Asymmetric Information about Collateral Values

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Empirical Household Finance - PhD Class

Motivation

- Differential information between competing mortgage lenders:

  – Borrower characteristics

  – Collateral values

- Market for lending to purchase newly developed properties:

  – Integrated Lender, usually owned by developer.

  – 85% of houses in developments with integrated lender, 70% market share.

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- What I do in this paper:

  - Construct a dataset of all housing transactions & mortgages in AZ.

  - Analyze sources and magnitude of superior information.

Motivation

- Simple framework modeled in paper:

  - First-price sealed-bid auction, (Engelbrecht-Wiggans et al., 1983).

    - Good and bad houses sell at pooling price.

    - Borrower simultaneously approaches lenders for offer.

    - Integrated lender conditions offer on informative signal.

    - Borrower accepts most attractive offer.

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- Borrower and non-integrated lender cannot extract (all) of the integrated lender's information from its bid.

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- Non-integrated lenders increase interest rates when competing with integrated lender.

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- The interest rate increase is larger when:
  1. Housing return is more sensitive to construction quality.
  2. Mortgage cash-flows are more sensitive to housing returns.

Data Description

- **Ownership-Changing Deeds**

    - Transaction: Date, Price, Parties Involved $+$ Classification

    - Precise Location of House

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    - Characteristics (Size, Bedrooms, Bathrooms), Year Built

    - Market Value Assessment

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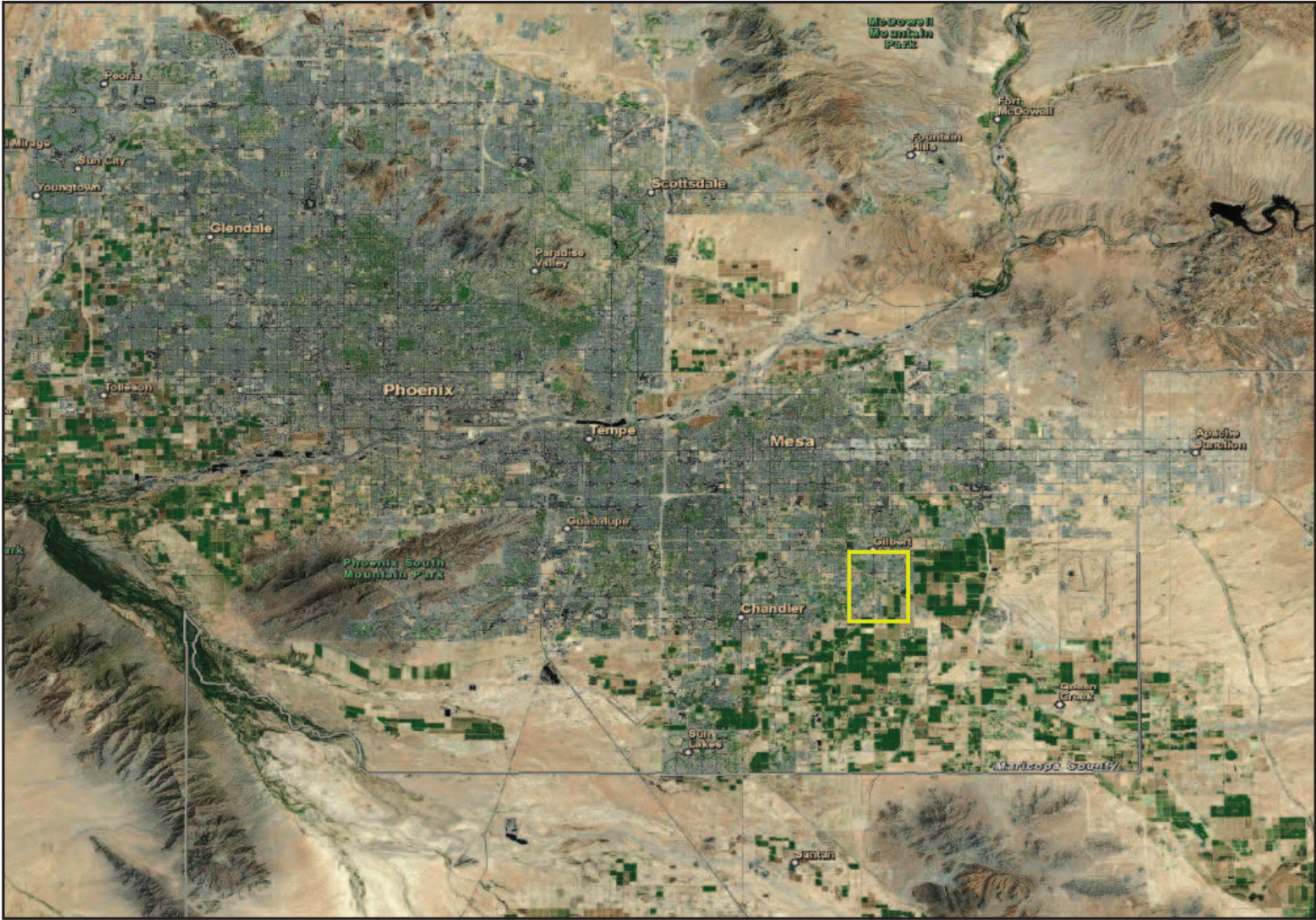   - Mortgage Information (Amount, Lender, Interest, Duration)

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- **HMDA - Mortgage applications**

    - Mortgage Information

    - Applicant Income, Race and Sex

Maricopa County, AZ
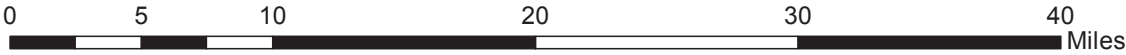
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Empirical Predictions - Housing Return
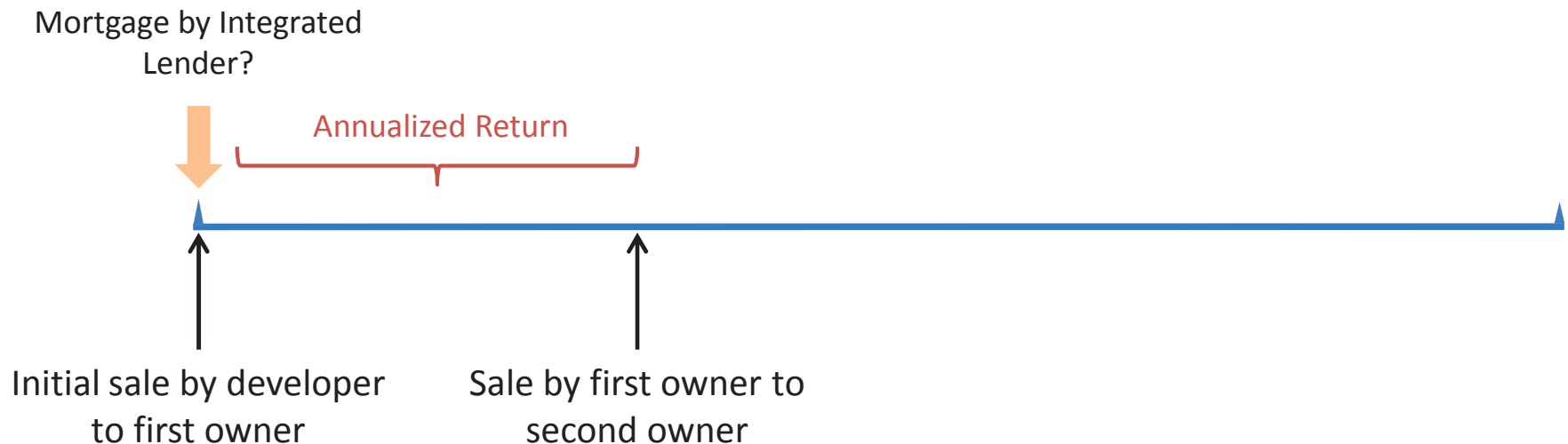
Developments with Integrated Lender

- The capital gain of houses financed by an integrated lender is higher than that of ex-ante similar houses financed by non-integrated lenders.

Annualized Return - Repeat Sales Data

- Single-family residences with repeat sales in developments with integrated lender.

- First sale between 2000 and 2007 (ca. $30,000$ observations).

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- Calculate annualized return of housing collateral.

Mortgage by Integrated
Lender?

Annualized Return

Initial sale by developer
to first owner

Sale by first owner to
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$$Return_i = \alpha + \kappa IntegratedLender_i + \delta_{q_1,q_2} + X_i\beta + \epsilon_i$$

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Controls

- **House Characteristics**: Initial sales price, lot size, building size, bedrooms, bathrooms, pool, garage spaces, rental property.

- **Owner Characteristics**: Income, Single, Asian, Latino.

- **Financing Characteristics**: Loan-to-Income, Loan-to-Value, Type, Duration.

- **6-digit census tract**: Median income, Percent High-school.

Annualized Return - Repeat Sales Data

Table: Annualized Return (Percentage Points) - Repeat Sales

	(1)	(2)	(3)	FORCED MOVES (4)	(5)
Integrated Lender	0.419*** (0.155)	0.441*** (0.119)	0.403*** (0.113)	0.418** (0.170)	0.376* (0.198)
Quarter-Pair Fixed Effect	✓	✓	✓	✓	✓
County Fixed Effect	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	·	✓
Owner Characteristics	·	✓	✓	·	✓
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Census Tract Demographics	·	✓	✓	·	✓
Developer Fixed Effects	·	✓	·	·	✓
Development Fixed Effects	·	·	✓	·	·
R-squared	0.869	0.887	0.896	0.885	0.903
Mean Dependent Variable	7.438	7.438	7.438	5.437	5.437
N	30,343	30,343	30,343	3,287	2,793

Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

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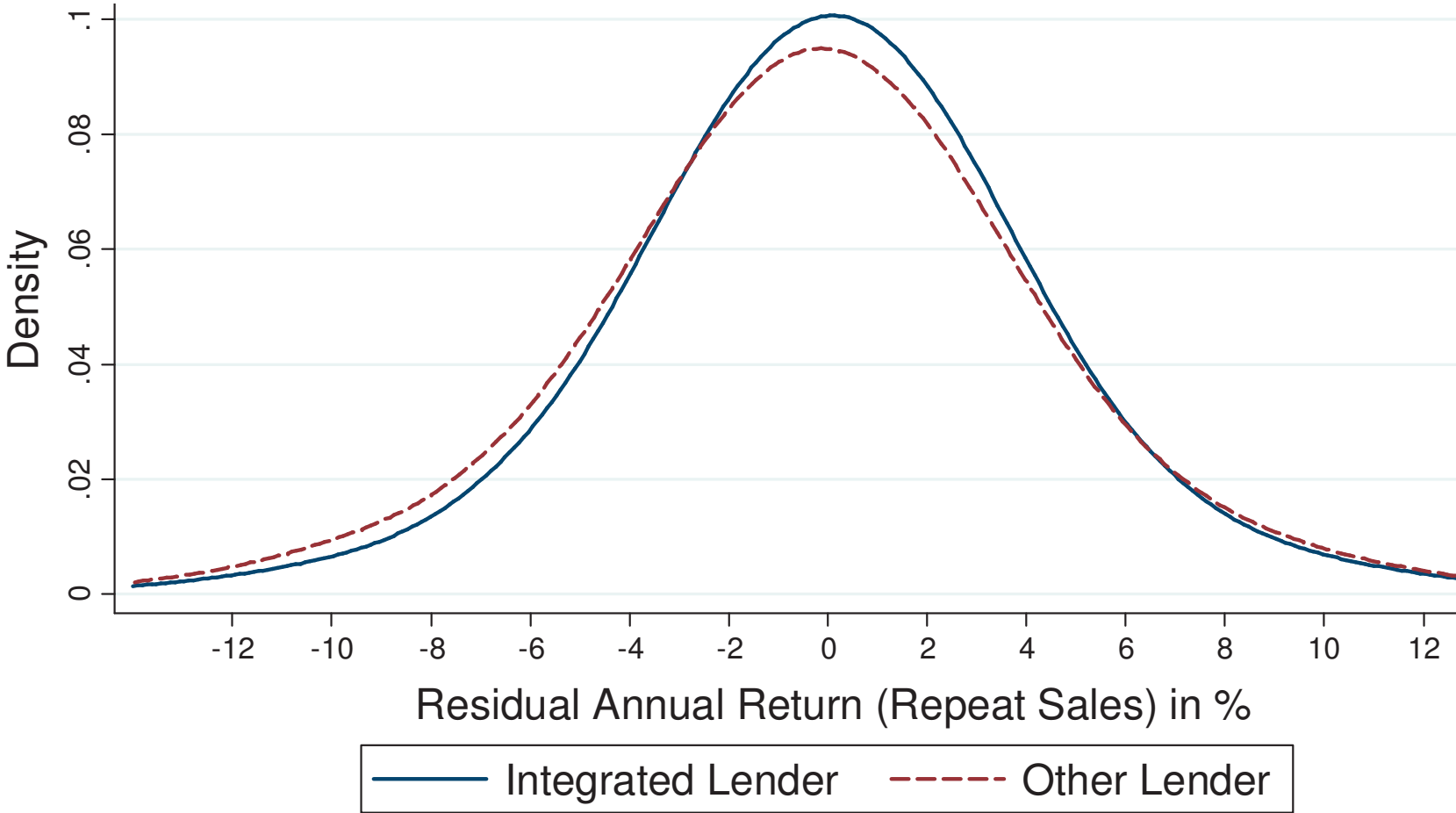Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

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Residual Annual Return (Repeat Sales) in %

Integrated Lender — — — Other Lender

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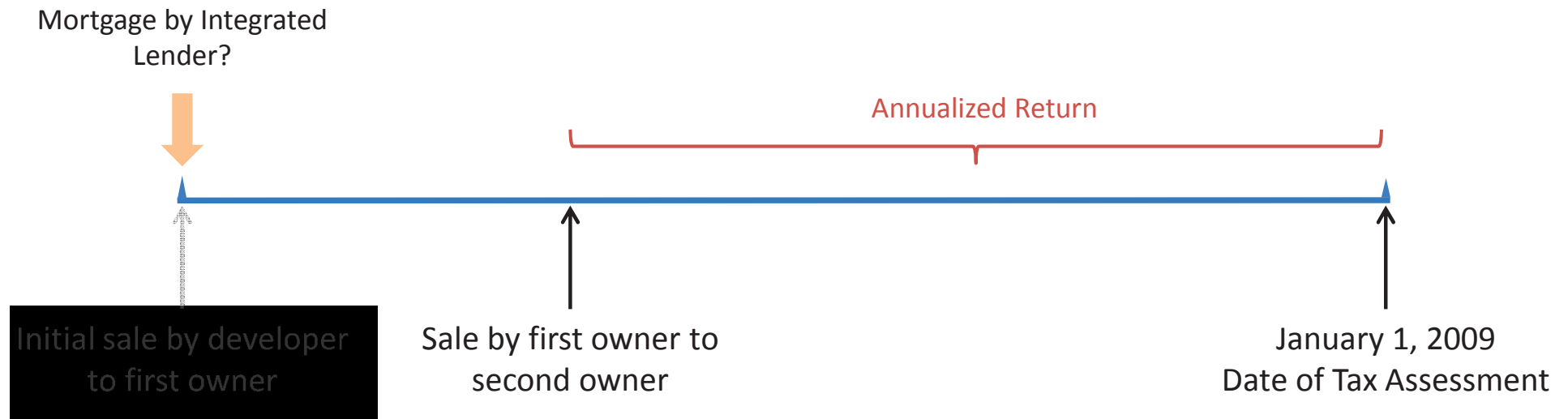|	(1)	(2)	(3)	FORCED MOVES (4)	(5)
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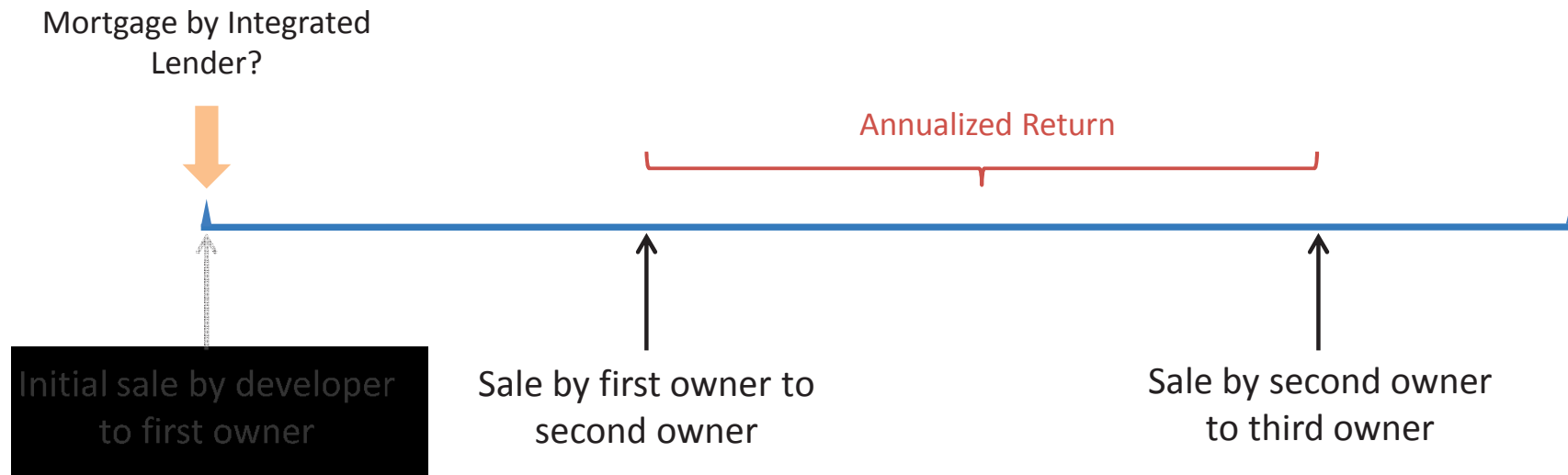# Source of Asymmetric Information

