The supply side of housing finance

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Financial Advice

- Households rely heavily on advice from financial intermediaries: 80% in Germany, 91% UK, 73% US
- Potential for biased recommendations
  1. Limited information
  2. Limited sophistication
- Research questions:
  1. How to identify biased advice?
  2. Is it quantitatively important?
- Look at mortgage type choice – ARM/FRM (temptation to bias and its cost can be large)

A Test for Financial Advice

- Under no advice, prices summarize supply effects on choice
- Under advice, supply shocks and incentives matter
- Mortgage choice (*ARM* vs *FRM*) and prices for 2 million Italian mortgages originate (04-10)
  1. Observe bank identity
  2. Measure time-varying supply factors
     - Bank Bond spread, core deposits, access to securitization
- Disentangle the price channel and the advice channel

Approaches

- **Current approaches:**

1. Compare performance of advised vs non-advised
   - Selection bias
2. Randomized field experiments
   - External validity + long term customers

- Require to **observe advice**
  - Unsolicited
- **Our approach**:
  - no need to observe advice once we observe customers choices, prices and banks supply factors (incentives)
  - Identifying assumptions needed

Results

- We detect strong supplier effects=> consistent with biased advice
- Relative price of ARM/FRM main determinant of choice, but supply factors matter
  - E.g. borrowers from banks that experienced an increase in bond spread, more likely to take ARM
  - Bank bond spread effect is 10% of FRM/ARM price
- Additionally
  1. Results stronger under price inaction
  2. Effects stronger for unsophisticated households

Outline

- Theory
- Empirical strategy
- Data
- Results

Mortgage Choice

- Households
  - Get a mortgage. Choice *FRM* versus *ARM*
  - Risk: income, inflation, real rate
  - ϕ is the FRM premium
  - G is the distribution of risk aversion γ
- Koijen rule $\phi > \frac{\gamma H}{2}(\sigma_\varepsilon^2 - \sigma_\pi^2)$ $[\phi > \gamma]$

$G(\phi)$ is the ARM share. Choice is $m = \{FRM, ARM\}$

Banks

- Continuum of regions, distribution *G* in each region
  - Banks are local monopolies
  - Banks get (heterogeneous) supply shocks $\theta = \{\theta_1, .. \theta_n\}$
  - what is θ ? Access to LTF, deposit base, securitization

- Payoff of the bank

$$U = U(x, \phi, \theta)$$

  - *x* = $G(\phi)$ is the ARM share

No Advice (all weary)

- Bank's problem

$$Max_{\phi} U(G(\phi), \phi, \theta) = Max_{\phi} v(\phi, \theta)$$

- Optimization gives $\phi(\theta)$ so that decision rule (simplified) is

$$m = ARM \quad iff \quad \phi(\theta) > \gamma$$

Proposition 1: under no advice mortgage choice depends on supply factors only through prices

$$E(m \mid \phi, \theta) = E(m \mid \phi),$$

Distorted Advice

- μ is fraction of naives:
  - Naives follow the advice
  - Sophisticated ignore it
- The bank can change HDR by α:
  - ARM iff $\phi - \alpha > \gamma$
- Cost of advice: $c(\alpha, \mu, \theta)$
- ARM fraction: $g(\phi, \mu, \alpha) = \mu G(\phi - \alpha) + (1 - \mu) G(\phi)$

Distorted Advice: FOCs

- Bank payoff

$$v(\mu, \alpha, \phi, \theta) = U(g(\alpha, \phi, \mu), \phi, \theta) - C(\alpha, \mu, \theta)$$

- FOCs

$$v_\alpha(\alpha(\theta), \phi(\theta), \theta, \mu) = 0$$

$$v_\phi(\alpha(\theta), \phi(\theta), \theta, \mu) = 0$$

Naïve =>

$$m = ARM \ \ iff \ \ \phi(\theta) > \lambda + \alpha(\theta)$$

Advice

Proposition 2: under advice

$$E(m \mid \phi, \theta) \neq E(m \mid \phi), \qquad \text{(if \# of } \theta s > 1 \text{)}$$

- FOCs are a joint restriction on ϕ, α
- But α unobservable

- θ_S add information (unless ϕ, α are linked by a deterministic relationship - always true if $\# \theta s = 1$)

