1.15***
Gross income (£.000)	47.33	(37.92)	51.14	(388.25)	-3.81***
Property value (£.000)	223.87	(97.56)	214.15	(115.81)	9.72***
Down payment (£.000)	17.71	(19.90)	62.42	(73.67)	-44.70***
Equity loan (£.000)	46.86	(28.74)	0.00	(0.00)	46.86***
Mortgage value (£.000)	159.56	(65.94)	151.47	(83.24)	8.10***
Interest Rate (%)	2.58	(0.65)	2.95	(0.89)	-0.37***
Maturity (Years)	29.73	(6.28)	27.49	(6.11)	2.24***
2-year fixed (%)	0.45	(0.50)	0.41	(0.49)	0.04***
Other fixed (%)	0.53	(0.50)	0.51	(0.50)	0.02***
LTV	72.11	(7.04)	67.66	(21.13)	4.45***
Combined LTV	92.53	(6.16)	67.67	(21.25)	24.85***
LTI	3.53	(0.72)	3.20	(0.98)	0.33***
Combined LTI	4.57	(1.25)	3.22	(1.51)	1.35***
Payment-To-Gross income (%)	17.02	(3.97)	17.54	(8.89)	-0.53***
Payment-To-Net income (%)	22.99	(5.21)	23.50	(11.01)	-0.51***
N	73,140		67,052		140,192

Summary statistics: EL vs. non-EL borrowers

First time buyers only, controlling for region and year fixed effects

	EL		Non-EL		
	Mean	SD	Mean	SD	Difference
Age (Years)	31.17	(0.05)	32.15	(0.05)	-0.97***
Gross income (£.000)	56.80	(1.94)	57.74	(2.09)	-0.94
Property value (£.000)	292.12	(0.61)	268.63	(0.66)	23.50***
Down payment (£.000)	31.12	(0.35)	72.64	(0.38)	-41.51***
Equity loan (£.000)	51.39	(0.09)	0.00	(0.00)	51.39***
Mortgage value (£.000)	204.98	(0.47)	188.50	(0.51)	16.48***
Interest Rate (%)	2.35	(0.01)	2.47	(0.01)	-0.11***
Maturity (Years)	30.36	(0.04)	28.52	(0.05)	1.84***
2-year fixed (%)	0.62	(0.00)	0.67	(0.00)	-0.05***
Other fixed (%)	0.37	(0.00)	0.26	(0.00)	0.11***
LTV	70.01	(0.11)	66.16	(0.12)	3.85***
Combined LTV	92.07	(0.06)	66.16	(0.12)	25.91***
LTI	3.73	(0.01)	3.38	(0.01)	0.35***
Combined LTI	4.81	(0.01)	3.38	(0.01)	1.43***
Payment-To-Gross income (%)	17.37	(0.05)	17.31	(0.06)	0.07
Payment-To-Net income (%)	24.41	(0.07)	24.41	(0.07)	0.00

EL Also Relaxes PTI Checks...



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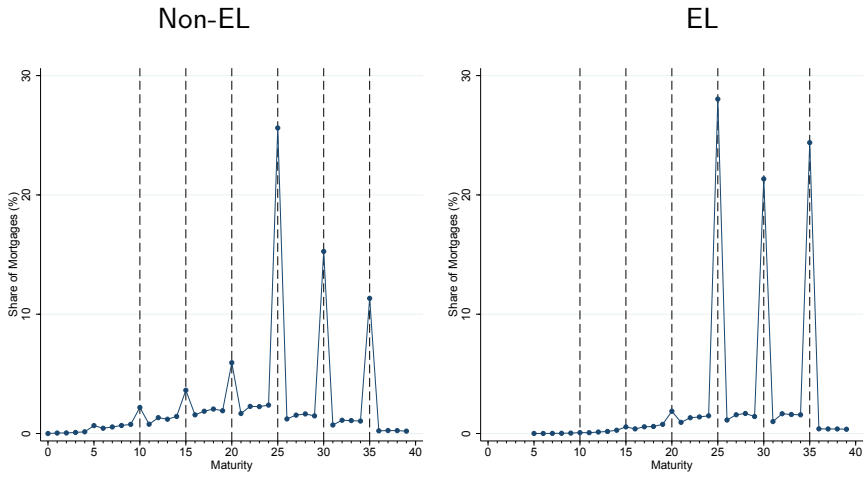
...Together with Longer Maturities.



