The Cost of Distorted Advice in the Mortgage Market

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Financial Advice

Households rely heavily on advice from financial intermediaries
Survey evidence: 80% of households in Germany; 91% in UK; 73% in US

Potential for biased recommendations

1. Limited information
2. Limited sophistication

Two big research questions:

1. How to identify existence of biased advice? 
   If present, is it quantitatively important?
2. What is its welfare cost? 
   Which policies can best reduce it?
Two dimensions

• Address both questions using two complementary approaches:
  1. A reduced form approach to identify existence
  2. A structural estimation approach to assess welfare and alternative policies

• Look at mortgage choice, look at Italy. Draw on:
  • Foà, Gambacorta, Guiso and Mistrulli (on 1)
  • Guiso, Pozzi, Tsoy, Gambacorta, Mistrulli (on 2)
Temptation to Bias and its Cost May Be Large
Why the Italian mortgage market?

- Two mortgage types:
  - Adjustable rate mortgage (ARM)
  - Fixed rate mortgage (FRM)

- Advice provided by banks

- Banks trade-off: FRMs expose to interest rate risk

- Banks’ risk management tools:
  - pricing;
  - distorted advice;
  - other instruments
Related literature

• Expert advice in financial markets: Empirics
  [Anagol et al. (2017); Egan (2015); Egan et al. (2015); Foà et al. (2016); Foester et al. (2017); Hackethal et al. (2012); Ru and Schoar (2015); Woodward and Hall (2012)]

• Structural models of financial markets
  [Allen et al. (2016); Crawford et al. (2015); Einav et al. (2012); Hortacsu et al. (forthcoming); Hortacsu and Kastl (2012)]

• Expert advice in financial markets: Theory
  [Gennaioli et al. (2015); Inderst and Ottaviani (2012); Kartik (2007); Ottaviani and Squintani (2007)]
Outline

- Reduced form empirical strategy
- Data
- Reduced form evidence
- Structural model and identification
- Structural estimates
- Welfare evaluation & Counterfactual
Reduced Form Tests: Approaches

• **Current approaches:**
  • Compare performance of advised vs unadvised
    • Selection bias
  • Randomized field experiments
    • External validity + long term customers
  • Require to **observe advice**
    • Unsolicited
Our Test Strategy

• Under no advice, prices summarize supply effects on choice

• Under advice, banks identity and incentives matter

• Goal: disentangle the price channel and the advice channel

Features:

• no need to observe advice once we observe customer choices, prices and banks supply factors (incentives)

• identifying assumptions needed
Bank of Italy datasets

- Credit Registry: all loans \( \geq 75K \)
- Data on interest rate charged on loans (175 banks)

Data for reduced form

- Microdata on 2 mln mortgages 25 and 30 years 2004-2010
- Contract info: Amount borrowed, rate and type
- Borrower info: age, gender, nationality, province, cohabitation, proximity to bank
- Lender info: identifier \( \Rightarrow \) balance sheet information

Data for structural analysis

- Universe of 25 and 30 years mortgages 2005-2008
- Aggregate info (by bank-quarter-province): Num ARM and average rate; Num FRM and average rate
- Lender info: as above + Market share in deposit market
Mortgage choice

- Households (sophisticated and unsophisticated)
  - Get a mortgage (choose FRM vs ARM)
  - Risk: income, inflation, real rate
  - $\phi$: FRM-ARM spread
  - $Q$: distribution of risk aversion

- Spread rule (Koijen et al. 2009)

$$\phi > \frac{\gamma H}{2} \left( \sigma_{\epsilon}^2 - \sigma_{\pi}^2 \right)$$

- Unsophisticated follow advice by the bank
Main equation

- Our test involves estimating:

\[ x_{ijt} = \beta_1 \phi_{ijt} + \beta_2 z_{ijt} + \beta_3 B_{it} + f_i + f_t + \varepsilon_{ijt} \]

- \( x_{ijt} = 1 \) if FRM
- The coefficient of interest is \( \beta_3 \)
- \( f_i \) banks fixed characteristics
- \( f_t \) take care of aggregate factors