Costly price adjustment

Assume menu cost to change ϕ => price inaction

Proposition 3: under advice and price inaction

1. $E(m \mid \phi, \theta) \neq E(m \mid \phi)$, Even if # of $\phi = 1$

2. Effect of $\theta' s$ on mortgage choice stronger during inaction

Takeaways

- Under no advice, supply factors do not affect mortgage choice conditional on prices

- Under advice they do

  1. We test for $E(m \mid \phi, \theta) = h(\phi, \theta)$

  2. Signs should go in the "right" way: $\alpha_{\theta_i}(\theta)$

- Under price rigidity the result is always true

Main Equation

To test these propositions we estimate:

$$x_{ibt} = \beta_1 \phi_{ibt} + \beta_2 z_{ibt} + \beta_3 B_{bt} + f_b + f_t + \varepsilon_{ibt}$$

- $x_{ibt} = 1$ if FRM. The coefficients of interest are β_3
- f_b and f_t take care of aggregate factors and banks fixed characteristics
- Identification assumption: $\mathrm{Cov}(\varepsilon, \mathrm{B} | \phi, z, f_b, f_t) = 0$
  - Unobserved individual heterogenity is uncorrelated with time varying bank supply factors

Identification

- Source of failure: sorting
  - e.g. Larger banks attract more risk averse customers
- Include a **bank fixed effects** together with time varying supply factors
  - **Key assumption:** the composition of the pool of borrowers does not react to bank specific quarter to quarter variation in funding conditions
- Sorting unlikely to be an issue in our data

Price inaction

Model role of price inaction as:

$$x_{ibt} = \beta_1 \phi_{ibt} + \beta_2 z_{ibt} + \beta_3 B_{bt} + \beta_4 B_{bt} D_{bt} + f_b + f_t + \varepsilon_{ibt}$$

- D_{bt} =1 if b keeps relative price unchanged in $[t, t-1]$
- Coefficients of interest: β_3 , β_4 => same sign
- Roles of price inaction:

=> Stonger effects of B_{bt} at times of inaction (a check of the theory)

=> Test robust to measurement error in ϕ_{ibt}

=> Test robust to omitted price relevant demand controls

(inaction breaks the correlation between B_{bt} and ϕ_{ibt})

Data Sources

- Bank of Italy datasets:
  - Credit Register: info on loans exposure (above 75k)
  - SLIR: survey data on interest rate charged on loans (175 banks)
  - Banks broad geographic coverage (median: 80% of provinces)
- Data: 2 mln mortgages 04-10. Focus on comparable contracts: standard 20-25 year FRM and ARM
  - End up with 80% of the sample 1.6 mln
- Relevant info:
  - Mortgage info: amount, rate, type
  - Borrower info: age, gender, nationality, province, cohabitation, distance
  - Lender info: identifier => balance sheet information

descr stats

The Relative Price

- Relative price $r_{ibt}^{FRM} - r_{ibt}^{ARM}$

- Problem: do not observe both for single *i*
- Impute them for *each b* from

$$r_{ibt}^{ARM} = \delta_{1b} z_{ibt} + \chi_{1b} T_t \quad \text{for} \quad i \in ARM$$

$$r_{ibt}^{FRM} = \delta_{2b} z_{ibt} + \chi_{2b} T_t \quad \text{for} \quad i \in FRM$$

- Compute FRM risk premium (1 year lag mov av)

$$\phi_{ibt} = r_{ibt}^{FRM} - Er_{ibt}^{ARM}$$

- Issue: some measurement error in ϕ_{ibt} **link**

Supply Factors

- **Bank bond spread**=> relative advantage in ARM
- **Securitization activity** => relative advantage in FRM (Fuster & Vickery, 2014)
- **Deposit to total funding** => relative advantage in FRM (Berlin & Mester, 1999)