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PTI With Expenditures

	Obs.	Mean	Sd	p1	Median	p99
Panel A - All						
PTI (gross)	87,588.0	17.1	4.9	6.3	16.9	30.5
PTI (net)	87,596.0	24.3	7.7	9.0	23.5	49.1
Panel B - Three banks						
PTI (gross)	19,150.0	16.6	4.4	6.3	16.7	28.2
PTI (net)	19,151.0	22.7	6.2	8.5	22.6	39.9
PTI (net - other debt)	19,151.0	23.2	6.6	8.5	23.0	42.4
PTI (net - other debt - exp.)	19,151.0	42.9	13.9	15.5	41.7	87.9

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Combined LTV and LTI Constraints

Panel A: Loan cut-offs at Cumulative LTV=95%, Cumulative LTI=4.5

	All				First time buyers			
	CLTI $\leq$ 4.5		CLTI $>$ 4.5		CLTI $\leq$ 4.5		CLTI $>$ 4.5	
CLTV $\leq$ 95%	45,785	(46%)	53,510	(54%)	33,330	(46%)	39,584	(54%)
CLTV $>$ 95%	157	(0%)	119	(0%)	126	(0%)	100	(0%)

Panel B: Loan cut-offs at Cumulative LTV=90%, Cumulative LTI=4.5

	All				First time buyers			
	CLTI $\leq$ 4.5		CLTI $>$ 4.5		CLTI $\leq$ 4.5		CLTI $>$ 4.5	
CLTV $\leq$ 90%	7,820	(8%)	16,189	(16%)	4,073	(6%)	9,760	(13%)
CLTV $>$ 90%	38,122	(38%)	37,440	(38%)	29,383	(40%)	29,924	(41%)

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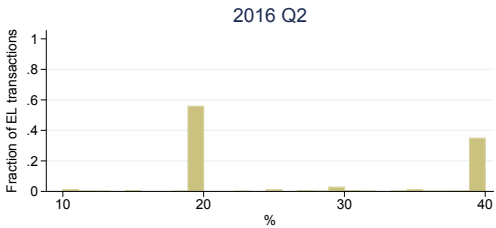
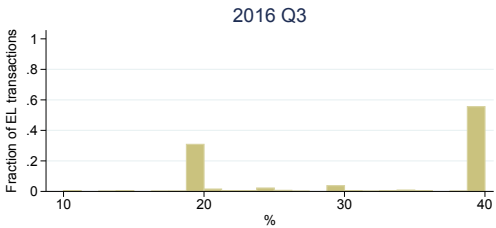
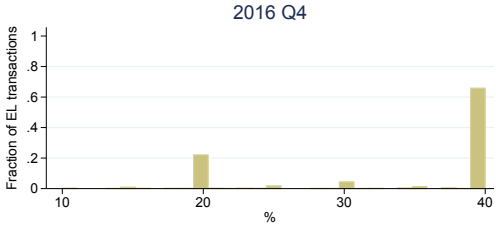
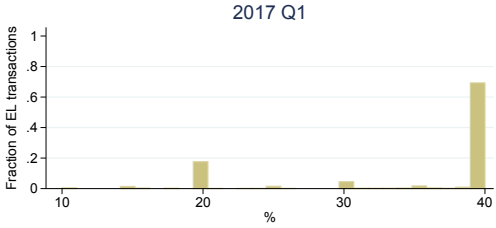
Down payment to value and EL to value distributions in London









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Effect of the introduction of the London EL scheme

	Values in £1,000				
	(1) Equity loan	(2) Purchase price	(3) Down payment	(4) Mortgage amount	(5) Deflated purchase price
London × Post Jan 2016	37.32***	34.88***	1.26	-3.71	29.58***
	(6.02)	(8.97)	(2.20)	(3.61)	(8.21)
London	7.73***	41.67***	10.95***	23.00***	40.90***
	(1.78)	(8.64)	(2.71)	(4.51)	(8.51)
Post Jan 2016	2.51***	13.38***	4.16***	6.71***	-0.98
	(0.52)	(2.51)	(0.86)	(1.45)	(2.41)
Borrower characteristics	Yes	Yes	Yes	Yes	Yes
Regional house price index	No	No	No	No	No
r2	0.45	0.55	0.12	0.62	0.55
N	10,073	10,073	10,073	10,073	10,037

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Number of EL deals: six months before/after introduction of London EL