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January 1, 2009
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Sale by second owner
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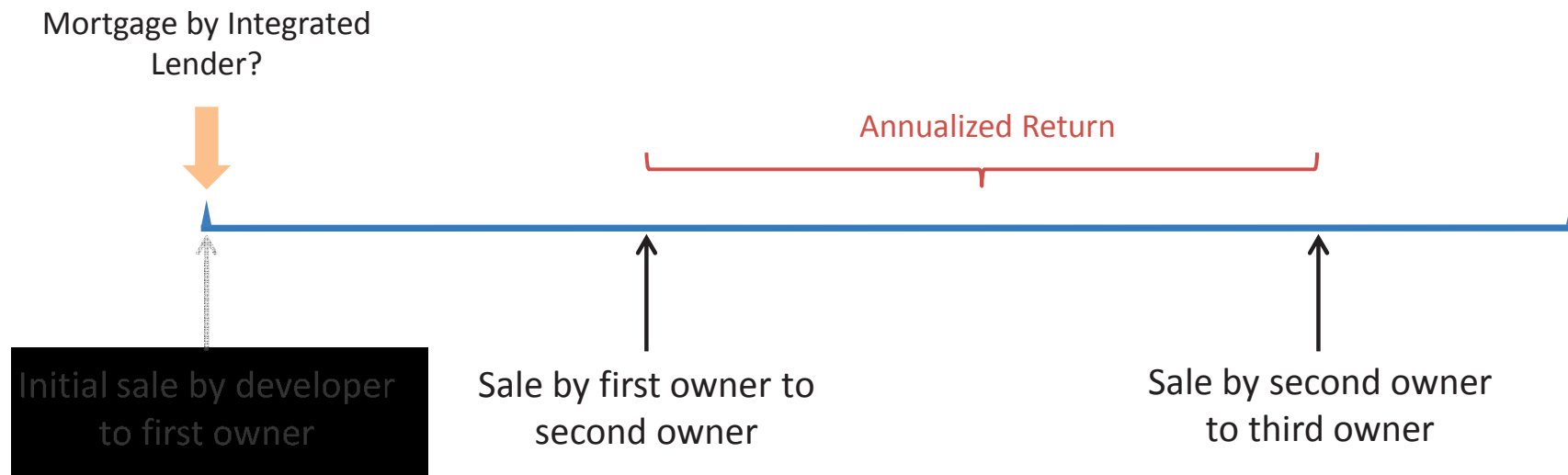- Outperformance over these horizons: $30 - 60$ bps.
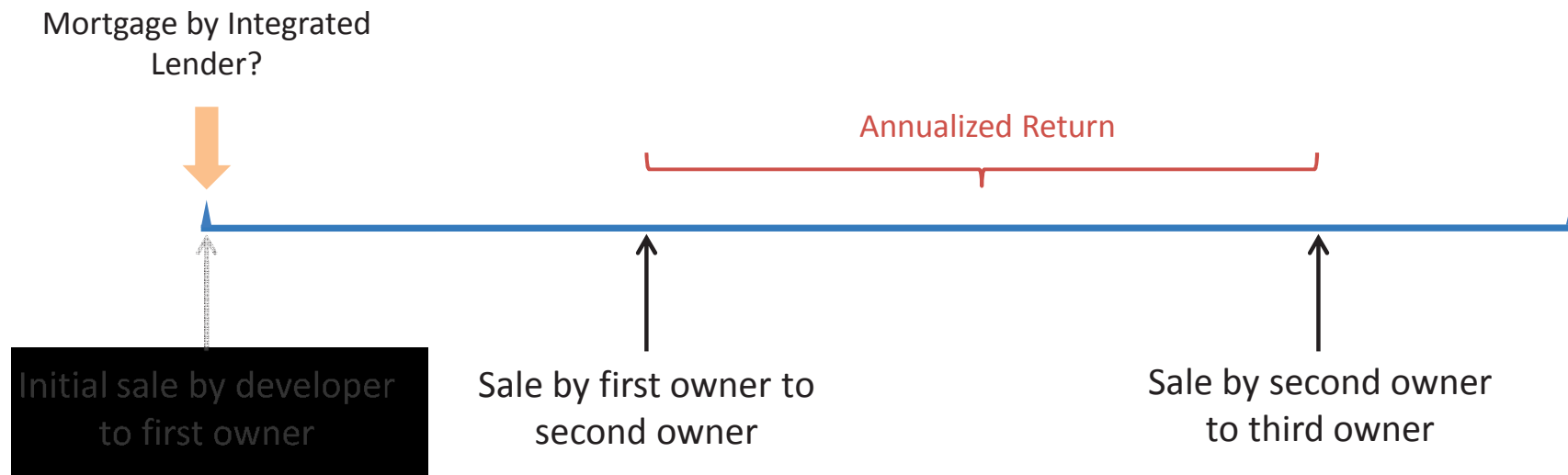
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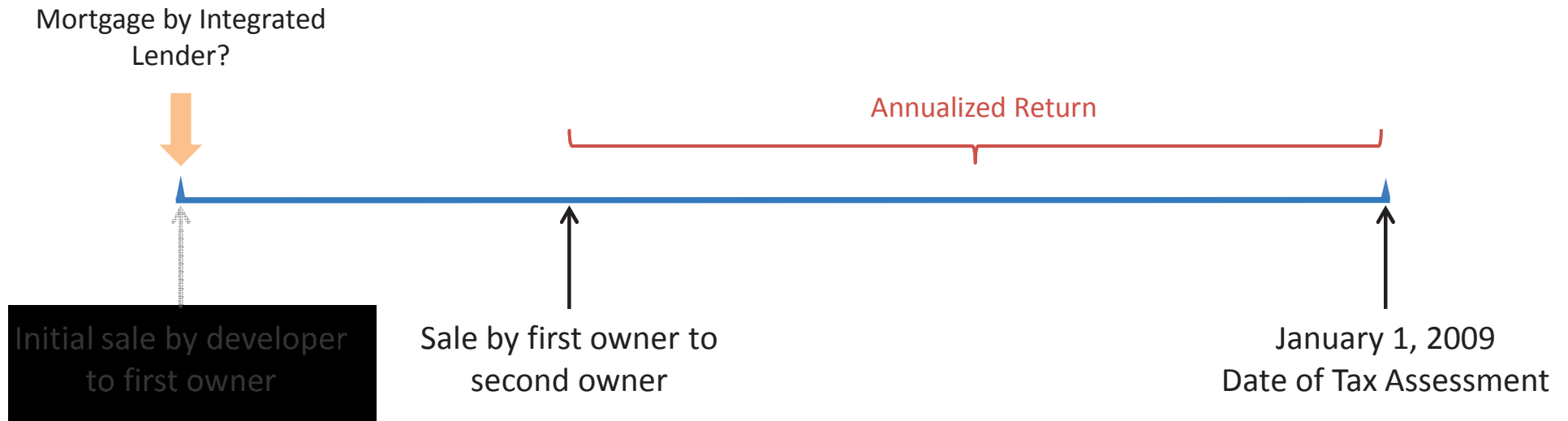to third owner

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Concern: Bundling House and Mortgage

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- BUT: Return over ownership of second owner.

Mortgage by Integrated Lender?

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January 1, 2009
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▸ Regression Tables – Year 2008   ▸ Timing

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- Analyze the text in properties that are listed in Trulia.com between 2005 and October 2010.

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    - Special Buyer: Handyman, Investor, Right Buyer.

Bundeling Concern

Table: Probability of Observing in Property Listing

	"As Is"		Damage Indicator		Special Buyer	
Integrated Lender	-0.028***	-0.026***	-0.010**	-0.011**	-0.012**	-0.016**
	(0.007)	(0.008)	(0.005)	(0.006)	(0.005)	(0.006)
Month of Sale Fixed Effect	✓	✓	✓	✓	✓	✓
Control Variables	✓	✓	✓	✓	✓	✓
Developer Fixed Effects	✓	✓	✓	✓	✓	✓
Development Fixed Effects	·	✓	·	✓	·	✓
Mean Dependent Variable	0.138	0.143	0.055	0.063	0.046	0.055
N	11,287	10,732	10,896	9,370	10,746	8,799

Controls for time between sale and listing, characteristics of the buyer, house, financing and census tract. Standard errors clustered at developer level. Significance: * (p<0.10), ** (p<0.05), *** (p<0.01).

Empirical Predictions - Housing Return

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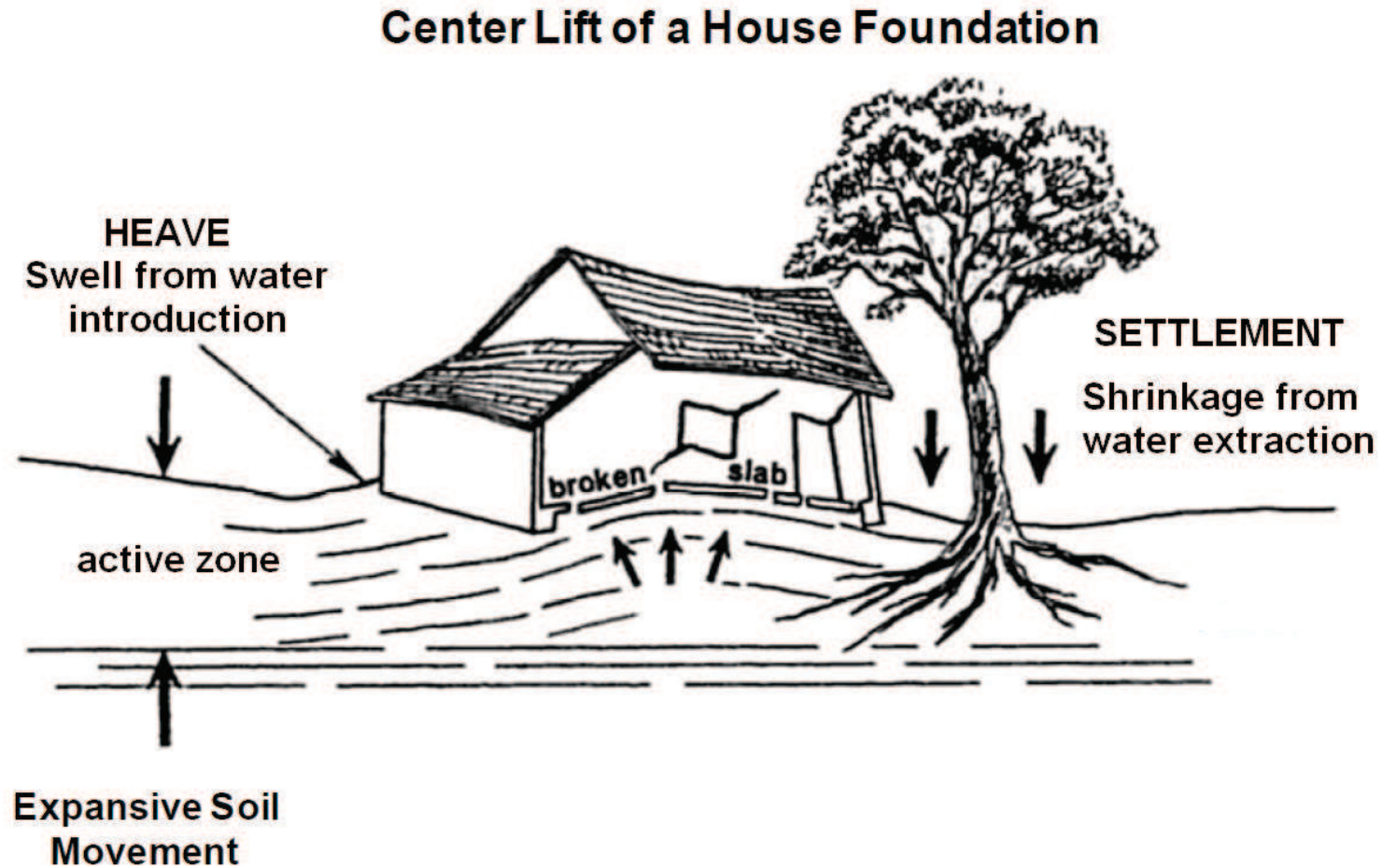   - Not driven by bundling home and mortgage.

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    - Exploit geographic differences in soil type.

Geological Variation - Expansive Soil

- In Arizona, many problems with newly constructed homes arise from insufficient care with "expansive soil."