Price Inaction

- Compute for each *b*,*t*

$$\Delta Spread_{bt} = \Delta(r_{bt}^{FRM} - r_{bt}^{ARM})$$

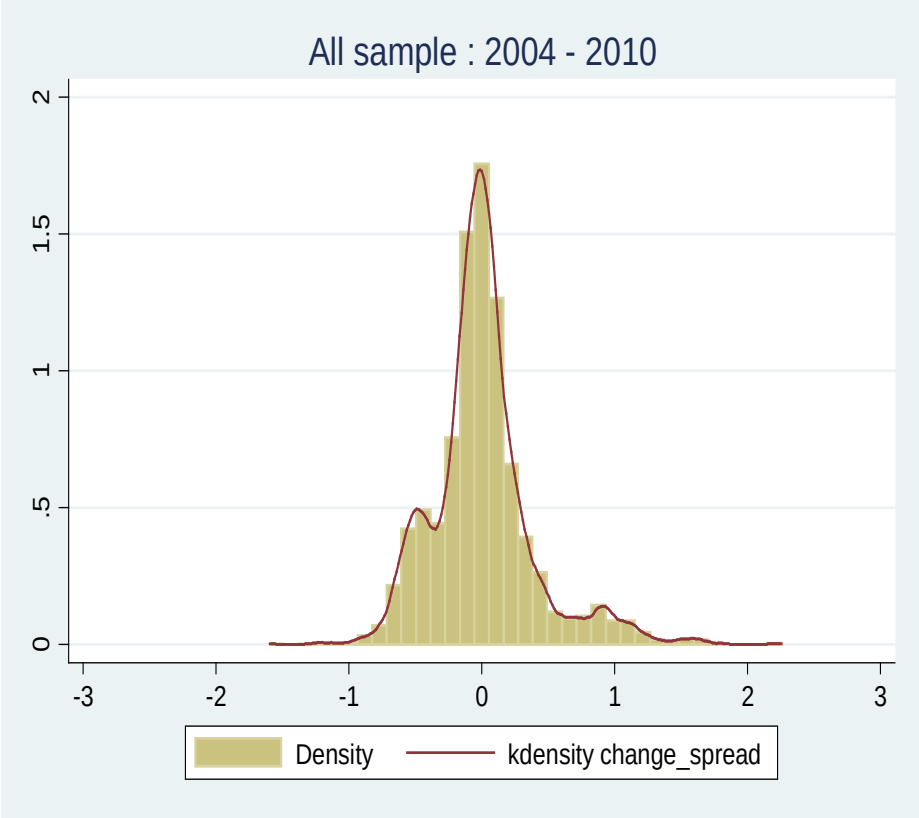
- Define inaction =1 if

$$\Delta Spread_{bt} \in \pm \frac{Sd(\Delta Spread)}{3}$$

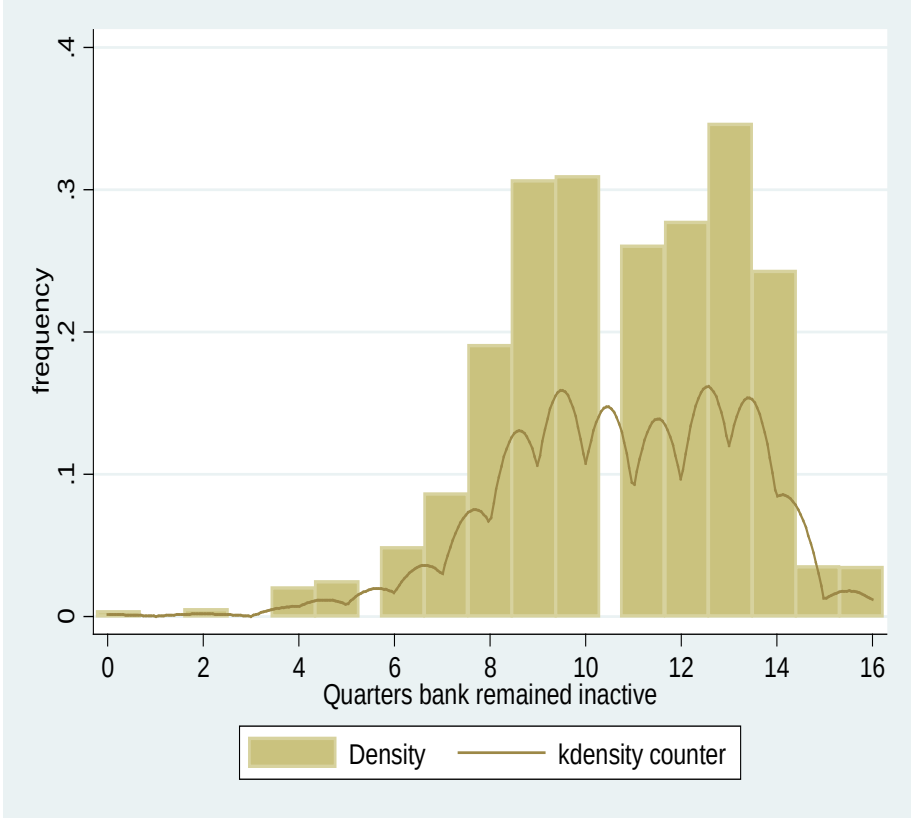