- Identification assumption: \( \text{Cov}(\varepsilon, B|\phi, z, f_i, f_t) = 0 \)
  - individual heterogeneity is uncorrelated with time varying bank supply factors
Identification strategy

Quarter 1
Mortgage choice
Bond premium = 100bp
FRM-ARM spread = 100bp

Say household chooses FRM

Compare with:

Quarter 2
Mortgage choice by same borrower from same bank
Bond premium = 200bp
FRM-ARM spread unchanged (or controlled for)

If household chooses ARM⇒
Evidence of distorted advice
Supply Shifters

- **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; Ivashina & Scharfstein, 2010)
# Reduced Form Results

<table>
<thead>
<tr>
<th>Dependent variable =1 if borrower chooses FRM</th>
<th>I Baseline</th>
<th>II Bond spread always observed</th>
<th>III Nonlinear LTFP</th>
<th>IV Banks operating in all provinces</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTFP</td>
<td>-0.0623***</td>
<td>-0.0625***</td>
<td>-0.0524***</td>
<td>-0.0703***</td>
</tr>
<tr>
<td>LTFP(^2)</td>
<td></td>
<td></td>
<td>-0.0020</td>
<td></td>
</tr>
<tr>
<td>LTFP(^3)</td>
<td></td>
<td></td>
<td>0.0002</td>
<td></td>
</tr>
<tr>
<td>Bank bond spread</td>
<td>-0.0678***</td>
<td>-0.0633***</td>
<td>-0.0700***</td>
<td>-0.0737***</td>
</tr>
<tr>
<td>Securitization activity</td>
<td>0.0006***</td>
<td>0.0006***</td>
<td>0.0007***</td>
<td>0.0008***</td>
</tr>
<tr>
<td>Deposit ratio (%)</td>
<td>0.0016*</td>
<td>0.0022**</td>
<td>0.0016*</td>
<td>0.0022*</td>
</tr>
<tr>
<td>Bank f.e.</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Region-time f.e.</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Borrower characteristics</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>
"Dynamic" Sorting?

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Mortgage size (log)</th>
<th>Italian</th>
<th>Cohabitation</th>
<th>Age</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank bond spread</td>
<td>0.0005</td>
<td>-0.0079</td>
<td>0.0034</td>
<td>-0.1227</td>
<td>-0.0020</td>
</tr>
<tr>
<td></td>
<td>(0.0052)</td>
<td>(0.0056)</td>
<td>(0.0024)</td>
<td>(0.0862)</td>
<td>(0.0014)</td>
</tr>
<tr>
<td>Securitization activity</td>
<td>0.0079</td>
<td>-0.0016</td>
<td>-0.0058</td>
<td>-0.2730</td>
<td>0.0035</td>
</tr>
<tr>
<td></td>
<td>(0.0136)</td>
<td>(0.0014)</td>
<td>(0.0068)</td>
<td>(0.4104)</td>
<td>(0.0031)</td>
</tr>
<tr>
<td>Deposit ratio (%)</td>
<td>0.0003</td>
<td>-0.0002</td>
<td>-0.0001</td>
<td>-0.0014</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0005)</td>
<td>(0.0003)</td>
<td>(0.0128)</td>
<td>(0.0001)</td>
</tr>
<tr>
<td>Bank f.e.</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Region-time f.e.</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>F-test joint significance (p-value)</td>
<td>0.4020</td>
<td>0.9166</td>
<td>0.8890</td>
<td>0.7853</td>
<td>0.2684</td>
</tr>
</tbody>
</table>

Time-varying bank supply factors uncorrelated with customers observable characteristics
Yet, Individual Characteristics Affect Contract Choice