	London	Outside
Pre	1,010	14,874
Post	1,180	15,794
Δ	$+18\%$	$+6\%$

- Pre: 6 months up to Jan 2016
- Post: 6 months starting Feb 2016

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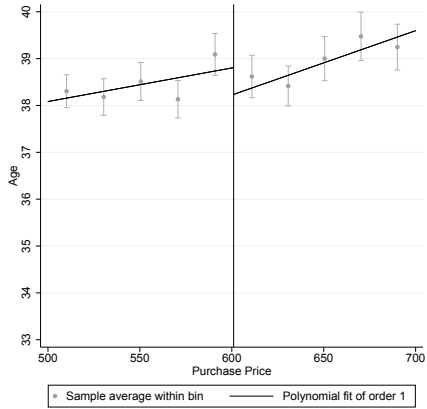
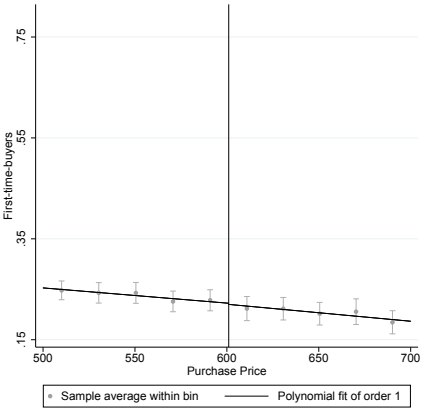
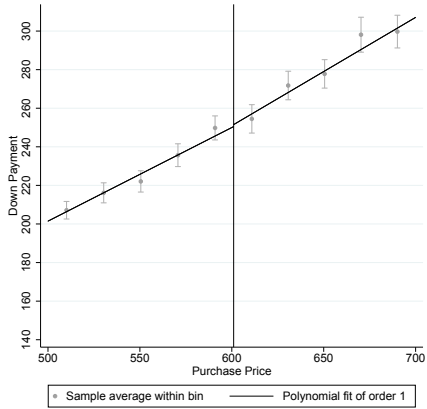
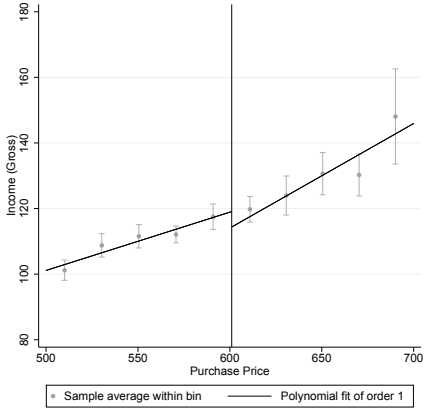
... No Difference Around Threshold for New Built Before Policy Change...



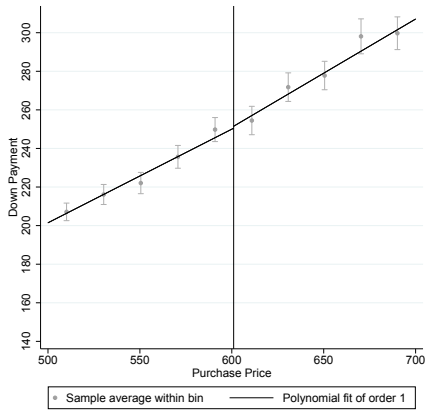


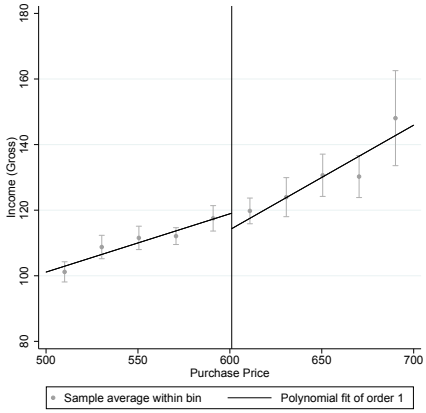
... No Difference Around Threshold for New Built Before Policy Change...





... No Difference Around Threshold for New Built Before Policy Change...





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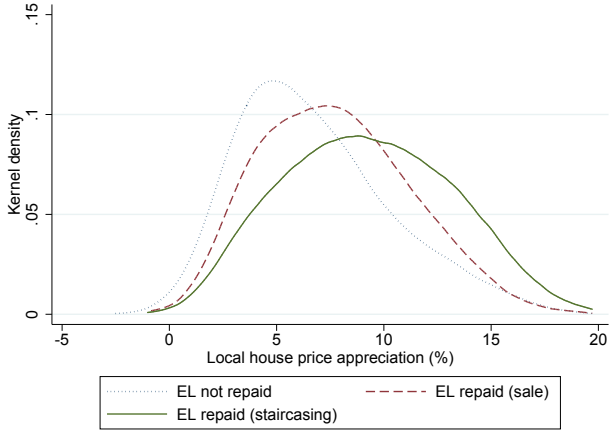
... and They Experienced House Price Growth → Relaxes LTV...