Center Lift of a House Foundation

HEAVE
Swell from water
introduction

active zone

Expansive Soil
Movement

broken   slab

SETTLEMENT

Shrinkage from
water extraction

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  - *"Builders frequently ignore their own [soil reports'] recommendations. The reports typically recommend stronger foundations, but some builders resist them, citing cost."*

    (Arizona New Times, 2006)

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- Return of houses built on expansive soil is particularly sensitive to (unobservable aspects of) construction quality.
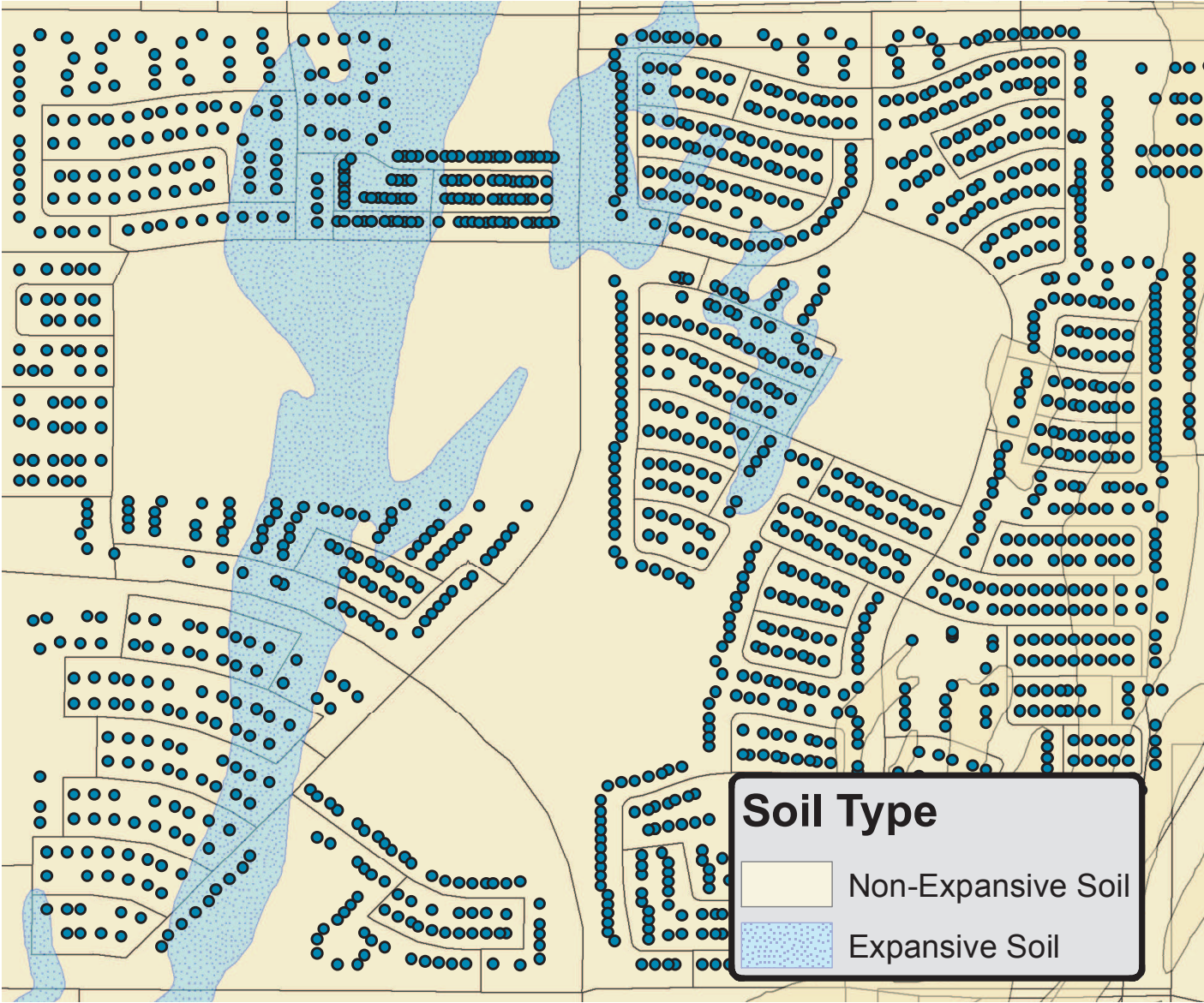
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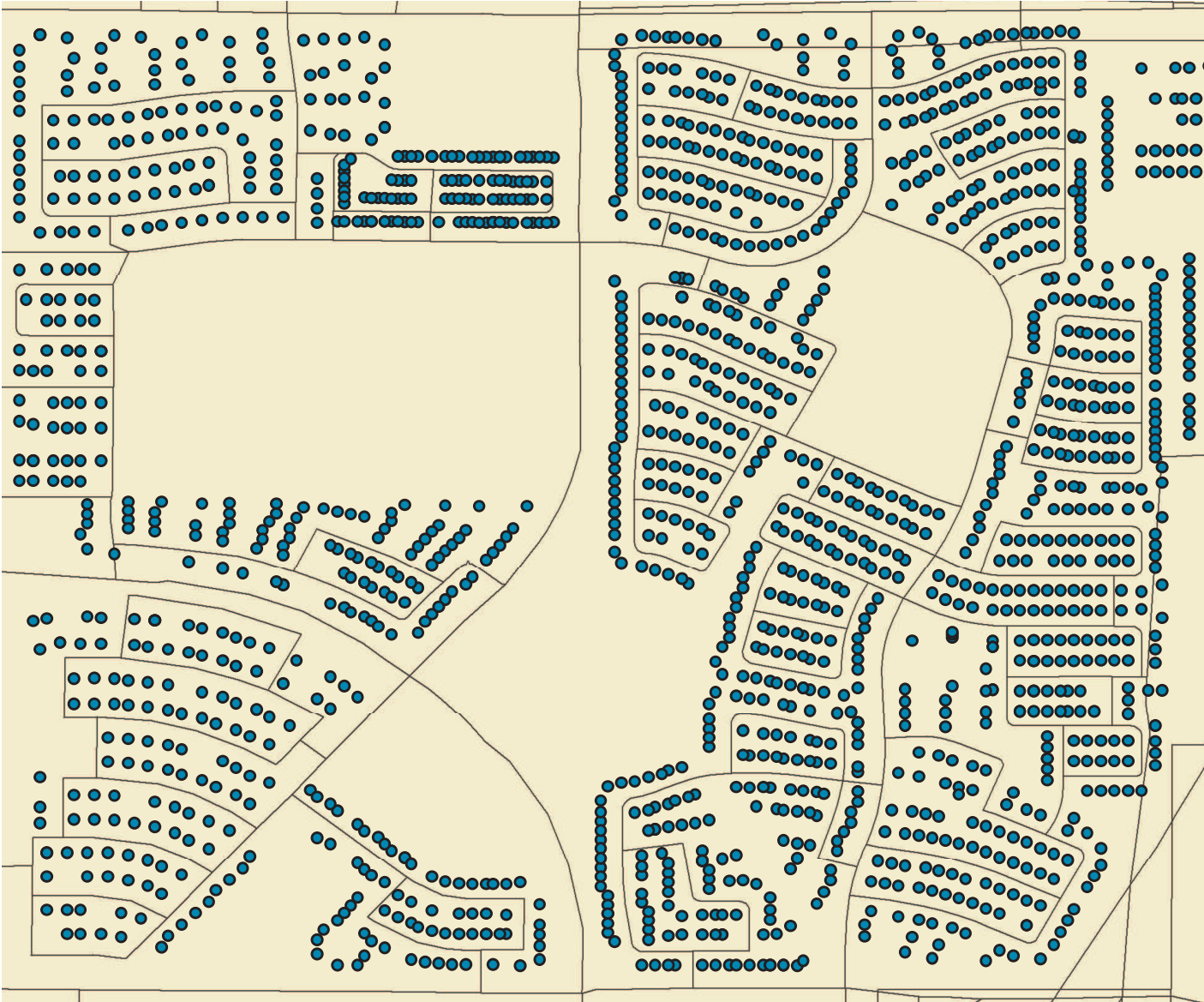
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- Assign each house an $ExpansiveSoil_i$ Dummy.

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\end{aligned}
$$

- $\kappa_1 + \kappa_3$: outperformance of integrated lender for homes built on expansive soil.

Expansive Soil

Table: Annualized Return (Percentage Points) between Repeat Sales

	(1)	(2)	(3)
Integrated Lender	0.412***	0.385***	0.371***
	(0.130)	(0.122)	(0.108)
Expansive Soil	-0.229	-0.235	-0.762**
	(0.511)	(0.517)	(0.338)
Integrated Lender × Expansive Soil	0.547*	0.562**	0.322
	(0.283)	(0.267)	(0.226)
Control Variables (See Note)	✓	✓	✓
Developer Fixed Effects	.	✓	.
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R-squared	0.886	0.887	0.896
Mean Dependent Variable	7.438	7.438	7.438
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Integrated Lender	0.412***	0.385***	0.371***
	(0.130)	(0.122)	(0.108)
Expansive Soil	-0.229	-0.235	-0.762**
	(0.511)	(0.517)	(0.338)
Integrated Lender × Expansive Soil	0.547*	0.562**	0.322
	(0.283)	(0.267)	(0.226)
Control Variables (See Note)	✓	✓	✓
Developer Fixed Effects	.	✓	.
Development Fixed Effects	.	.	✓
R-squared	0.886	0.887	0.896
Mean Dependent Variable	7.438	7.438	7.438
N	30,343	30,343	30,343

Each specification controls for sales quarter-pair fixed effects, county fixed effects, house characteristics, owner characteristics, financing characteristics and census tract demographics. Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

Empirical Predictions - Housing Return

Developments with Integrated Lender

- The return of houses financed by an integrated lender is higher than that of ex-ante similar houses financed by non-integrated lenders.

    - "Integrated Lender Collateral" outperforms by 40 bps annually.

    - Not driven by selection on borrower characteristics or "bundling."

    - Driven by asymmetric information about initial collateral quality.

- The outperformance of the integrated lender's housing collateral is larger when housing return is more sensitive to construction quality.

    - Exploit geographic differences in soil type.

    - On "expansive soil" outperformance is about 100 bps.

Additional Evidence - Foreclosures

- Integrated lender mortgages are 1 percentage point less likely to enter into foreclosure within 3 years.

    - Sample mean: 2 percent.

- This is true during the ownership of first and second owner.

Effect on Interest Rates

Impact of competition with integrated lender

- For adjustable-rate mortgages I also observe interest rate.

$$
\begin{aligned}
InterestRate_i \;=\;\; & \alpha + \kappa HasIntegratedLender_i + X_i\beta + \\
& \tau_l + \delta_{m,f} + \psi_c + \epsilon_i
\end{aligned}
$$

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\end{aligned}
$$

- Lender Fixed Effects are key.

Effect on Interest Rates

Table: Interest Rate Charged

	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	0.117** (0.055)	0.114** (0.054)	0.098** (0.046)	0.089** (0.044)	0.092** (0.043)	0.077* (0.042)
Has Integrated Lender × Expansive Soil						0.150*** (0.050)
Expansive Soil						-0.089* (0.048)
Fixed Effects (Month of Sale, County, Lender)	✓	✓	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓	✓
Owner Characteristics	·	·	✓	✓	✓	✓
Census Tract Demographics	·	·	·	✓	✓	✓
Developer Fixed Effects	·	·	·	·	✓	·
R-squared	0.555	0.583	0.590	0.591	0.596	0.591
$\bar{y}$	6.640	6.640	6.640	6.640	6.640	6.640
N	15,587	15,587	15,584	15,584	15,584	15,584

Standard errors clustered at lender level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

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▸ DC

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▸ SE clustered at lender and month level   ▸ End

Empirical Predictions - Interest Rates

## Impact of competition with integrated lender

- The non-integrated lender charges a higher interest rate when competing against an integrated lender.

    - Ex-ante similar mortgages 10 bps more expensive.

- The interest rate increase is:

    1 Larger when housing return is more sensitive to construction quality.

    – Exploit geographic differences in soil type.

Empirical Predictions - Interest Rates

Impact of competition with integrated lender

- The non-integrated lender charges a higher interest rate when competing against an integrated lender.

    - Ex-ante similar mortgages 10 bps more expensive.

- The interest rate increase is:

    1. Larger when housing return is more sensitive to construction quality.

    – Exploit geographic differences in soil type.

    2. Larger when mortgage repayment is more sensitive to housing return.

    – Exploit differences in the downpayment on the mortgage.

Importance of Collateral Quality

- Higher loan-to-value (LTV) ratio: Prices need to fall by less before generating incentives for default.

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- Split into four LTV groups: LTV $< 80\%$, between 80% and 90%, between 90% and 97% and $> 97\%$.
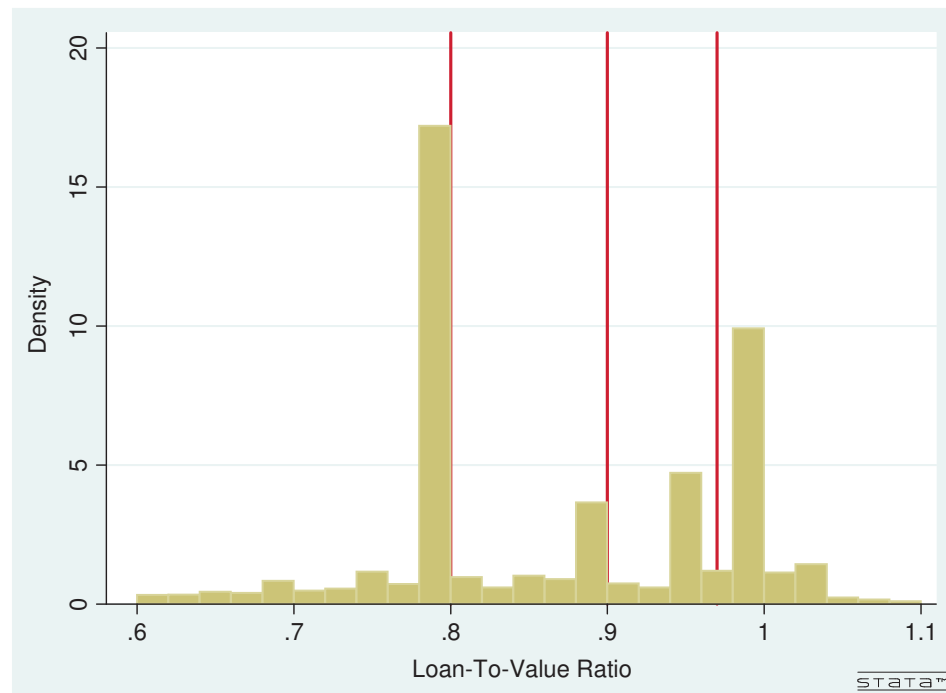
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$$
\begin{aligned}
InterestRate_i \quad = \quad & \alpha + \sum_{j=1}^{4} \kappa_j \times HasIntegratedLender_i \times LTVDummy_{i,j} \\
& + \sum_{j=2}^{4} \omega_j \times LTVDummy_{i,j} + X_i\beta + \delta_{m,f} + \tau_l + \psi_c + \epsilon_i
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$$

Importance of Collateral Quality
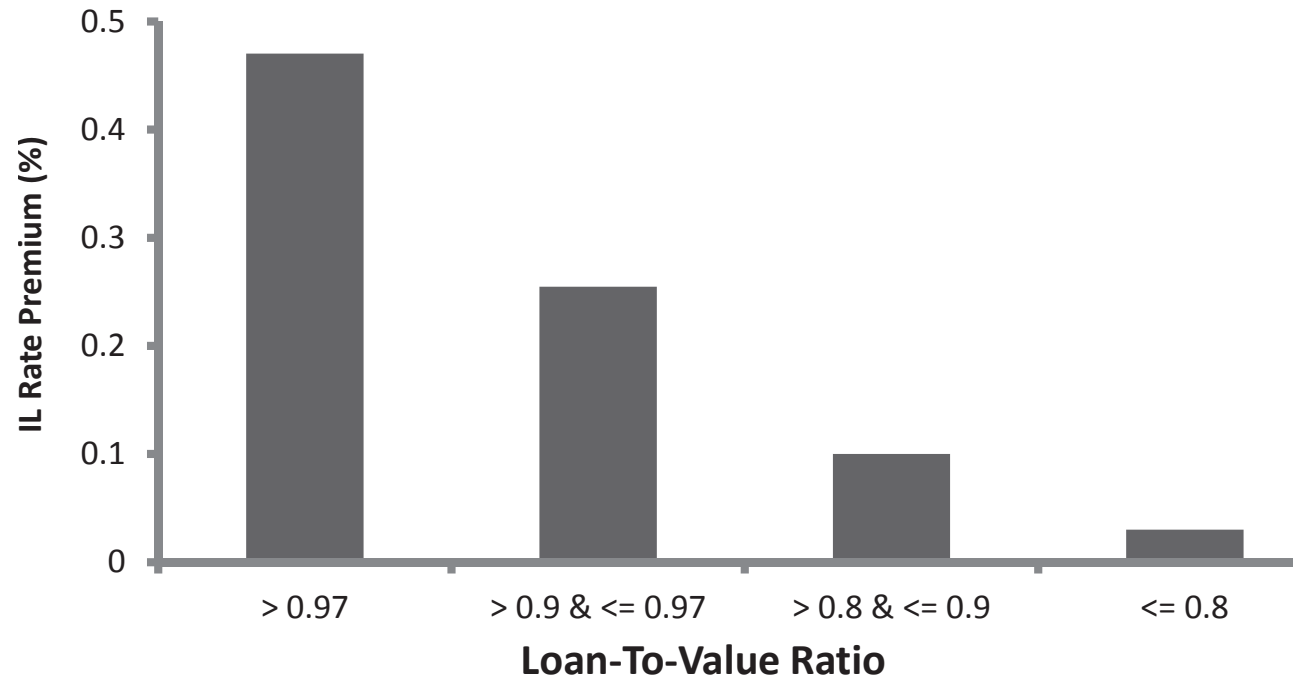
- Interest Rate (%) - Full Set of Controls, ex. Developer FE