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortgage size (log)</td>
<td>-0.044***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
</tr>
<tr>
<td>Joint Mortgage</td>
<td>0.006*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
</tr>
<tr>
<td>Italian</td>
<td>0.065***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
</tr>
<tr>
<td>Cohabitation</td>
<td>0.004***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0002)</td>
</tr>
<tr>
<td>Female</td>
<td>0.012***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
</tr>
<tr>
<td>Bank, time, province FE</td>
<td>yes</td>
</tr>
</tbody>
</table>
## Effect of Sophistication

| Dependent variable is the probability that the borrower chooses a FRM | (a) Sophisticated borrowers from provinces top 5% in education | (b) Unsophisticated borrowers from provinces bottom 5% in education | Difference $|b - a|$ $H_0 : |b - a| > 0$ |
|---|---|---|---|
| Long term financial premium (LTFP) (1) | -0.0691*** (0.0065) | -0.0601*** (0.0083) | 0.009 (0.011) |
| Bank bond spread (2) | -0.0504*** (0.0131) | -0.0878*** (0.0109) | 0.037** (0.017) |
| Securitization activity (3) | -0.0016 (0.0299) | 0.0897*** (0.0260) | 0.091** (0.040) |
| Deposit ratio (%) (4) | -0.0009 (0.0013) | 0.0023* (0.0013) | 0.003** (0.002) |
| Bank f.e. | yes | yes |
| Regin-time f.e. | yes | yes |
| Borrowers’ characteristics | yes | yes |
Summary of reduced form

• Supplier shocks affect mortgage choice even after prices are controlled for

• Consistent with biased advice

• Sign of coefficients reflects incentives

• Quantitatively important. 1 sd QoQ increase in:
  • bond spread $\Rightarrow +3.4$ pp in Pr(ARM)
  • entry in sec mkts $\Rightarrow -3.3$ pp in Pr(ARM)
  • Deposits/Funding $\Rightarrow -0.3\%$ in Pr(ARM)

• Sophistication reinforces results
Evidence raises new questions:

1. Can Financial Advice be valuable even when distorted?
2. What is the cost of the distortion for consumers?
3. Who bears the cost if not all the consumers are naive? Can some actually gain?
Structural model

- Model
  - Households
  - Banks
- Identification
- Estimates
- Counterfactuals
Model: Households

- Born in bank \( i \) (home bank) with prob. \( p_i \)
- Choose bank and type of mortgage (ARM vs FRM)
- Households heterogeneity:
  - sophisticated (frac. \( 1 - \mu \)) vs naive (\( \mu \));
    [captures people who are susceptible to advice]
  - un-attached (frac. \( \psi \)) vs attached (\( 1 - \psi \)) to home bank;
    [captures market frictions]
  - Optimal cutoff on FRM-ARM spread \( \delta \sim N(\mu_\delta, \sigma_\delta) \)
    [risk aversion, mortgage size, beliefs on volatility of rates and inflation, expectations on nominal interest rates]
**Model: Household behavior**

<table>
<thead>
<tr>
<th></th>
<th>Un-attached (frac. $\psi$)</th>
<th>Attached (frac. $1 - \psi$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sophisticated</strong> (frac. $1 - \mu$)</td>
<td>• best market rates</td>
<td>• rates at home bank</td>
</tr>
<tr>
<td></td>
<td>• “Spread rule”</td>
<td>• “Spread rule”</td>
</tr>
<tr>
<td><strong>Naive</strong> (frac. $\mu$)</td>
<td>• best fixed rate</td>
<td>• rates at home bank</td>
</tr>
<tr>
<td></td>
<td>[“Money doctors” (Gennaioli et al. 2015)]</td>
<td>• recommended mortgage type</td>
</tr>
<tr>
<td></td>
<td>• recommended mortgage type</td>
<td></td>
</tr>
</tbody>
</table>

"Spread rule" (ex. Koijen et al. 2015). ARM iff:

$$\nu_r + H\gamma(\sigma_e^2 - \sigma_\pi^2) \equiv \delta \leq \phi_{ht} \equiv \text{FRM-ARM spread}$$
Model: Banks