- Also with Sd/4 link

Price Inaction: evidence

Distribution of the changes of the spread



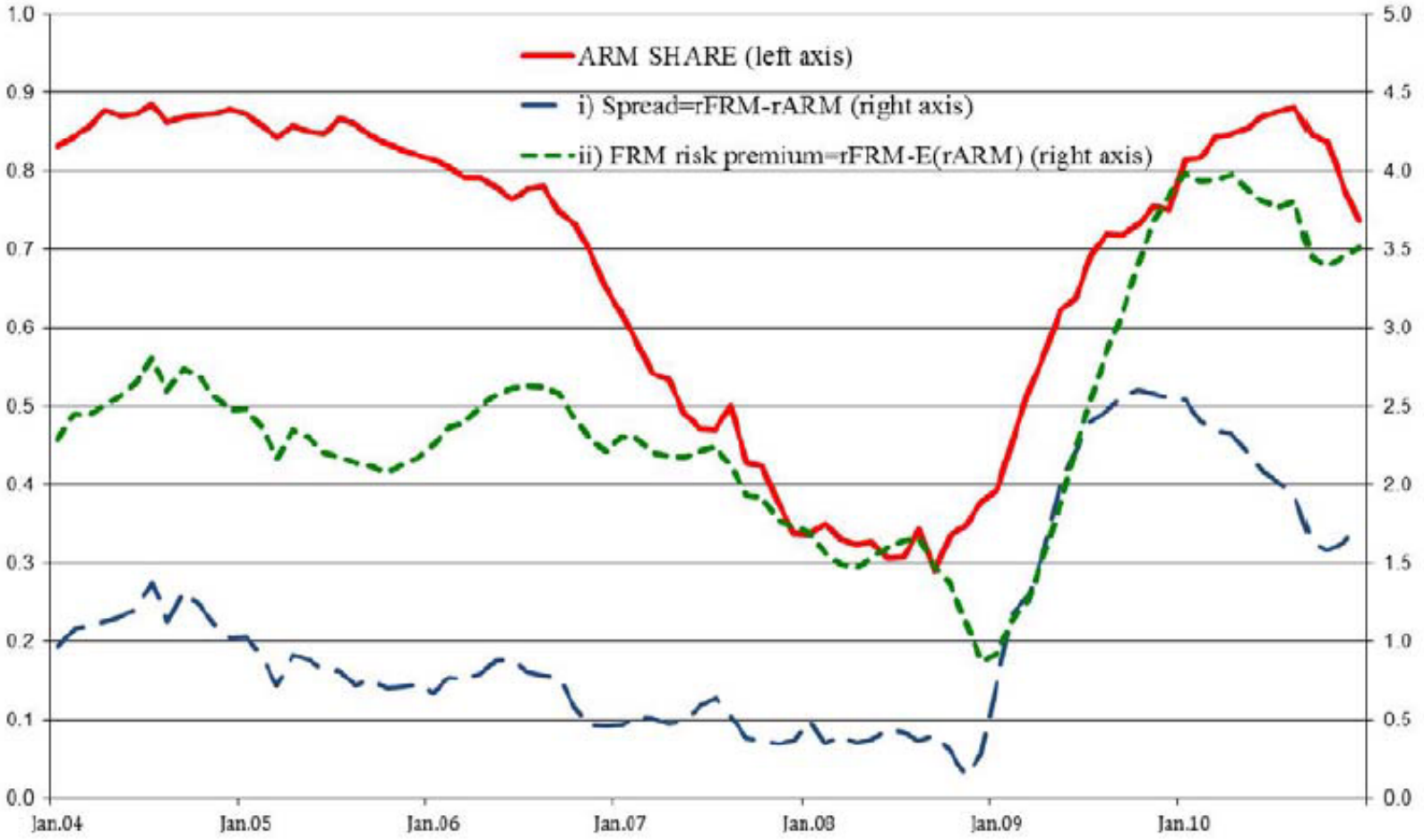
Cross sectional distribution of the numbers of quarters banks remained inactive (28 Q): median 11