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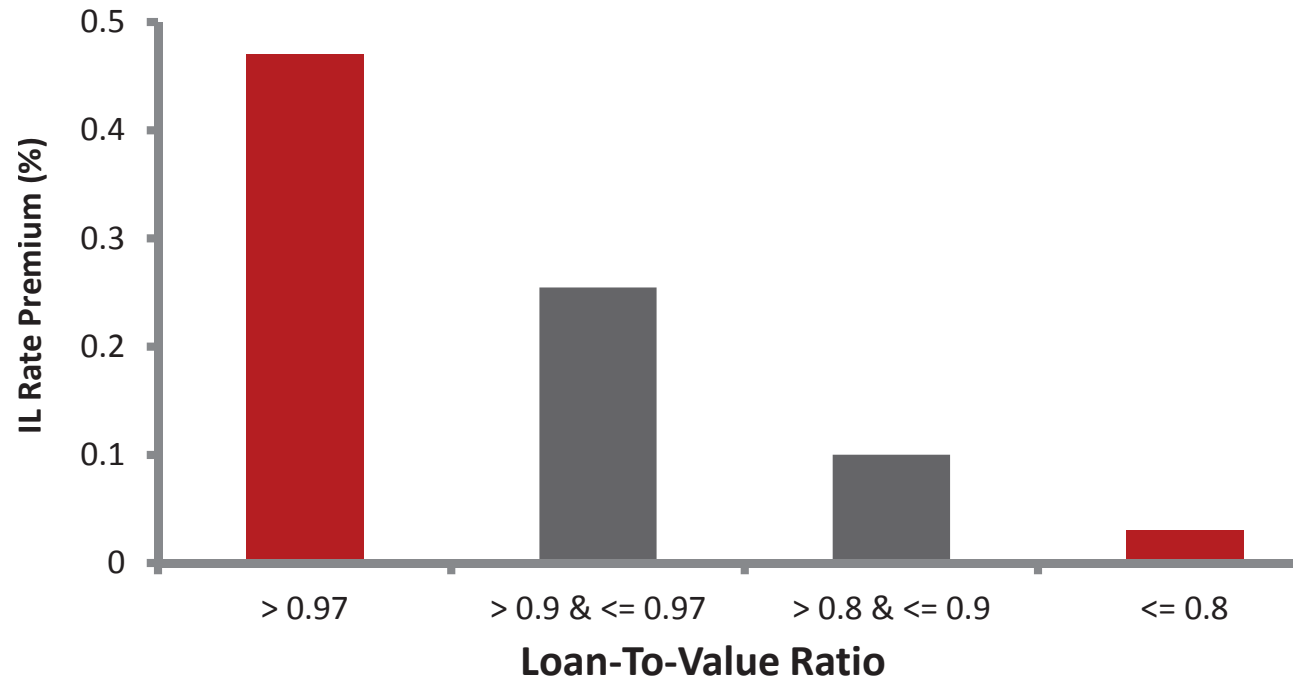
Wald Test of H_0: $\kappa_1 = \kappa_4$

- F-Statistic: 18.01 (p-value of 0.00)

Magnitude of Interest Rate increase

- Comparison with ex-post default rate not appropriate.

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- Over duration of mortgage (8-10 years): lower collateral value when competing with integrated lender similar to $\uparrow$ LTV by 5%.

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- Comparison with ex-post default rate not appropriate.

- Impact of collateral value decline on value of default option.

- Over duration of mortgage (8-10 years): lower collateral value when competing with integrated lender similar to $\uparrow$ LTV by 5%.

From Rate-Sheet at *US Bank* (June 2008)

- For 5/1 adjustable-rate mortgage (700 - 719 FICO):
    - 75% $\rightarrow$ 80% LTV: +10 bps.
    - 80% $\rightarrow$ 85% LTV: +20 bps.
    - 85% $\rightarrow$ 90% LTV: +25 bps.

Ingredients of Welfare Analysis

- Higher interest rates: Competed away in construction sector?

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  - Redeployability of collateral.

  - Solution to Coase's durable goods monopoly problem?

Discussion of Results

- Interpretation of uninformed bank behavior: Does it "know" about adverse selection?

    - "Statistical pricing of mortgages."

    - ▸ Rate Adjustments

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    - Gorton + Souleles (2007): Reputation is important.

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- Role of Securitization?

    - Securitization reduces but does not remove exposure to subsequent default.

    - Gorton + Souleles (2007): Reputation is important.

    - Future Research: Adverse selection into securitization on collateral quality.

Conclusion

- Superior information of integrated lender $\Rightarrow$ adverse selection on collateral quality.

    - Possibility for market failure.

    - Policy Responses - Disclosure in Securitization.

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  - Possibility for market failure.

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- Sophisticated pricing by mortgage lenders.

- Insights into competition under asymmetric information:

  - Small business lending.

  - Stapled M&A financing.

  - Public auctions (oil contracts).

  - Labor Markets.

Backup Slides

Theoretical Framework

Houses

- Cost $1 to purchase.

- Good or bad type, unobservable.

- Good houses worth more next period, bad houses worth less.

- Proportions in development are known (reputation).

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Houses

- Cost $1 to purchase.

- Good or bad type, unobservable.

- Good houses worth more next period, bad houses worth less.

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Households

- Want to buy a house, no capital. Renting costs zero.

- Always repay mortgage when house value has gone up.

- Differ in observable probability of repayment when house value has gone down (credit worthiness).

Theoretical Framework

Lenders

- All lenders have access to funds at same cost.

- Integrated lender has informative signal $\eta \in \{h, l\}$.

- Precision: $\phi = P(\eta = h \mid \text{House is good type}) > \frac{1}{2}$

Theoretical Framework

Lenders

- All lenders have access to funds at same cost.

- Integrated lender has informative signal $\eta \in \{h, l\}$.

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Information

- Buyer, Integrated Lender, Other lenders: Proportion of good houses in economy and creditworthiness of borrower.

- Integrated Lender: Informative Signal about collateral type.

Theoretical Framework

Game

- Integrated lender and N non-integrated lenders offer mortgage.

- Integrated lender conditions offer on its signal.

- Borrower chooses lowest interest rate offer.

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Game

- Integrated lender and N non-integrated lenders offer mortgage.

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- Borrower chooses lowest interest rate offer.

Features of Bayesian Nash Equilibrium

- Non-integrated lenders face winner's curse and make zero profit.

- Integrated lender makes positive profit.

  - Milgrom and Weber (1982)

Focus on Arizona

- Data Availability and Quality ▸ Return to Data Description

Focus on Arizona

- Data Availability and Quality

- Informative about rest of U.S.?

  - Same actors (Developers / Integrated Lenders operate nationally).
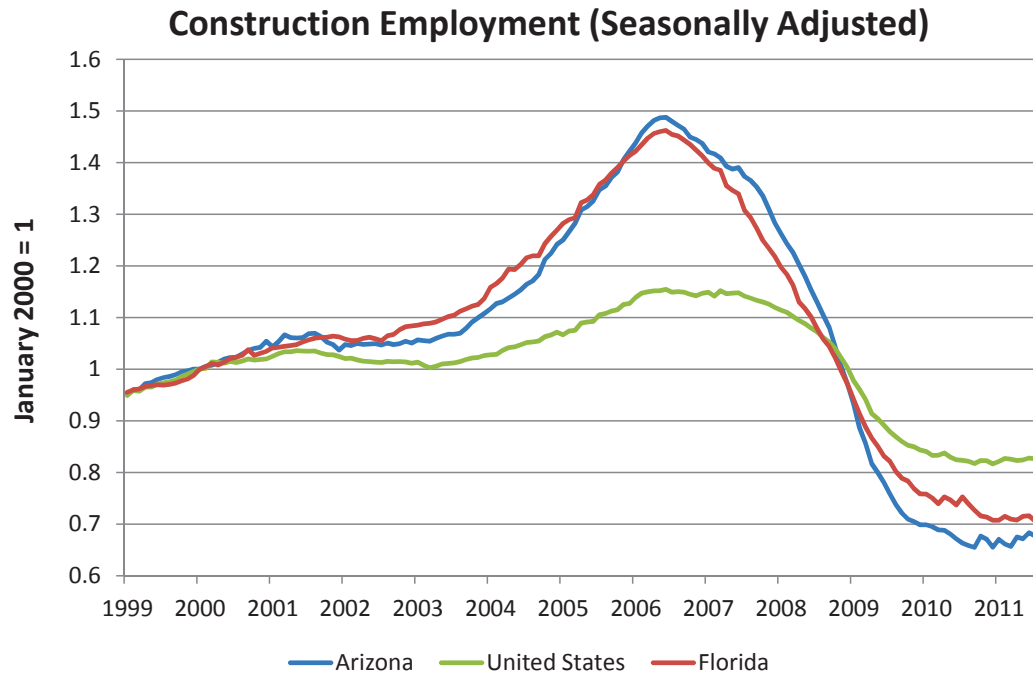 - Construction problems national: 21% roof; 14% foundation.

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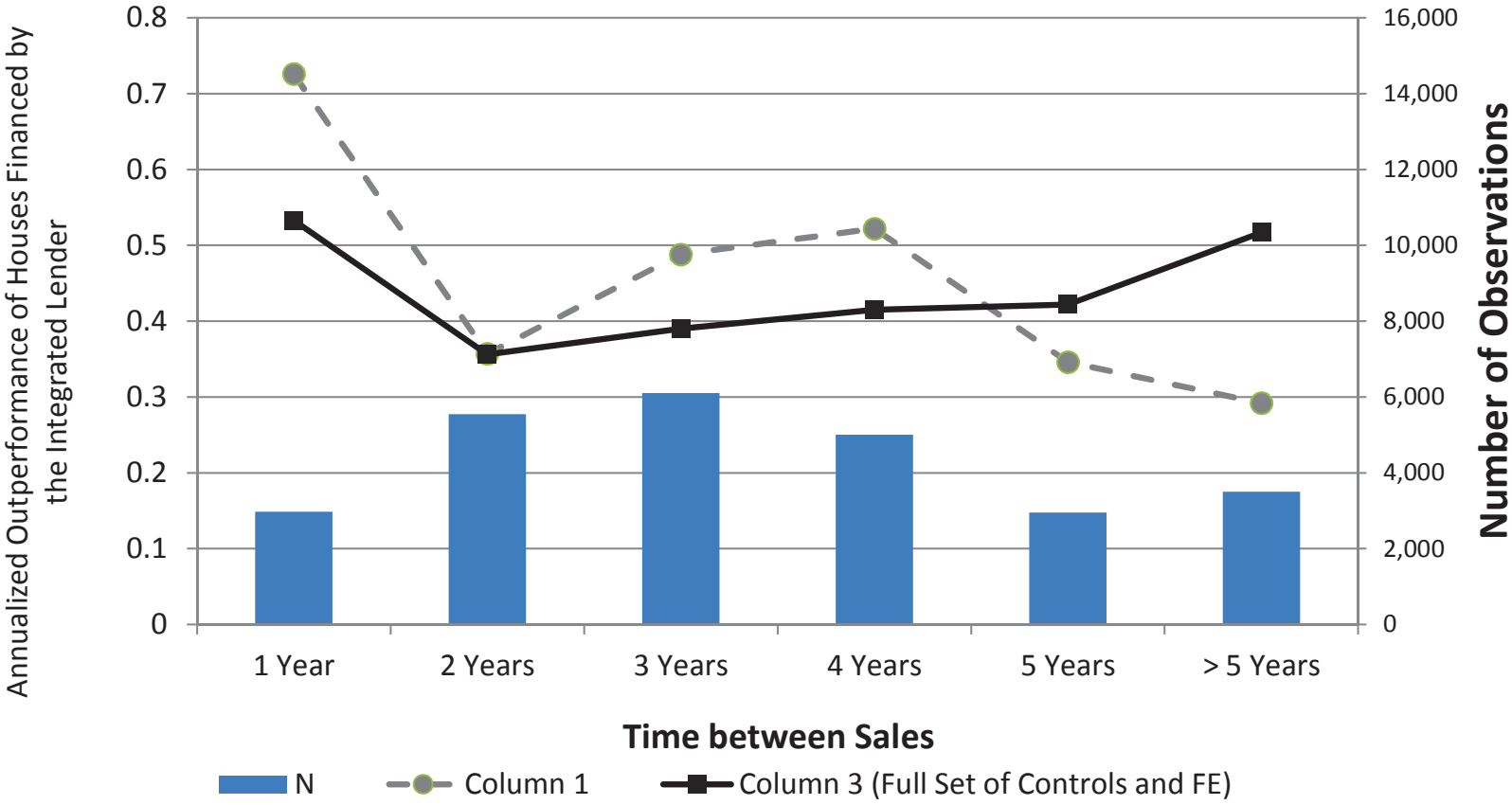
- BUT: Larger Boom Bust Cycle

Construction Employment (Seasonally Adjusted)

January 2000 = 1 (y-axis), years 1999–2011 (x-axis), line labeled Arizona.

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Construction Employment (Seasonally Adjusted)

Timing of Information Release

Wald Test of H_0: All coefficients are equal

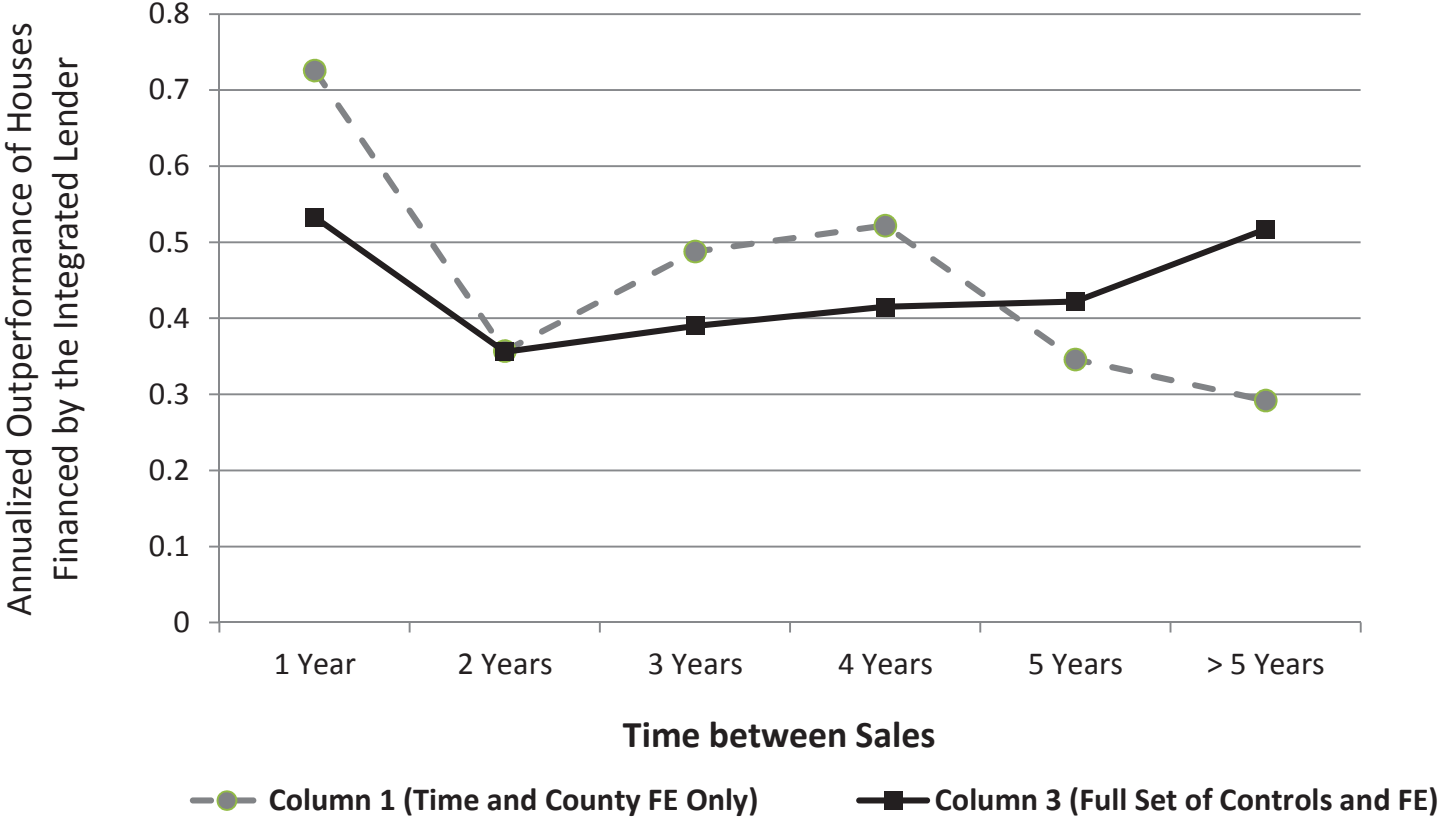- F-Statistic: 0.46 (p-value of 0.81) and 0.05 (p-value of 0.99)

Return

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- Previous specification assumed constant hazard of the revelation of asymmetric information at house level.