Bank managers maximize:

\[
\begin{bmatrix}
\text{profits on ARM} & \text{profits on FRM} & \text{cost of deviating from ideal frac. of FRM} \\
\end{bmatrix}
\]

\[s^a_{it}(1 - x_{it}) + s^f_{it}x_{it} - \lambda(x_{it} - \theta_{it})^2\]

\[\times m_{it} \times e^{-\beta r_{it}}\]

- Heterogenous in cost-efficient fraction of FRMs: \(\theta_{it} \sim TN\)
  Drives banks' incentives in setting rates and provide advice

- Compete setting FRM spread over interest rate swap: \(s^f_{it}\)

- Distort choices of naive through advice
  Recommend “Take ARM” to fraction \(1 - \omega_i\) of their customers
Identification

“Demand” parameters

- % of un-attached ($\psi$) $\sim$ % taking mortgage outside home bank (SHIW)
- % of naive ($\mu$) $\sim$ Behavior naive vs. sophisticated
- Optimal cutoff ($\mu_\delta, \sigma_\delta$) $\sim$ Variation in FRM-ARM spread
- Estimation by maximum likelihood

“Supply” parameters

- We want to recover: $\theta_{it}$’s, $\beta$ and $\lambda$
- Exploit 2 sets of FOCs: advice; FRM-ARM spread
- Need stationarity of demand to identify $\theta_{it}$’s
### Parameter estimates

<table>
<thead>
<tr>
<th>Demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Estimate</strong></td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td><strong>Supply</strong></td>
</tr>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Estimate</strong></td>
</tr>
<tr>
<td>μ (frac. of naive)</td>
<td>0.48 [0.46;0.49]</td>
</tr>
<tr>
<td>ψ (frac. of un-attached)</td>
<td>0.0884 [0.0879;0.0891]</td>
</tr>
<tr>
<td>μδ (cutoff distrib. - mean)</td>
<td>−0.68 [−0.88;−0.56]</td>
</tr>
<tr>
<td>σδ (cutoff distrib. - stdev)</td>
<td>0.9 [0.81;1.01]</td>
</tr>
<tr>
<td>λ (cost param.)</td>
<td>2.5 [2.36;13.15]</td>
</tr>
<tr>
<td>β (high spread penalty)</td>
<td>0.46 [0.38;0.52]</td>
</tr>
</tbody>
</table>

*Imply that banks distort choice for 48% of the customers*
Evidence of distorted advice

\[ \theta_{bt} = a_b + b \times \text{Bond spread}_{bt} + \tau_t + e_{bt} \]

<table>
<thead>
<tr>
<th></th>
<th>All sample</th>
<th>Deposit/ Liabilities &lt; 75 pctile</th>
<th>Deposit/ Liabilities &lt; 50 pctile</th>
<th>Deposit/ Liabilities &lt; 25 pctile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank bond spread</td>
<td>-0.042* (0.025)</td>
<td>-0.069** (0.028)</td>
<td>-0.078** (0.033)</td>
<td>-0.089 (0.055)</td>
</tr>
<tr>
<td>Obs.</td>
<td>762</td>
<td>521</td>
<td>386</td>
<td>202</td>
</tr>
</tbody>
</table>

Distribution of \( \theta \)
Counterfactual exercises

• Welfare measure: Average change in certainty equivalent of mortgage payment per capita per year

• **Limiting distorted advice**
  • Bank can manipulate only half of their naive customers (e.g. tighter regulation monitoring, fiduciary standards)

• **Undistorted advice**
  • Banks provide advice in the best interest of the customers → Everybody follows the ”spread rule”

• **Financial literacy campaign**
  • Policy reducing the fraction of naive. Ex., $\mu \downarrow$ to 24%
# Counterfactual results

<table>
<thead>
<tr>
<th></th>
<th>Limiting Advice</th>
<th>Undistorted Advice</th>
<th>Financial Literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>-998 (17%)</td>
<td>661 (7.8%)</td>
<td>304 (3.6%)</td>
</tr>
<tr>
<td>Sophisticated</td>
<td>-590</td>
<td>-295</td>
<td>-314</td>
</tr>
<tr>
<td>Naive</td>
<td>-1,444</td>
<td>1,705</td>
<td>980</td>
</tr>
</tbody>
</table>