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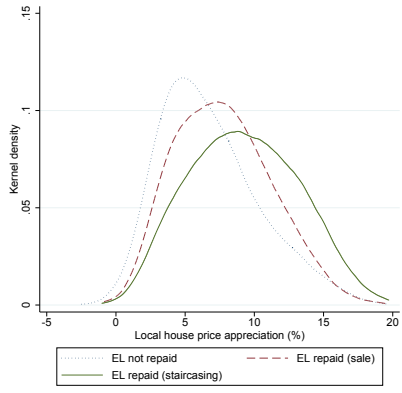
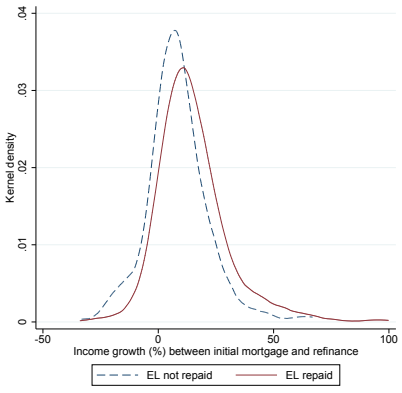
...or Income Growth → Relaxes LTI





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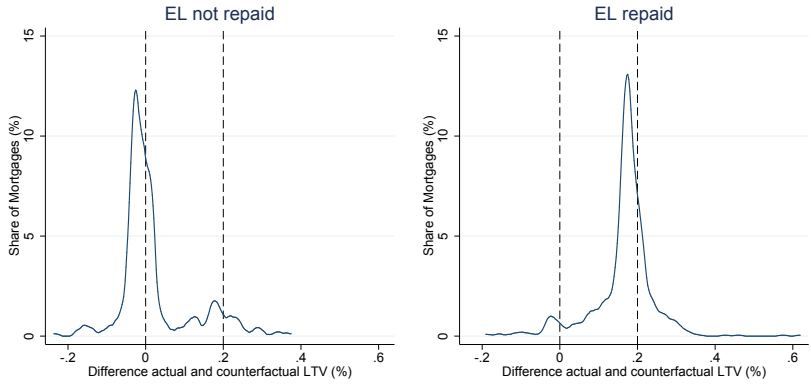
LTV Difference at Repayment



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Interest rate gains with EL for non-EL borrowers

	mean	sd	p10	p50	p90
Panel A: Two-year fixed rate (2013- 2015)					
LTV $>$ 85	1.47	0.71	0.65	1.34	2.50
75 $<$ LTV $\leq$ 85	0.69	0.63	-0.10	0.75	1.40
LTV $\leq$ 75	0.04	0.58	-0.60	0.00	0.75
Panel B: Full sample (2013-2017)					
LTV $>$ 85	1.11	0.82	0.00	1.18	2.15
75 $<$ LTV $\leq$ 85	0.47	0.63	-0.21	0.45	1.25
LTV $\leq$ 75	0.08	0.54	-0.45	0.00	0.70
Panel C: Full sample (2015-2017)					
LTV $>$ 85	1.07	0.79	0.10	1.07	2.10
75 $<$ LTV $\leq$ 85	0.30	0.52	-0.28	0.26	0.90
LTV $\leq$ 75	0.06	0.49	-0.40	0.00	0.55
LTV $>$ 85 (match with fee band)	1.09	0.70	0.25	1.10	1.90
75 $<$ LTV $\leq$ 85 (match with fee band)	0.31	0.48	-0.15	0.30	0.80
LTV $\leq$ 75 (match with fee band)	0.07	0.43	-0.28	0.00	0.46

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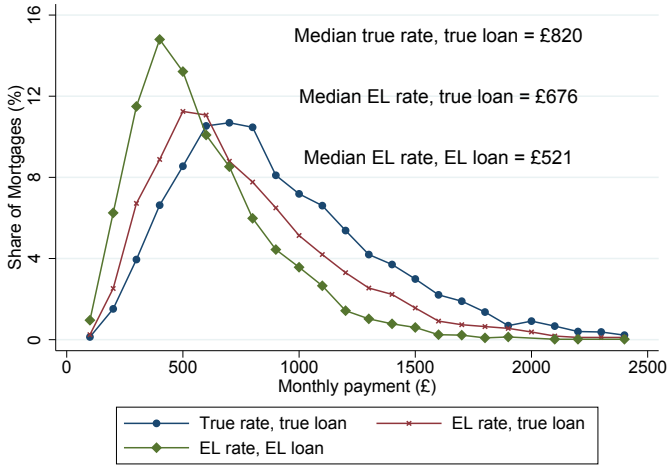
Distribution of Counterfactual Monthly Payments