Price inaction in about 50% of the observations

ARM Share

Figure 1. Aggregate share of ARM and alternative "Long term financial premium" measures



Lender Characteristics & Mortgage Choice

lhs=1 if FRM chosen

	I	II	III	IV
Long Term Financial Premium (LTFP)		-0.31***	-0.35***	-0.34***
		(0.029)	(0.027)	(0.026)
Bank fixed effects	yes	yes	yes	yes
Time fixed effects	no	no	yes	yes
Borrowers' Characteristics	no	no	no	yes
Province fixed effects	no	no	no	yes
Observations	1,662,429	1,662,429	1,662,429	1,662,429
R-squared	0.098	0.476	0.592	0.600

1 percentage point increase (1 sd) in the FRM premium lowers the fraction of FRM by 34 pp

Supply effects

	Baseline model	non- linear terms for LTP
LTFP	-0.349***	-0.474***
$LTFP^2$		-0.012
$LTFP^3$		0.028***
Bank bond spread	-0.027*	-0.029*
	(0.015)	(0.017)
Securitization activity	0.138***	0.124***
	(0.028)	(0.023)
Deposit ratio %	0.006***	0.006***
	(0.002)	(0.002)
Bank fixed effects	yes	yes
Time fixed effects	yes	yes
Borrowers' Characteristics	yes	yes
Province fixed effects and control for bank competition	yes	yes
Observations	1,662,389	1,662,389
R-squared	0.608	0.628

RC

Static Sorting? link

	Observations	Mortgage size (log)		Age		Female	
		Mean	*Std.Dev.*	*Mean*	*Std.Dev.*	*Mean*	*Std.Dev.*
All sample							
a) Banks specialized in ARM	150,792	11.744	0.445	37.978	9.189	0.443	0.348
b) Non-specialized banks	1433889	11.734	0.440	38.119	9.282	0.434	0.357
c) Banks specialized in FRM	77,748	11.717	0.458	39.381	9.783	0.445	0.346
Ho: Mean (a) = Mean (c) (p-value)		(0.970)		(0.926)		(0.997)	
Ho: SD (a) = SD (c) (p-value)			(0.737)		(0.707)		(0.766)
2004-2007							
a) Banks specialized in ARM	60,596	11.703	0.450	37.505	9.417	0.440	0.342
b) Non-specialized banks	895,219	11.713	0.438	37.733	9.270	0.430	0.354
c) Banks specialized in FRM	48,074	11.698	0.465	38.940	9.790	0.443	0.345
Ho: Mean (a) = Mean (c) (p-value)		(0.994)		(0.926)		(0.995)	
2008-2010							
a) Banks specialized in ARM	90,196	11.771	0.439	38.295	9.020	0.445	0.352
b) Non-specialized banks	538,670	11.768	0.442	38.761	9.266	0.440	0.362
c) Banks specialized in FRM	29,674	11.749	0.443	40.096	9.730	0.447	0.346
IIo: Mean (a) = Mean (c) (p-value)		(0.975)		(0.904)		(0.997)	

“Dynamic” Sorting?