Note: Welfare effects are expressed in Euros per household per year.
Yearly repayment for 125,000 euros mortgage at 4%: 8,550 euros.
Conclusions

- Model of mortgage market with naive households receiving advice from self-interested banks
- Exploit detailed administrative data + institutional features of the Italian mortgage market to:

  1. **Assess relevance of advice distortion**
     - Large fraction of naive households
     - Novel evidence of advice distortion

  2. **Quantify impact on households welfare**
     - Effects are sizeable
     - Educating the population leads to gains but not for all
     - Banning advice reduces welfare for everybody

  3. **Establish that effects are heterogenous**
     - Financial education and undistorted advice policies exposed to non trivial political economy problem
Backup slides
Sources of advice

From which of the following sources do you obtain often or very often information on financial choices?

- Bank
- Broker
- Friends and family
- Media

Source: “Large bank”’s customers survey
Evidence of incomplete hedging

Source: Our elaboration on Cerrone et al. (JFS, 2017)

- Esposito et al. (JB&F, 2015): In 2008 on average positive interest risk exposure equal to 3.1% of regulatory capital
Bersani Law (April 2007)
• Cap to prepayment fees at 1.90% (0 for new mortgages) vs. > 3% before reform
ARM vs FRM market share

ARM FRM ARM with cap Mixed rate

Share of new mortgages issued (%)


ARM FRM ARM with cap Mixed rate
## Mortgage pricing

<table>
<thead>
<tr>
<th>% borrowing at posted rate</th>
<th>Discount (bps)</th>
<th>Discount &gt; 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25 percentile</td>
<td>50 percentile</td>
</tr>
<tr>
<td>Mortgages issued in the same quarter</td>
<td>56</td>
<td>16</td>
</tr>
<tr>
<td>Allen et al. (2016)</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>
FRM vs ARM for naive households

Question in SHIW on inflation risk

Suppose you have 1,000 euros in an account that yields a 1% interest rate and carries no fees. If inflation is going to be 2%, do you think that in one year time you will be able to afford the same goods that you can buy today with the balance of your account? 1) Yes; 2) No, I will be able to buy less; 3) No, I will be able to buy more; 4) I do not know.

<table>
<thead>
<tr>
<th></th>
<th>Sophisticated</th>
<th>Naive</th>
<th>Clueless</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>answ=2</td>
<td>answ=1 or 3</td>
<td>answ=4</td>
</tr>
<tr>
<td>ARM (%)</td>
<td>0.63</td>
<td>0.53</td>
<td>0.5</td>
</tr>
<tr>
<td>FRM (%)</td>
<td>0.37</td>
<td>0.47</td>
<td>0.5</td>
</tr>
</tbody>
</table>
## Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std.dev.</th>
<th>25th pctile</th>
<th>50th pctile</th>
<th>75th pctile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Branch level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRM-ARM Spread</td>
<td>13,747</td>
<td>0.54</td>
<td>0.63</td>
<td>0.23</td>
<td>0.54</td>
<td>0.84</td>
</tr>
<tr>
<td>FRM rate</td>
<td>13,747</td>
<td>5.47</td>
<td>0.62</td>
<td>5.17</td>
<td>5.58</td>
<td>5.91</td>
</tr>
<tr>
<td>ARM rate</td>
<td>13,747</td>
<td>4.63</td>
<td>0.87</td>
<td>3.80</td>
<td>4.66</td>
<td>5.36</td>
</tr>
<tr>
<td>FRM rate - 25 yrs swap</td>
<td>13,747</td>
<td>1.16</td>
<td>0.47</td>
<td>0.99</td>
<td>1.16</td>
<td>1.32</td>
</tr>
<tr>
<td>ARM rate - Euribor 1m</td>
<td>13,747</td>
<td>1.29</td>
<td>0.50</td>
<td>1.13</td>
<td>1.38</td>
<td>1.54</td>
</tr>
<tr>
<td>Num. mortgages</td>
<td>13,747</td>
<td>47.41</td>
<td>95.09</td>
<td>8</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>% of mortgage market</td>
<td>13,747</td>
<td>0.10</td>
<td>0.09</td>
<td>0.03</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td>% of FRM issued</td>
<td>13,747</td>
<td>0.37</td>
<td>0.34</td>
<td>0.03</td>
<td>0.27</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Bank level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total assets (TA)</td>
<td>268</td>
<td>39,495</td>
<td>45,098</td>
<td>11,737</td>
<td>17,169</td>
<td>57,768</td>
</tr>
<tr>
<td>Deposits/TA</td>
<td>268</td>
<td>0.46</td>
<td>0.11</td>
<td>0.38</td>
<td>0.45</td>
<td>0.53</td>
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<tr>
<td>Bank bond spread</td>
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<td>0.27</td>
<td>0.52</td>
<td>-0.07</td>
<td>0.28</td>
<td>0.64</td>
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<td><strong>Market variables</strong></td>
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<td>Num. banks in the mkt.</td>
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<td>10.18</td>
<td>1.98</td>
<td>9</td>
<td>10</td>
<td>11</td>
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Spread fluctuations in Italy