  $\Rightarrow$ Constant annualized outperformance at portfolio level.

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\begin{aligned}
Return_i \quad = \quad & \alpha + \sum_{j=1}^{6} \kappa_j \times IntegratedLender_i \times TimeBetweenSales_{i,j} \\
& + X_i \beta + \delta_{q_1, q_2} + \psi_c + \epsilon_i
\end{aligned}
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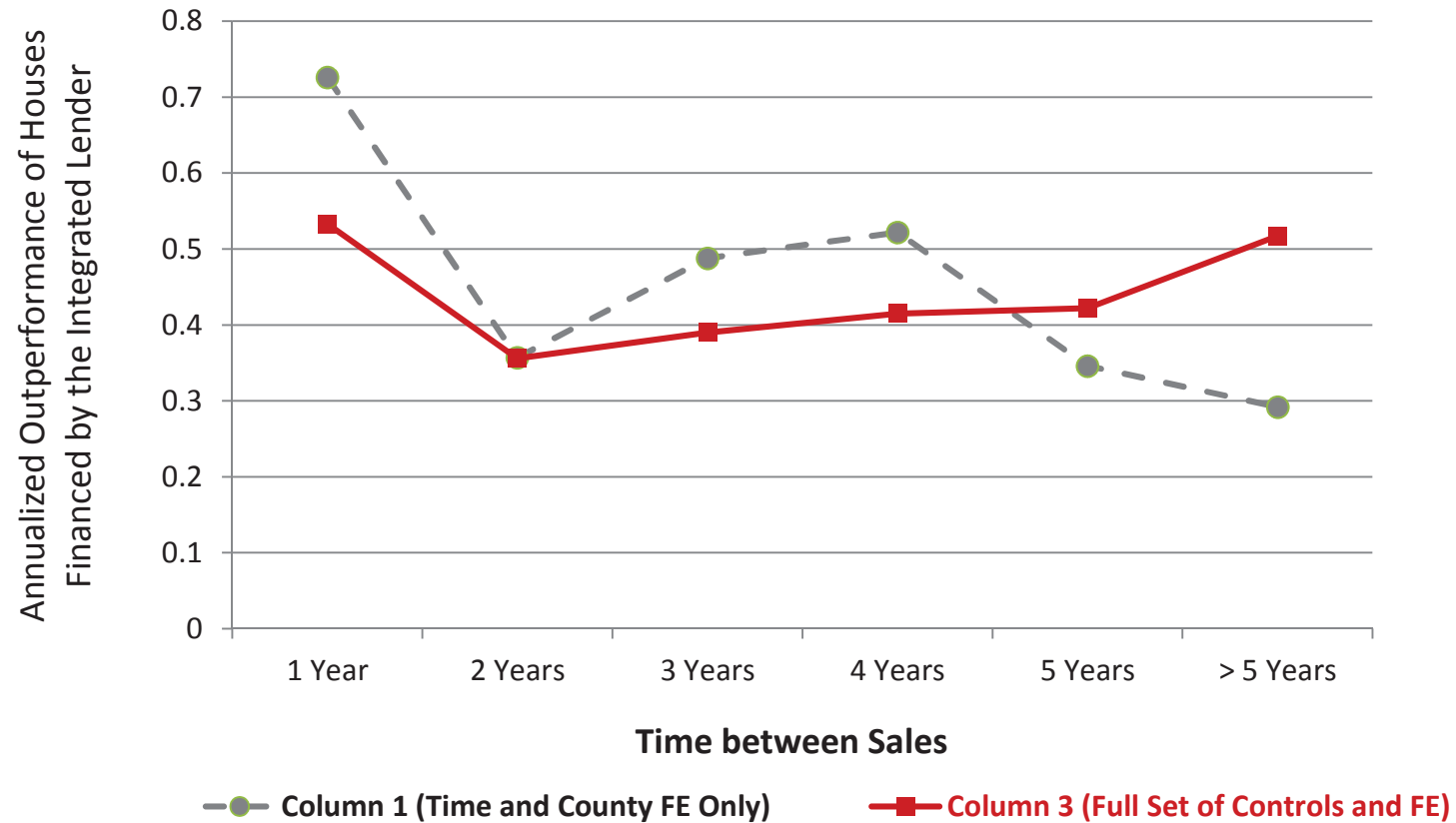
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Timing of Information Release

- *"Concrete can develop smaller hairline cracks as it cures – and it can continue to cure for many years after the home is built."*

- *"A building site not compacted properly can settle and move extensively for a number of years."*

- *"Over a number of years this recurrent movement will cause extensive damage and will be very costly to repair."*

- Similar evidence from construction defect lawsuits (Mold intrusion may also take years to detect).

- Constant arrival hazard of information at the house level will lead to a constant annualized outperformance at the portfolio level.
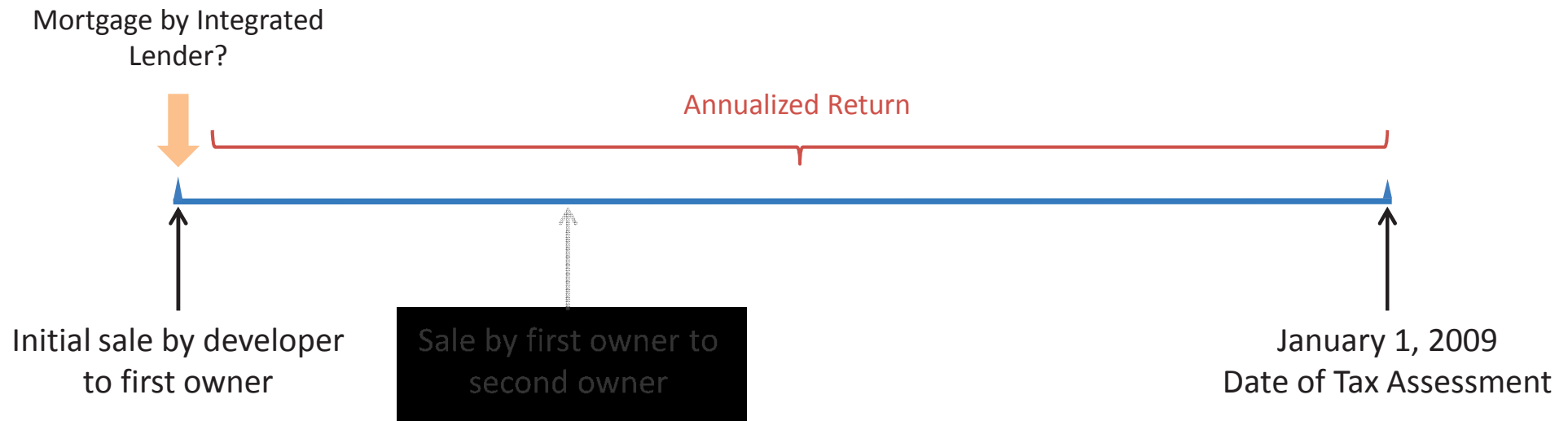
Concern: Selection into Repeat Sales

- Assessed market values in January 2009 (property taxes) available for *all* observations.
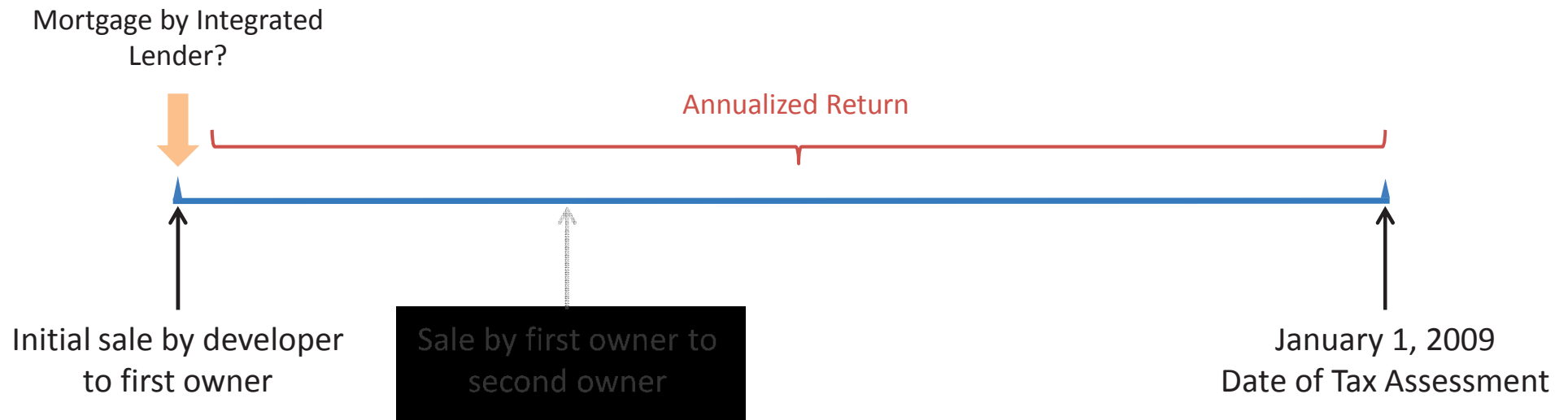
Concern: Selection into Repeat Sales

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- Outperformance over this horizon: $40 - 50$ bps.

Mortgage by Integrated
Lender?

Annualized Return

Initial sale by developer
to first owner

Sale by first owner to
second owner

January 1, 2009
Date of Tax Assessment

▸ Return to Repeat Sales Table   ▸ Quality of Assessor Data

Outperformance - Assessor Data

Table: Annualized Return (Percentage Points) - Assessor Data

	(1)	(2)	(3)	(4)	(5)	(6)
Integrated Lender	0.401***	0.447***	0.473***	0.407***	0.332***	0.196***
	(0.111)	(0.105)	(0.098)	(0.106)	(0.091)	(0.048)
Month of Sale Fixed Effect	✓	✓	✓	✓	✓	✓
County Fixed Effect	✓	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓	✓
Owner Characteristics	·	·	✓	✓	✓	✓
Financing Characteristics	·	·	✓	✓	✓	✓
Census Tract Demographics	·	·	·	✓	✓	✓
Developer Fixed Effects	·	·	·	·	✓	·
Development Fixed Effects	·	·	·	·	·	✓
R-squared	0.810	0. 827	0.831	0.880	0.891	0.935
Mean Dependent Variable	-6.602	-6.602	-6.602	-6.602	-6.602	-6.602
N	83,669	83,668	83,668	83,668	83,668	83,668

Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

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Financing Characteristics	.	.	✓	✓	✓	✓
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▸ Return

Assessor Data

- A.R.S ğ 42 - 11001(5) to be "synonymous with market value, which means the estimate of value that is derived annually by using standard appraisal methods and techniques."

- Using "Comparables" Methodology.

- Appeals process - annually 1.3% - 2% of assessments.

  - Knocked off $4 billion in property values (2009 Figures).

Assessor Data

Based on 4863 observations

- Marginally underpredicts - but declining market.

Return during second owner

Table: Annualized Collateral Return (%) - Second Ownerhip Period

| | 1ST RESALE TO ASSESSMENT | | | | | 1ST RESALE TO 2ND RESALE | | |
| | ALL MOVES | | | FORCED MOVES | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Integrated Lender	0.374*** (0.115)	0.308*** (0.092)	0.170* (0.089)	0.597** (0.238)	0.464* (0.251)	0.598** (0.277)	0.522* (0.296)	0.336 (0.233)
Controls (See Note)	✓	✓	✓	✓	✓	✓	✓	✓
Other Fixed Effects	.	D1	D2	.	D1	.	D1	D2
R-squared	0.893	0.901	0.947	0.876	0.889	0.885	0.886	0.891
$\bar{y}$	-10.85	-10.85	-10.85	-12.53	-12.53	3.32	3.32	3.32
N	18,285	18,285	18,285	1,653	1,653	5,379	5,379	5,379

Controls for time between sale and listing, characteristics of the buyer, house, financing and census tract. Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

▸ Return

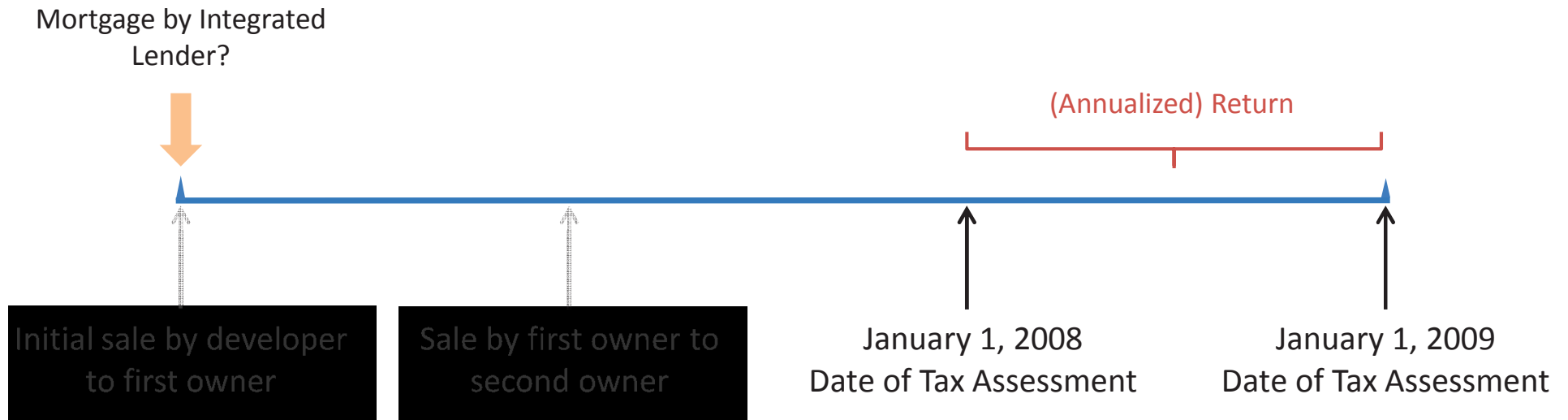# Concern: Bundling House and Mortgage

- Could explain observed differences in return.

- BUT: Timing and return over ownership of second owner.

- Additional measure: Return during 2008.

Mortgage by Integrated Lender?

(Annualized) Return

Initial sale by developer to first owner

Sale by first owner to second owner

January 1, 2008
Date of Tax Assessment

January 1, 2009
Date of Tax Assessment
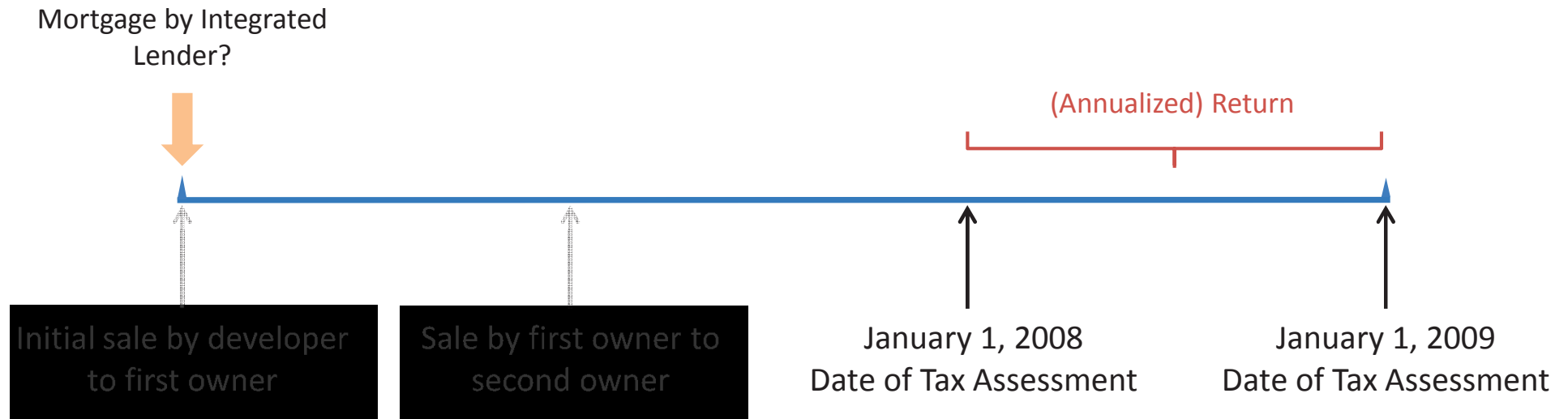
▸ Return

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- Additional measure: Return during 2008.