	Mortgage size (log)	Italian	Cohabitation	Age	Female
Bank bond spread	-0.0010	0.0007	0.0009	-0.0251	-0.0016
	(0.0067)	(0.0045)	(0.0022)	(0.0775)	(0.0012)
Deposit ratio	-0.0001	-0.0001	0.0001	-0.0047	-0.0000
	(0.0005)	(0.0006)	(0.0004)	(0.0104)	(0.0001)
Securitization activity	-0.0172	0.0036	-0.0103	-0.4767	0.0024
	(0.0247)	(0.0191)	(0.0090)	(0.3757)	(0.0033)
Bank fixed effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Province fixed effects	yes	yes	yes	yes	yes
Observations	1,600,309	1,600,309	1,600,309	1,600,309	1,600,309
R-squared	0.0413	0.0613	0.0179	0.0347	0.0030

Yet, Individual Characteristics Affect Contract Choice

Log Mortgage size	-0.043***
	(0.007)
Female	0.011***
	(0.001)
Age	-0.0004*
	(0.0002)
Italian	0.049***
	(0.008)
Joint mortgage	0.007**
	(0.003)
Cohabitation	-0.003**
	(0.0014)
BFE, TFE, PFE, Bank competition and other controls	yes
Observations	1,662,389
Adjusted R-squared	0.360

Demand Shocks Driving Results?

	Controlling for Time-Province FE	Only banks present in all provinces
LTFP	-0.280***	-0.404***
	(0.021)	(0.034)
Bank bond spread (2)	-0.027*	-0.026*
	(0.015)	(0.015)
Securitization activity (3)	0.132***	0.223***
	(0.030)	(0.04)
Deposit ratio % (4)	0.005***	0.009***
	(0.001)	(0.002)
Observations	1,662,389	957,961
Adjusted R-squared	0.5729	0.6615

Effects Under Price Inaction

	Baseline
LTFP (1)	-0.350***
	(0.024)
Bank bond spread	-0.014
	(0.016)
Securitization activity	0.137***
	(0.025)
Deposit ratio %	0.005***
	(0.002)
D_{ib}	0.052*
	(0.031)
Bank bond spr * D_{ib}	-0.0621***
	(0.013)
Secur- Activity * D_{ib}	0.017*
	(0.010)
Dep ratio * D_{ib}	0.0008*
	(0.0005)
Bank, Time, Province FE , Borrowers' Characteristics	yes
Observations	1,662,389
R-squared	0.609

Effect of Sophistication link

	(a) Sophisticated borrowers:	(b) Unsophisticated borrowers:	Difference |b-a|	H0: |b-a|>0
Long Term Financial Premium (LTFP) (1)	-0.315***	-0.397***	0.082	**
	(0.025)	(0.029)	(0.039)	
Bank bond spread (2)	-0.013	0.007	0.021	
	(0.019)	(0.024)	(0.030)	
Securitization activity (3)	0.108***	0.175***	0.066	**
	(0.024)	(0.019)	(0.031)	
Deposit ratio % (4)	0.005***	0.007***	0.002	*
	(0.001)	(0.001)	(0.001)	
D_{ib} (5)	0.060	0.046	0.014	
	(0.039)	(0.028)	(0.048)	
Bank bond spread * D_{ib}	-0.036**	-0.085***	0.048	**
	(0.015)	(0.025)	(0.029)	
Securitization Activity * D_{ib}	-0.017	0.027*	0.045	**
	(0.021)	(0.015)	(0.026)	
Deposit ratio % * D_{ib}	-0.001	0.001**	0.003	**
	(0.002)	(0.0004)	(0.002)	
(BFE, TFE, PFE), Borrowers characteristics	yes	yes		

Alternative explanation?

- Advertisement, not distorted advice
- Banks target share of FRM/ARM: say 70/30 and then rationing
  - Rationing stronger at times of price inaction
  - Stronger for unsophisticated if have higher search costs (take the contract offered rather than move)
- Both imply sorting/selection
- We do not see it in the data

Summarizing

- Evidence consistent with biased advice
- Quantitatively important. 1 sd QoQ increase in:
  - bond spread) +2.8 pp in Pr(ARM)
  - entry in sec mkts): – 3.1 pp in Pr(ARM)
  - Deposits/Funding): -3.2% in Pr(ARM)
- Inaction and sophistication reinforce results

Next Steps

- Deal with sorting formally
- Observe banks visited (banks have to send an inquire to the Credit Register)
- Two stage (Heckman type) model:
  - Bank selection: driven by **level** of interest rates
  - Mortgage type: driven by **FRM premium**
- Same FRM *spread* consistent with different *levels* of interest rates (natural exclusion restrictions)
- Extend model to deal with competition
  - Price (comparable) versus advice (harder to compare) under competition