2-year fixed, 2013-2015, LTV $>$ 85%



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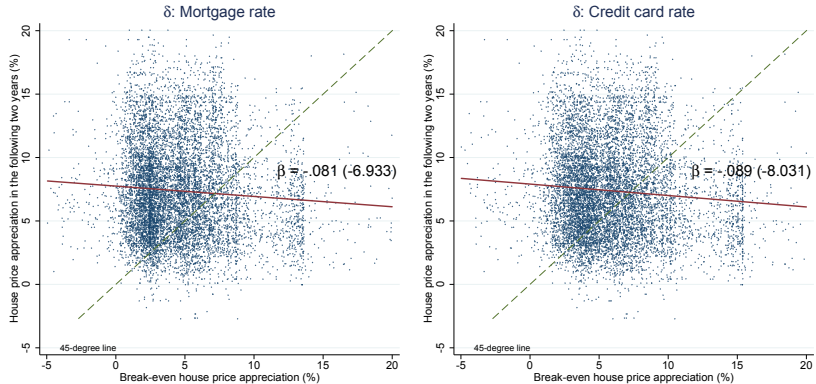
Break-even and Actual House Price Appreciation

2-year fixed, 2013-15



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House Price Effect: EL vs non-EL Within New Builds

	(1)	(2)	(3)	(4)
	Δ log Price	Δ log Price	Δ log Price	Δ log Price
EL	-0.033***	-0.027***	-0.018***	-0.005
	(0.008)	(0.006)	(0.005)	(0.006)
Fixed effects		Purchase year X Sale year	Purchase year X Sale year, LA	Purchase year X Sale year X LA
SE clustering	LA, sale month	LA, sale month	LA, sale month	LA, sale month
r2	0.00	0.01	0.06	0.24
N	38,864	38,863	38,863	37,887

Standard errors in parentheses

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

An Alternative Counterfactual

- **Actual choice:** £15 down payment, £85 mortgage
  - house consumption: £100
  - house investment: £100

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An Alternative Counterfactual

- **Actual choice:** £15 down payment, £85 mortgage
  - house consumption: £100
  - house investment: £100

- **Our counterfactual:** £15 down payment, £65 mortgage, £20 EL
  - $=$ house consumption: £100
  - $\neq$ house investment: £80

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An Alternative Counterfactual

- **Actual choice:** £15 down payment, £85 mortgage
  - house consumption: £100
  - house investment: £100
- **Our counterfactual:** £15 down payment, £65 mortgage, £20 EL
  - $=$ house consumption: £100
  - $\neq$ house investment: £80
- **Alternative counterfactual:** £15 down payment, £85 mortgage, £25 EL
  - $\neq$ house consumption: £125
  - $=$ house investment: £100

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Horse-racing Expectation VS Hedging Motives

	(1)	(2)	(3)	(4)	(5)
Standard deviation past hp appreciation	0.011			0.002	-0.000
	(0.011)			(0.010)	(0.008)
Past house price appreciation (1 year)		-0.011***		-0.011***	
		(0.002)		(0.003)	
Past house price appreciation (2 years)			-0.014***		-0.014***
			(0.003)		(0.003)
Mean Y	0.35	0.35	0.35	0.35	0.35
SD Y	0.12	0.12	0.12	0.12	0.12
N	329	329	329	329	329

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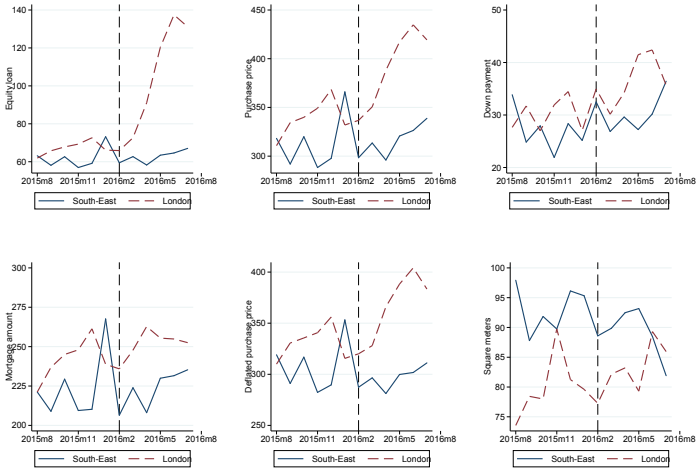
Parallel Trends



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