- Outperformance over this horizon: 60 bps.

Mortgage by Integrated Lender?

(Annualized) Return

Initial sale by developer to first owner

Sale by first owner to second owner

January 1, 2008
Date of Tax Assessment

January 1, 2009
Date of Tax Assessment

▸ Return

Return during 2008

Table: Annualized Return (Percentage Points) in 2008 - Assessor Data

	(1)	(2)	(3)	(4)	(5)	(6)
Integrated Lender	0.949*** (0.288)	0.786*** (0.225)	0.929*** (0.218)	0.816*** (0.190)	0.686*** (0.190)	0.350*** (0.119)
Quarter of Construction FE	✓	✓	✓	✓	✓	✓
County Fixed Effect	✓	✓	✓	✓	✓	✓
House Characteristics	.	✓	✓	✓	✓	✓
Owner Characteristics	.	.	✓	✓	✓	✓
Financing Characteristics	.	.	✓	✓	✓	✓
Census Tract Demographics	.	.	.	✓	✓	✓
Developer Fixed Effects	.	.	.	.	✓	.
Development Fixed Effects	.	.	.	.	.	✓
R-squared	0.211	0.304	0.331	0.573	0.605	0.795
Mean Dependent Variable	-27.23	-27.23	-27.23	-27.23	-27.23	-27.23
N	66,497	66,497	66,497	66,497	66,497	66,497

Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

▸ Return

Expansive Soil

Table: Annualized Return (Percentage Points) by Soil Conditions

	SALE 1 - ASSESSOR		SALE 2 - ASSESSOR		YEAR 2008	
	(1)	(2)	(3)	(4)	(5)	(6)
Integrated Lender	0.341***	0.276***	0.232**	0.203**	0.691***	0.560***
	(0.090)	(0.090)	(0.116)	0.102	(0.182)	(0.178)
Expansive Soil	-1.359*	-1.072*	-2.398***	-1.977**	-1.977**	-1.977**
	(0.752)	(0.643)	(0.575)	(0.485)	(0.485)	(0.485)
Integrated Lender × Expansive Soil	0.609**	0.557**	0.830***	0.719***	0.754*	0.936**
	(0.268)	(0.233)	(0.257)	(0.231)	(0.425)	(0.411)
Control Variables	✓	✓	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓	·
R-squared	0.881	0.891	0.893	0.899	0.581	0.612
Mean Dependent Variable	-6.602	-6.602	-11.00	-11.00	-27.23	- 27.23
N	83,668	83,668	16,764	16,764	66,497	66,497

Each specification controls for time fixed effects, county fixed effects, house characteristics, owner characteristics, financing characteristics and census tract demographics. Standard errors clustered at developer level.

Significance: * (p<0.10), ** (p<0.05), *** (p<0.01).

Empirical Results - Foreclosure

- Mortgage delinquency not observed.

- Foreclosure: Repossession of the house by the bank - ownership changing deeds

$$
\begin{aligned}
Foreclosure3Years_i \quad = \quad & \alpha + \textcolor{red}{\kappa IntegratedLender_i} + X_i\beta \\
& +\delta_m + \psi_c + \epsilon_i
\end{aligned}
$$

Empirical Results – Foreclosure

Table: Probability of Foreclosure within 3 Years

	(1)	(2)	(3)	(4)	(5)
Integrated Lender	-0.011***	-0.009***	-0.010***	-0.008*	-0.008***
	(0.001)	(0.001)	(0.002)	(0.005)	(0.001)
Month of Sale Fixed Effects	✓	✓	✓	✓	✓
County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓
Owner Characteristics	·	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓
Census Tract Demographics	·	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓
Development Fixed Effects	·	·	✓	·	·
Model + Sample	Probit	Probit	Probit	Probit Securitized	LPM
Mean Dependent Variable	0.019	0.020	0.022	0.021	0.015
N	66,633	63,917	56,092	11,548	83,702

Marginal probit effects. Standard errors clustered at developer level. * (p<0.10), ** (p<0.05), *** (p<0.01).

Empirical Results – Foreclosure

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County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓
Owner Characteristics	·	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓
Census Tract Demographics	·	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓
Development Fixed Effects	·	·	✓	·	·
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Month of Sale Fixed Effects	✓	✓	✓	✓	✓
County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓
Owner Characteristics	·	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓
Census Tract Demographics	·	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓
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	(0.001)	(0.001)	(0.002)	(0.005)	(0.001)
Month of Sale Fixed Effects	✓	✓	✓	✓	✓
County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓
Owner Characteristics	·	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓
Census Tract Demographics	·	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓
Development Fixed Effects	·	·	✓	·	·
Model + Sample	Probit	Probit	Probit	Probit Securitized	LPM
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Marginal probit effects. Standard errors clustered at developer level. * (p<0.10), ** (p<0.05), *** (p<0.01).

Empirical Results – Foreclosure

Table: Probability of Foreclosure within 3 Years

	(1)	(2)	(3)	(4)	(5)
Integrated Lender	-0.011***	-0.009***	-0.010***	-0.008*	-0.008***
	(0.001)	(0.001)	(0.002)	(0.005)	(0.001)
Month of Sale Fixed Effects	✓	✓	✓	✓	✓
County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓
Owner Characteristics	·	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓
Census Tract Demographics	·	✓	✓	✓	✓
Developer Fixed Effects	·	✓	·	✓	✓
Development Fixed Effects	·	·	✓	·	·
Model + Sample	Probit	Probit	Probit	Probit Securitized	LPM
Mean Dependent Variable	0.019	0.020	0.022	0.021	0.015
N	66,633	63,917	56,092	11,548	83,702

Marginal probit effects. Standard errors clustered at developer level. * (p<0.10), ** (p<0.05), *** (p<0.01).

▸ Return

Empirical Results - Foreclosure

- Also look at the foreclosure probability for the second owner.

- See whether it makes a difference who granted the mortgage to the first owner:

    - Only thing that is constant across mortgages is the housing collateral.

- Mortgage will no longer be held by the integrated lender, addressing questions about the differential aggressiveness of integrated lenders in pursuing foreclosures.

Empirical Results - Foreclosure

Table: Probability of Foreclosure within 3 Years - Second Owner

	(1)	(2)	(3)	(4)	LPM (5)
Integrated Lender	-0.011** (0.005)	-0.016*** (0.005)	-0.019*** (0.006)	-0.019*** (0.006)	-0.017*** (0.005)
Month of Sale Fixed Effects	✓	✓	✓	✓	✓
Quarter of Construction Fixed Effects	✓	✓	✓	✓	✓
County Fixed Effects	✓	✓	✓	✓	✓
House Characteristics	.	✓	✓	✓	✓
Owner Characteristics	.	✓	✓	✓	✓
Financing Characteristics	.	✓	✓	✓	✓
Census Tract Demographics	.	✓	✓	✓	✓
Developer Fixed Effects	.	.	✓	.	✓
Development Fixed Effects	.	.	.	✓	.
Mean Dependent Variable	0.045	0.048	0.050	0.056	0.044
N	12,526	11,616	11,050	9,762	12,594

Marginal probit effects. Standard errors clustered at developer level. * (p<0.10), ** (p<0.05), *** (p<0.01). ▸ Return

Effect on Interest Rates

Table: Interest Rate Charged

	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	0.120** (0.054)	0.100** (0.046)	0.099** (0.046)	0.091** (0.044)	0.093** (0.042)	0.081* (0.043)
Has Integrated Lender × Expansive Soil						0.149** (0.066)
Expansive Soil						-0.093 (0.067)
Fixed Effects (Month of Sale, County, Lender)	✓	✓	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓	✓
Owner Characteristics	·	·	✓	✓	✓	✓
Census Tract Demographics	·	·	·	✓	✓	✓
Developer Fixed Effects	·	·	·	·	✓	·
R-squared	0.468	0.534	0.534	0.534	0.540	0.532
Mean Dependent Variable	6.538	6.538	6.538	6.538	6.538	6.543
N	15657	15654	15654	15654	15654	15564

Standard errors clustered at lender and month level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$). ▸ Return

Lending in New Developments

- *Luxury Mortgage* Rate Sheet, March 2011

Adjustments for the Centurion Series	Rate
Loan Amount >=$417K - $730K	(0.125)
Loan Amount >$730K - $1M	0.000
Loan Amount >$1M - $1.5M	0.125
Loan Amount >$1.5M - $2.5M	0.250
Loan Amount >$2.5M - $3M	0.375
Loan Amount >$3M	Call
LTV/CLTV <= 50% & FICO >= 740	(0.125)
LTV/CLTV > 70% - 75% & FICO < 740	0.125
LTV/CLTV > 75% & FICO < 740	0.250
Second Home	0.250
Cash-Out	0.125
Interest Only	0.250
Declining Markets	0.125
New Developments	0.125

Lending in New Developments

- *ING Mortgage* Rate Sheet, March 2011

5 Yr & 10 Yr Easy Orange: Loan Limits & Maximum LTV / CLTV			
Primary Residence Only. I/O not available. **Min. Credit Score: 700**	**Max. Loan Amount**	**Non-Condo**	**Condo**
Purchase or Rate/Term Refi	750,000	70/70	50/50
Cash Out Refi		65/65	50/50
1 For new construction (newly built, never occupied) and construction loan payoffs, reduce max. LTV/CLTV limits shown above by 15% (but not below 50%). Subordinate financing permitted only on refi with existing 2nd lien. See Product Guidelines for details.			

Controlling for Interest Rate

$$Return_i = \alpha + \kappa IntegratedLender_i + \gamma MortSpr_i + \delta_{q_1,q_2} + X_i\beta + \epsilon_i$$

Table: Robustness Check - Control For Interest Rate

	Sale 1 - Sale 2 (1)	Sale 1 - Assessor (2)	Sale 2 - Assessor (3)	Year 2008 (4)
Integrated Lender	0.399*	0.356***	0.521***	0.617***
	(0.233)	(0.116)	(0.164)	(0.187)
Mortgage Spread	-0.520***	-0.175***	-0.024	-0.240**
	(0.119)	(0.030)	(0.063)	(0.079)
Controls	✓	✓	✓	✓
R-squared	0.893	0.880	0.861	0.580
Mean Dependent Var.	6.700	-8.426	-14.49	-27.43
N	6,999	23,355	3,296	18,174

Standard errors clustered at developer level. Significance: * (p<0.10), ** (p<0.05), *** (p<0.01).

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Standard errors clustered at developer level. Significance: * (p<0.10), ** (p<0.05), *** (p<0.01).

▸ Return

Effect on Interest Rates

- **Development characteristics include**: Age of Development, Size of Development, Zip-Code fixed effects

Table: Interest Rate Charged

	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	0.120** (0.054)	0.100** (0.047)	0.099** (0.046)	0.091** (0.045)	0.084** (0.044)	0.073* (0.044)
Fixed Effects (Month of Sale, County, Lender)	✓	✓	✓	✓	✓	✓
Financing Characteristics	·	✓	✓	✓	✓	✓
House Characteristics	·	✓	✓	✓	✓	✓
Owner Characteristics	·	·	✓	✓	✓	✓
Census Tract Demographics	·	·	·	✓	✓	✓
Development Characteristics	·	·	·	·	✓	✓
Developer Fixed Effects	·	·	·	·	·	✓
R-squared	0.468	0.534	0.534	0.534	0.540	0.532
Mean Dependent Variable	6.538	6.538	6.538	6.538	6.538	6.543
N	15657	15654	15654	15654	15654	15564

Standard errors clustered at lender. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$). ▸ Return

Stuff Not Currently Used

Empirical Predictions - Housing Return

Developments with Integrated Lender

- The return of houses financed by an integrated lender is higher than that of ex-ante similar houses financed by non-integrated lenders.

    - "Integrated Lender Collateral" outperforms by 50 bps annually.

    - Driven by asymmetric information about initial collateral quality.

- The outperformance of the integrated lender's housing collateral is:

    1 Larger when housing return is more sensitive to construction quality.

    ✓ - Exploit differences in soil type.

   **2** Smaller when mortgage repayment is more sensitive to housing return.

    ✓ - Exploit variation in borrower's downpayment.

Importance of Collateral Quality

- Higher loan-to-value (LTV) ratio: Prices need to fall by less before generating incentives for default.

Importance of Collateral Quality

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- Split into four LTV groups: LTV $< 80\%$, between 80% and 90%, between 90% and 97% and $> 97\%$.
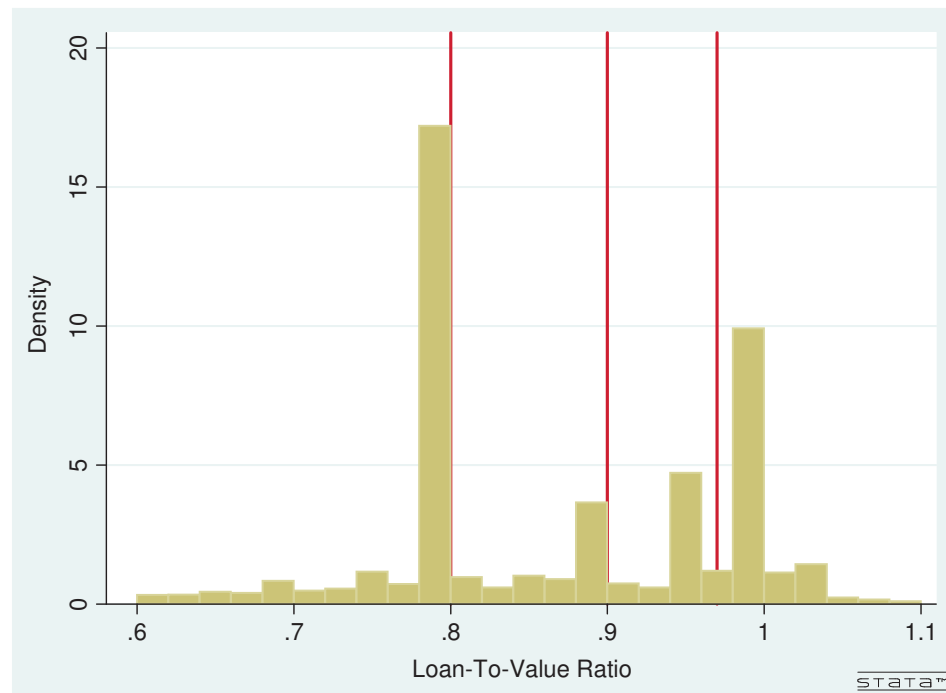
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- Split into four LTV groups: LTV $< 80\%$, between 80% and 90%, between 90% and 97% and $> 97\%$.

$$
\begin{aligned}
Return_i \;=\; & \alpha + \sum_{j=1}^{4} \kappa_j \times IntegratedLender_i \times LTVDummy_{i,j} \\
& + \sum_{j=2}^{4} \omega_j \times LTVDummy_{i,j} + X_i\beta + \delta_{q_1,q_2} + \psi_c + \epsilon_i
\end{aligned}
$$

- Include full set of control variables and developer fixed effects.