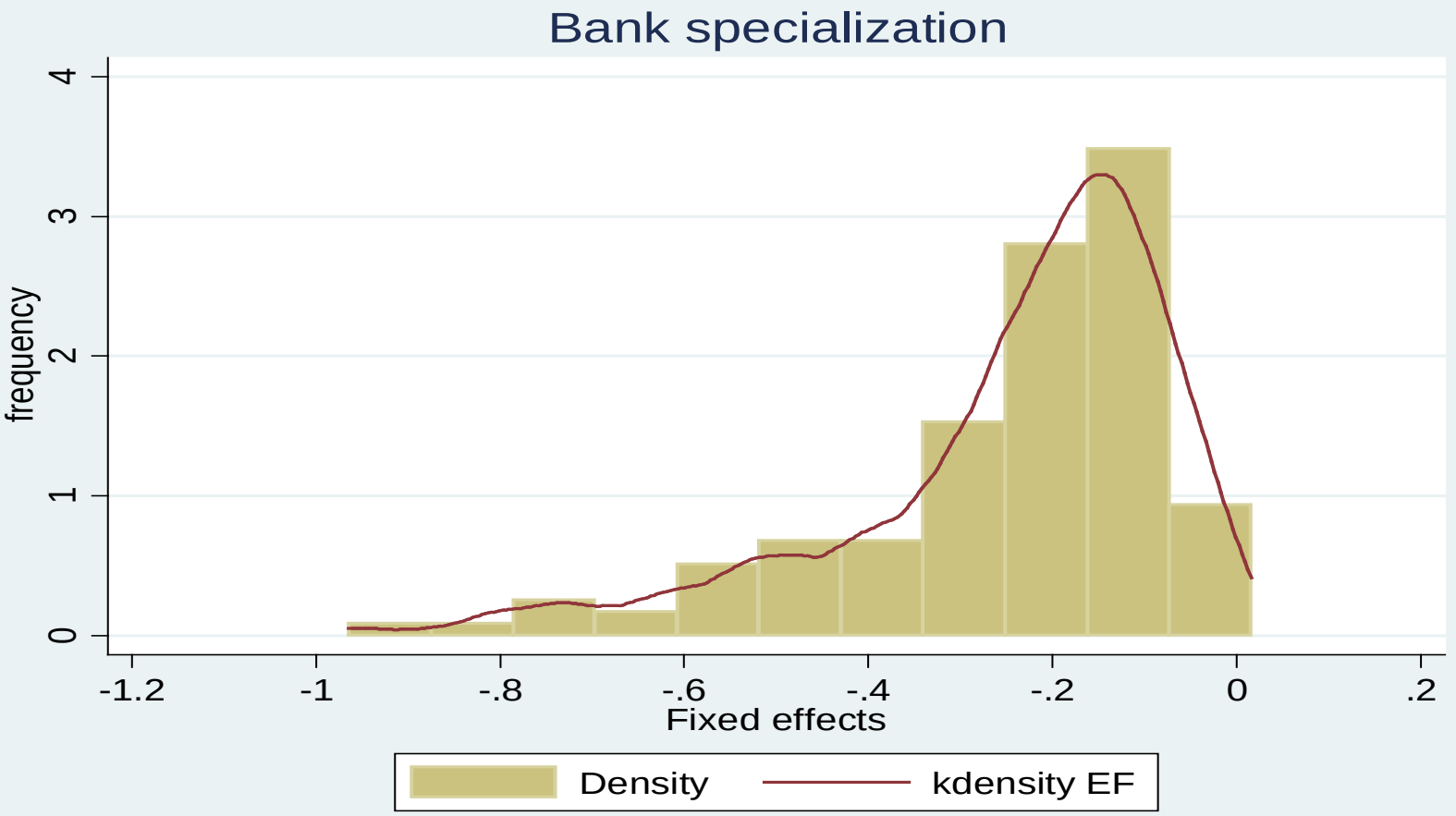
Measurement error: link

- Imputation may be problematic:
  - Measurement error => Φ endogenous
  - Φ and B correlated β_3 may be biased
- We restrict analysis to inaction times
  - Φ and B uncorrelated in inaction times
- Inaction orthogonal to selection within the bank

Supply shocks orthogonal to prices during inaction back

Exp. variables	Dependent variable FRM premium
Bank bond spread	0.1179**
	(0.048)
Bank bond spread *D	0.0099
	(0.0426)
Time dummies	yes
Bank fixed effects	yes
Observations	1,662,429
R-squared	0.6201

Bank fixed effect distribution back



Rationing back

- Banks target share of FRM/ARM: say 70/30
- They then ration contract types
  - Rationing stronger at times of price inaction
  - Stronger for unsophisticated if have higher search costs (take the contract offered rather than move)
- But rationing=> sorting which we do not see
  - Bank 70 FRM/30 ARM=> should attract disproportionate share of risk averse compared to bank targeting 30 FRM/70 ARM
  - We do not see it in the data

Reverse causality back

- Two answers:

1. unlikely as it takes time to securitize or to attract deposits
2. Cannot explain sign of Bank Bond Spread
    1. Increase in demand of FRM=> Issue more fixed rate bonds => pay higher spreads => positive correlation between FRM choice and Bank Bond Spread
    2. Correlation is negative

Financial Sophistication back

- H0: Biased advice less important for sophisticated borrowers
- Run the experiment for sophisticated/unsophisticated borrowers and test for difference
- Proxies:
  1. Value of the mortgage) proxies for wealth (education)
  2. Have already borrowed in the past vs first time borrowers

Descriptive stats: 1

Mortgage characteristics

Variables	Obs.	Mean	Std. Dev.	Median
Fixed Rate Mortgage contract	1662429	0.303	0.460	0.000
Mortgage size (log)	1662429	11.734	0.441	11.733
Joint Mortgage	1662429	0.509	0.500	1.000
Interest rate actual:				
1. FRM rate	504407	5.545	0.834	5.713
2. ARM rate	1158022	3.829	1.181	3.775
Interest rate fitted:				
3. FRM rate	1158022	5.106	0.482	5.133
4. ARM rate	504407	4.706	1.107	5.270
Spread (1)	1662429	0.915	1.004	0.725
FRM risk premium	1662429	0.897	1.074	0.938

Descriptive stats:2

Individual characteristics

Variables	Obs.	Mean	Std. Dev.	Median
Italian	1662429	0.893	0.294	1.000
Cohabitation (4)	1662429	0.206	0.405	0.000
Age (in years)	1662429	38.165	9.302	37.000
Female	1662429	0.435	0.356	0.500
Distance 1 (province)	1662429	0.152	0.359	0.000
Concentration Index (11)	1662389	60.152	7.386	59.294
GDP per capita (12)	1662429	10.190	0.236	10.273

Descriptive stats:3 back

Lender characteristics

Variables	Obs.	Mean	Std. Dev.	Median
Supply shift factors:				
Deposit funding % (5)	1662429	44.441	20.444	46.124
Securitization dummy (6)	1662429	0.783	0.321	1.000
Bank bond spread (7)	1662429	0.283	0.496	0.267
Other characteristics:				
Leverage ratio % (7)	1600446	6.449	2.524	6.238
Mutual bank dummy	1662429	0.005	0.072	0.000
Delinquency ratio %(8)	1662410	3.489	2.278	3.140
Bank size (log)	1662429	10.215	1.436	10.144
Group dummy	1662429	0.918	0.275	1.000
Foreign subsidiary dummy	1662429	0.051	0.219	0.000
Patti Chiari (9)	1662429	0.632	0.482	1.000

Descriptive stats:3

Stats for the time varying component of supply factors

Variable	Obs	Mean	Std. Dev.	Min	Max
Deposit strength	3536	3.51E-09	5.646	-26.50	62.77
Securitization activity	3536	8.25E-10	0.210	-1.015	1.004
Bank bond spread	3536	4.74E-10	0.364	-1.542	2.226

Note: Descriptive statistics calculated on the residuals obtained from three regressions in which the 3 bank supply factors are regressed one at the time on bank and time dummies