Importance of Collateral Quality
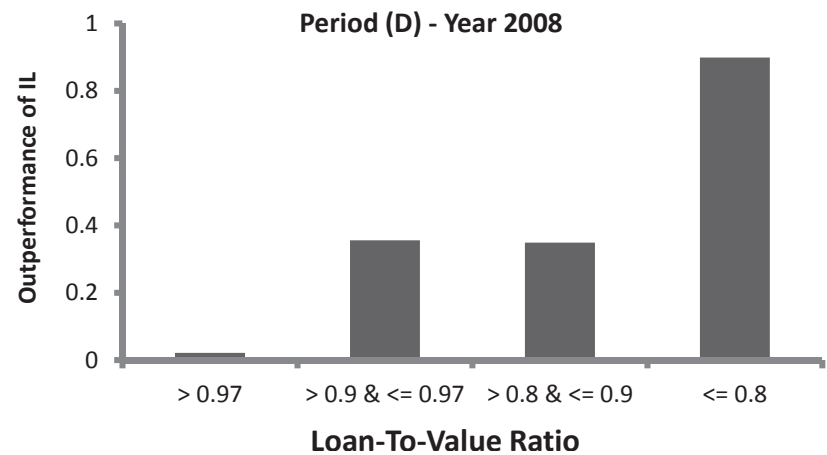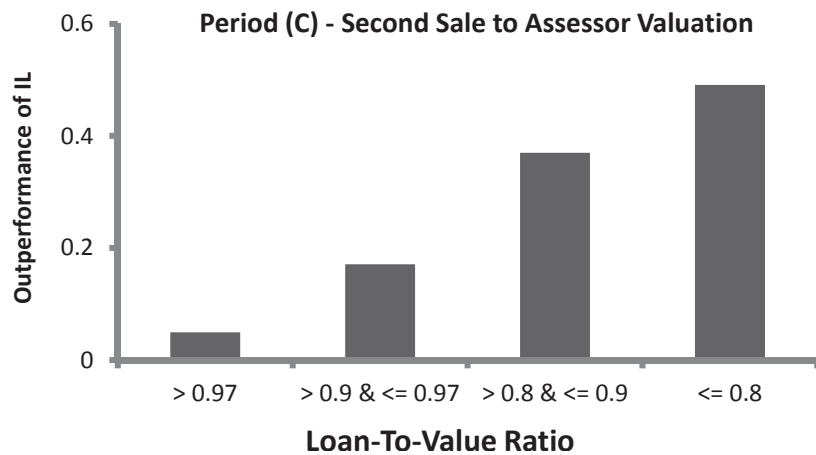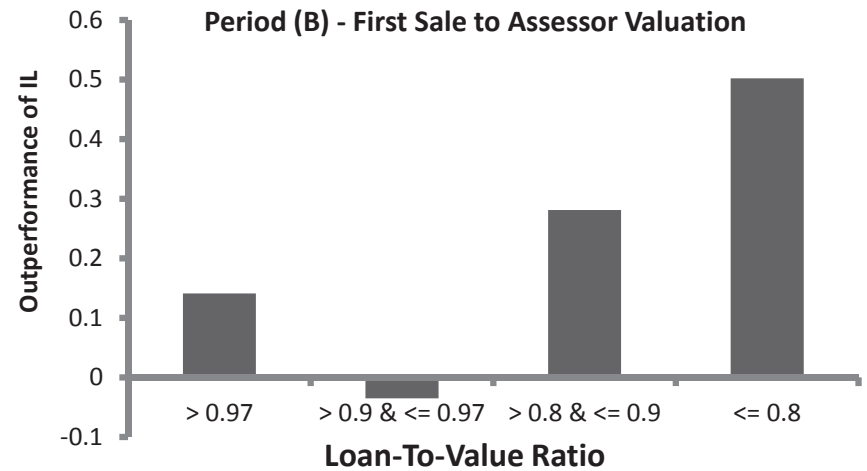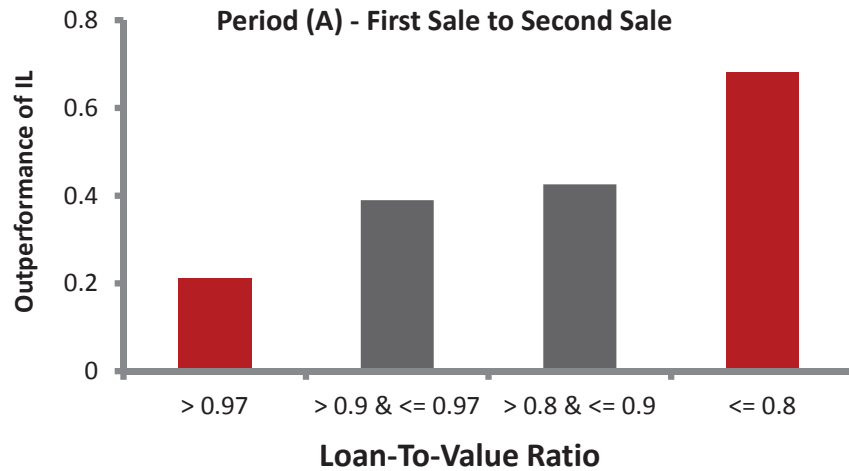
Period (A) - First Sale to Second Sale

Period (B) - First Sale to Assessor Valuation

Period (C) - Second Sale to Assessor Valuation

Period (D) - Year 2008

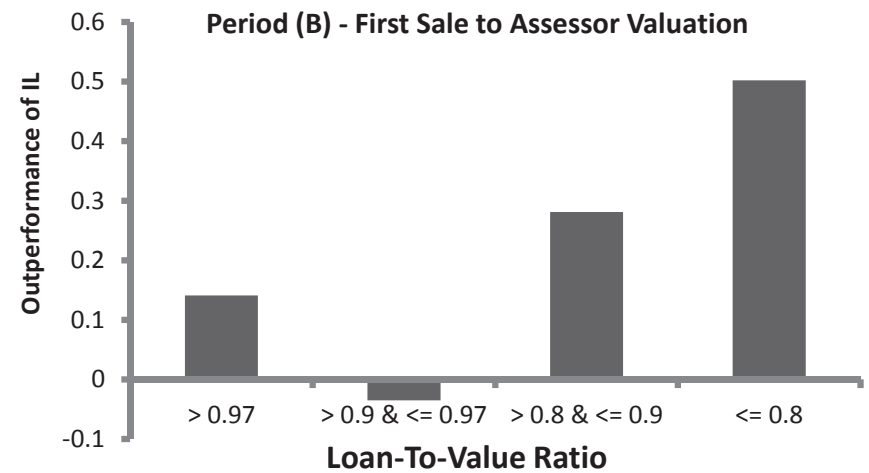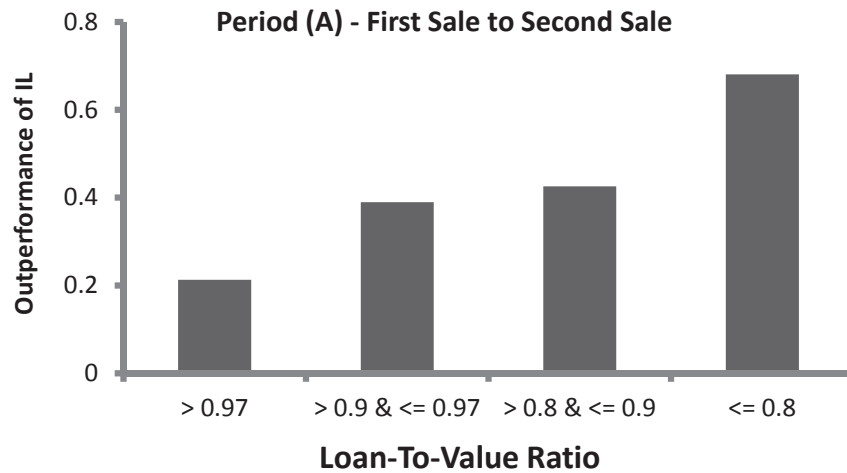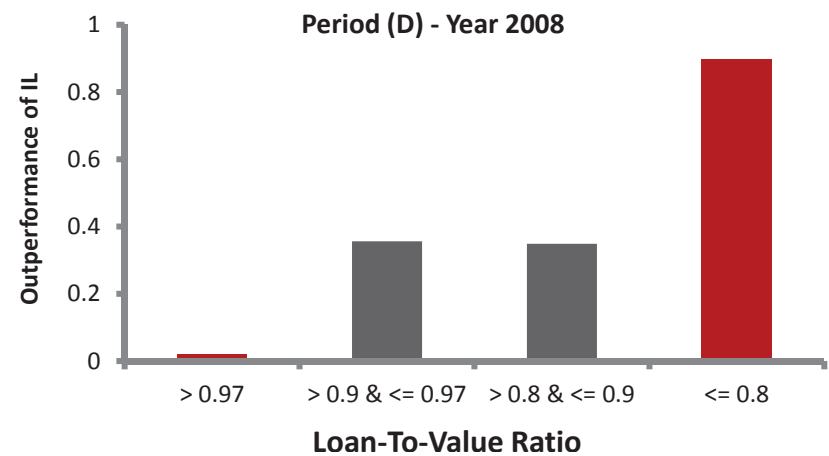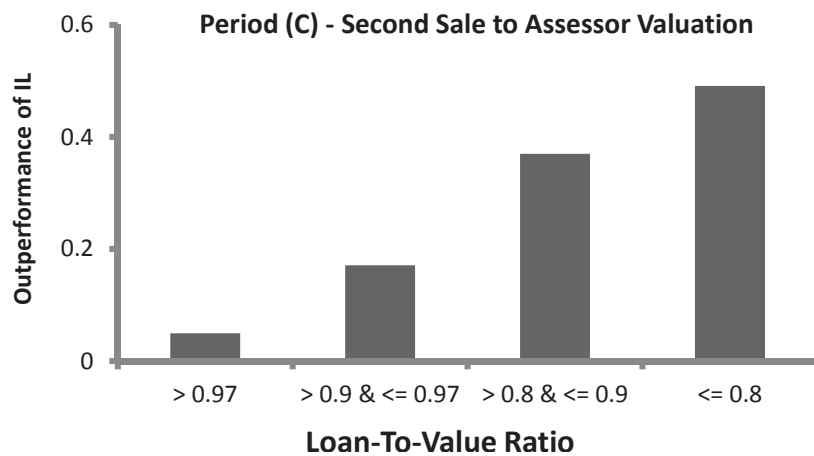# Importance of Collateral Quality

- $H_0 : k_1 = k_4$ - F-Statistics are 2.6 (p-value 0.11), 8.4 (p-value 0.01), 11.1 (p-value 0.00) and 16.7 (p-value 0.00) respectively.

Importance of Collateral Quality
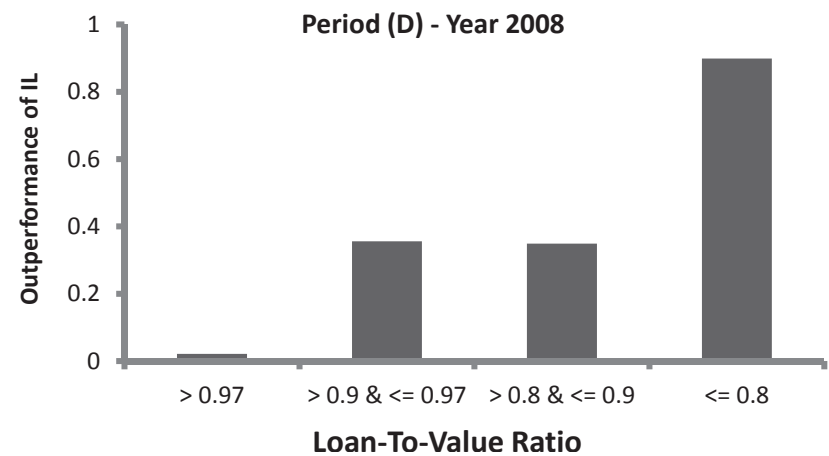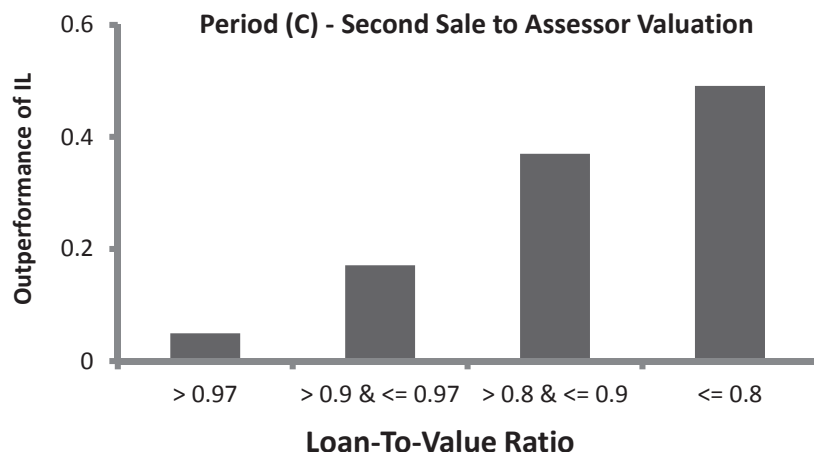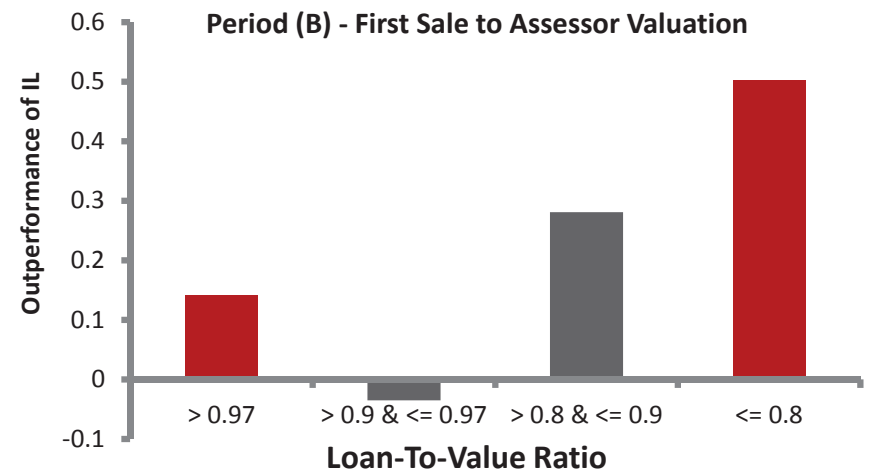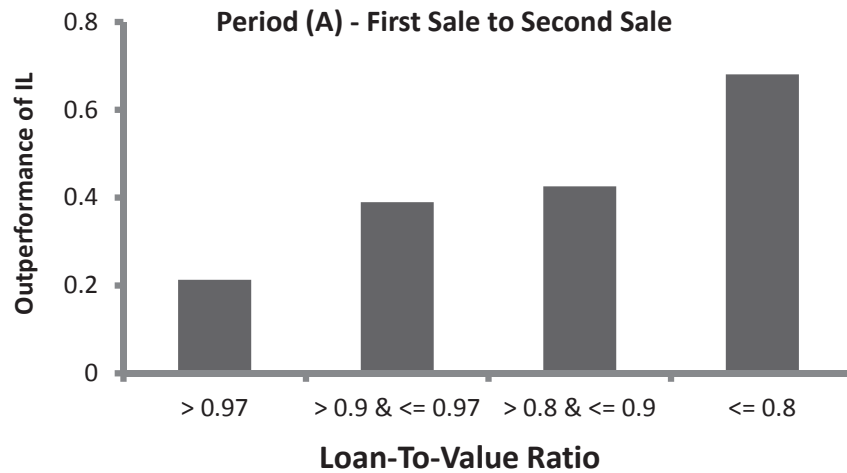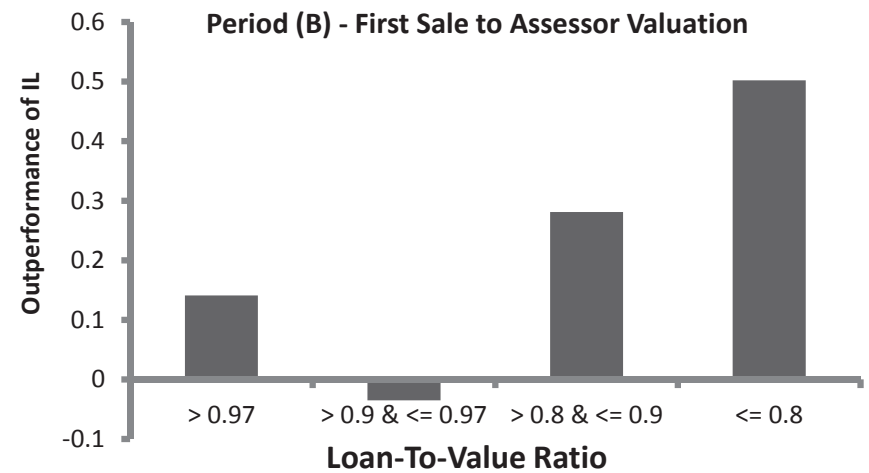

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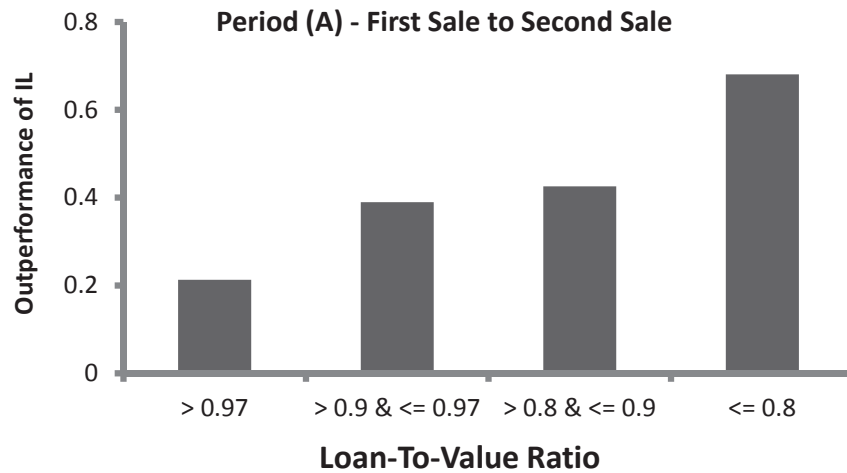
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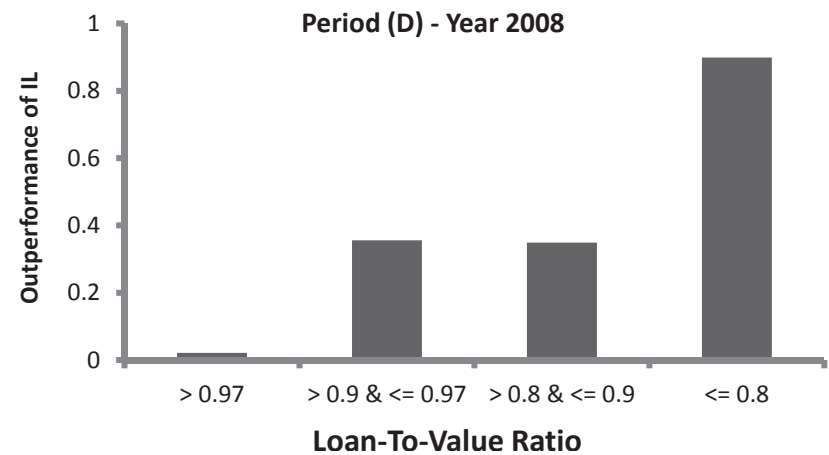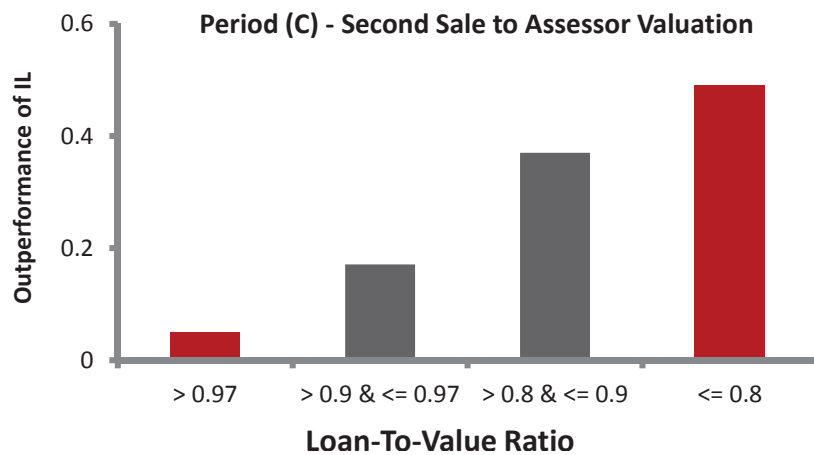
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Empirical Predictions - Housing Return

Developments with Integrated Lender

- The return of houses financed by an integrated lender is higher than that of ex-ante similar houses financed by non-integrated lenders.

  - "Integrated Lender Collateral" outperforms by 50 bps annually.

  - Driven by asymmetric information about initial collateral quality.

- The outperformance of the integrated lender's housing collateral is:

  1. Larger when housing return is more sensitive to construction quality.

     ✓ - Exploit differences in soil type.

  2. Smaller when mortgage repayment is more sensitive to housing return.

     ✓ - Exploit variation in borrower's downpayment.

Empirical Predictions and Results

Impact of competition with integrated lender

- The return of houses financed by a non-integrated lender is lower when the lender competes against an integrated lender.

    - Ex-ante similar housing collateral underperforms by 60 bps annually when competing against an integrated lender.

- This underperformance is:

    - Larger when housing return is more sensitive to construction quality (expansive soil).

    - Smaller when mortgage repayment is more sensitive to housing return (High LTV-ratio, Low Downpayment).

Empirical Predictions

Impact of competition with integrated lender

- Focus on return of collateral of those mortgages made by non-integrated lenders.

$$Return_i = \alpha + \kappa HasIntegratedLender_i + X_i\beta + \delta_{q_1,q_2} + \psi_c + \epsilon_i$$

Return of Non-Integrated Lender

	Return Period (A) - Repeat Sales			Return Period (C) - Second Owner		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	-0.616** (0.300)	-0.744* (0.419)	-0.589* (0.301)	-0.693* (0.330)	-1.065** (0.463)	-0.300 (0.256)
Has Integrated Lender × Expansive Soil			-0.214 (0.773)			-2.546*** (0.932)
Expansive Soil			0.009 (0.604)			-0.115 (0.575)
Control Variables (See Note)	✓	✓	✓	✓	✓	✓
Quarter-Pair Fixed Effect	✓	✓	✓	.	.	.
Month of Resale Fixed Effect	.	.	.	✓	✓	✓
Quarter of Construction	.	.	.	✓	✓	✓
Developer Fixed Effects	.	✓	.	.	✓	.
R-squared	0.869	0.877	0.869	0.890	0.904	0.894
Mean Dependent Variable	9.233	9.233	9.233	-10.02	-10.02	-10.02
N	12,483	12,483	12,483	7,957	7,957	7,957

All specifications control for borrower, house and financing characteristics. Standard errors clustered at developer level. Significance: * (p<0.10), ** (p<0.05), *** (p<0.01).

Return of Non-Integrated Lender

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	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	-0.616**	-0.744*	-0.589*	-0.693*	-1.065**	-0.300
	(0.300)	(0.419)	(0.301)	(0.330)	(0.463)	(0.256)
Has Integrated Lender × Expansive Soil			-0.214			-2.546***
			(0.773)			(0.932)
Expansive Soil			0.009			-0.115
			(0.604)			(0.575)
Control Variables (See Note)	✓	✓	✓	✓	✓	✓
Quarter-Pair Fixed Effect	✓	✓	✓	·	·	·
Month of Resale Fixed Effect	·	·	·	✓	✓	✓
Quarter of Construction	·	·	·	✓	✓	✓
Developer Fixed Effects	·	✓	·	·	✓	·
R-squared	0.869	0.877	0.869	0.890	0.904	0.894
Mean Dependent Variable	9.233	9.233	9.233	-10.02	-10.02	-10.02
N	12,483	12,483	12,483	7,957	7,957	7,957

All specifications control for borrower, house and financing characteristics. Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).

Return of Non-Integrated Lender

	Return Period (A) - Repeat Sales			Return Period (C) - Second Owner		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Integrated Lender	-0.616** (0.300)	-0.744* (0.419)	-0.589* (0.301)	-0.693* (0.330)	-1.065** (0.463)	-0.300 (0.256)
Has Integrated Lender × Expansive Soil			-0.214 (0.773)			-2.546*** (0.932)
Expansive Soil			0.009 (0.604)			-0.115 (0.575)
Control Variables (See Note)	✓	✓	✓	✓	✓	✓
Quarter-Pair Fixed Effect	✓	✓	✓	.	.	.
Month of Resale Fixed Effect	.	.	.	✓	✓	✓
Quarter of Construction	.	.	.	✓	✓	✓
Developer Fixed Effects	.	✓	.	.	✓	.
R-squared	0.869	0.877	0.869	0.890	0.904	0.894
Mean Dependent Variable	9.233	9.233	9.233	-10.02	-10.02	-10.02
N	12,483	12,483	12,483	7,957	7,957	7,957

All specifications control for borrower, house and financing characteristics. Standard errors clustered at developer level. Significance: * ($p<0.10$), ** ($p<0.05$), *** ($p<0.01$).
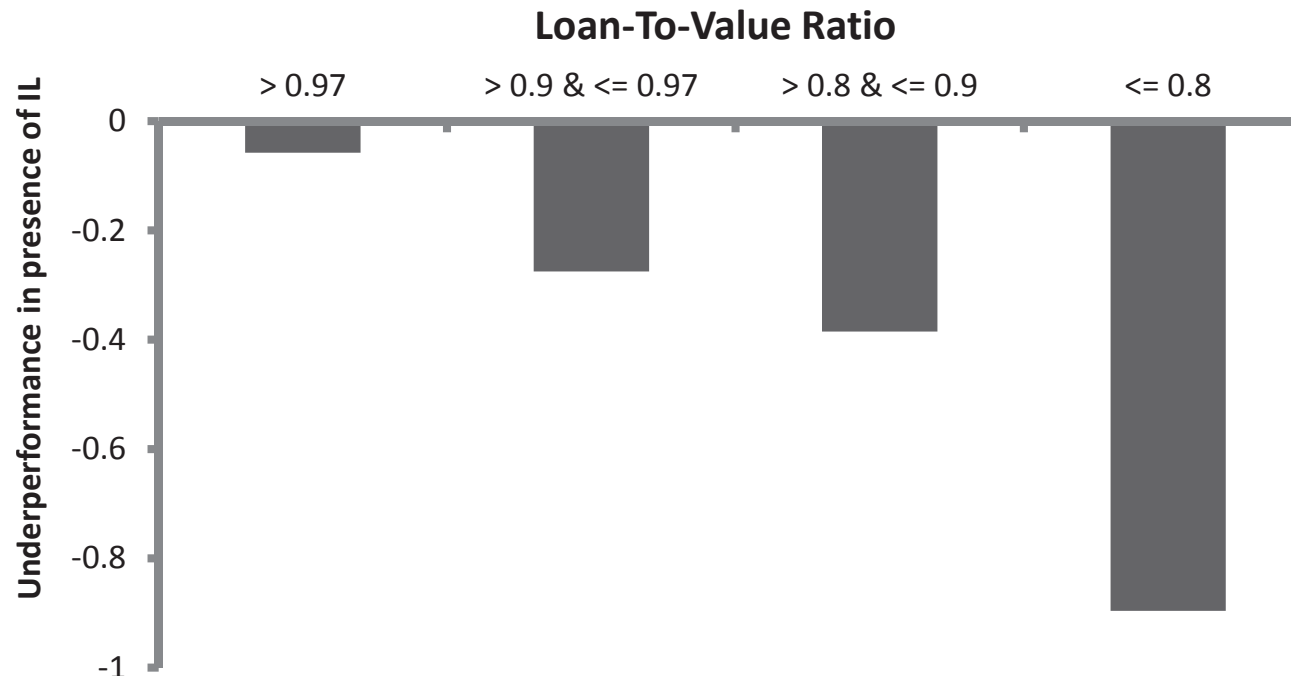
Empirical Predictions and Results

Impact of competition with integrated lender

- The return of houses financed by a non-integrated lender is lower when the lender competes against an integrated lender.

  - Ex-ante similar housing collateral underperforms by 60 bps annually when competing against an integrated lender.

- This underperformance is:

  - Larger when housing return is more sensitive to construction quality (expansive soil).
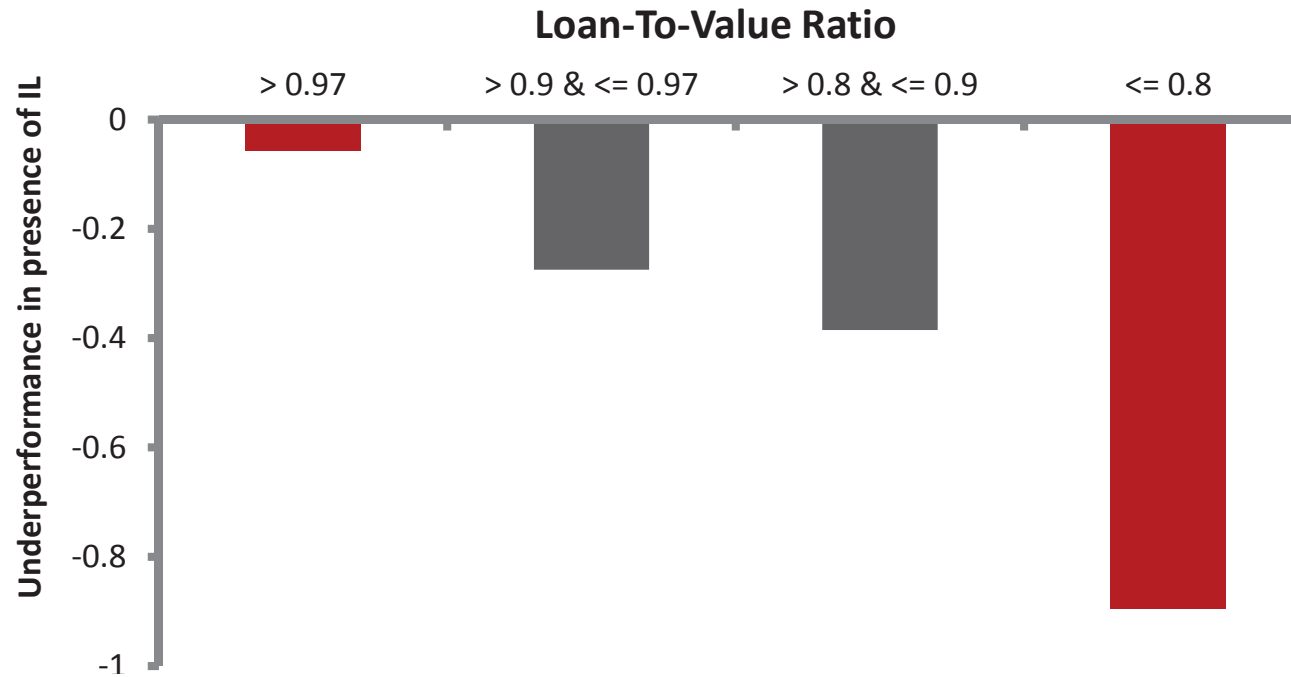
Importance of Collateral Quality

- Return over Period (A) - Full Set of Controls, ex. Developer FE

Importance of Collateral Quality

- Return over Period (A) - Full Set of Controls, ex. Developer FE

Wald Test of H_0: $\kappa_1 = \kappa_4$

- F-Statistic: 3.29 (p-value of 0.07)

Empirical Predictions

Impact of competition with integrated lender

- The return of houses financed by a non-integrated lender is lower when the lender competes against an integrated lender.

    - Ex-ante similar housing collateral underperforms by 60 bps annually when competing against an integrated lender.

- This underperformance is:

    - Larger when housing return is more sensitive to construction quality (expansive soil).

    - Smaller when mortgage repayment is more sensitive to housing return (High LTV-ratio, Low Downpayment).

▸ Return