A - Variazioni fra il 2004 e il 2007

\[ y = 0.0693x + 6.2695 \]

\[ R^2 = 0.1257 \]

B - Variazioni fra il 2008 e il 2011

\[ y = 0.1368x + 1.669 \]

\[ R^2 = 0.0044 \]

Crescita dell'importo dei mutui e dei prezzi delle abitazioni nei capoluoghi di provincia (variazioni percentuali)

4.1 I tassi

In Italia il contratto di mutuo più diffuso è quello a tasso variabile. L'incidenza di questi contratti si era tuttavia ridotta nel corso del 2007-2008, in corrispondenza di un sostenuto incremento del tasso Euribor e del conseguente calo dello spread fra i tassi fissi e variabili sui mutui (fig. 12).

Fig. 11

Fig. 12

Composizione percentuale dei mutui per durata originaria del tasso

*(dati trimestrali)*

Source: Felici et al., 2015
Likelihood function:

\[
\ell_{ijt} = (1 - \psi) p_{ijt} + \psi \mu \mathbb{I}\{r_{ijt} = r_{jt}\} + \\
\psi(1 - \mu) \mathbb{I}\{r_{ijt} = r_{jt}\} \left(1 - \Phi\left(\frac{1}{\sigma_\delta}(r_{jt} - s_{jt}^a - r_{t}^{eurbr} - \mu_\delta)\right)\right) + \\
\psi(1 - \mu) \mathbb{I}\{s_{ijt}^a = s_{jt}^a\} \Phi\left(\frac{1}{\sigma_\delta}(r_{jt}^f - s_{jt}^a - r_{t}^{eurbr} - \mu_\delta)\right) +
\]
Estimation: “Supply”

1. Optimal advice eq. \([+ \text{ distrib. assumption}] \Rightarrow \text{Get } \theta_{it}\)
2. Minimize deviations bw data and model predictions
Stationarity of demand

Risk aversion

Mortgage size

Source: Large bank’s customers survey

Source: Credit registry microdata
Evidence of (lack of) financial sophistication

Over 50% of the interviewed is unable to read a bank statement

---

You receive your account balance from the bank; can you tell how much money is available at the end of May?

<table>
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<tr>
<th>DATA</th>
<th>VALUTA</th>
<th>N. OPERAZIONE</th>
<th>DESCRIZIONE DELLE OPERAZIONI</th>
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<th>MOVIMENTI AVERE</th>
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</tr>
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</table>
Dispersion in rates

**ARM rates**

**FRM rates**

Back
Heterogeneity in demand parameters

\[ \mu_k = \frac{\exp(a_0 + a_1 \text{Education}_k)}{1 + \exp(a_0 + a_1 \text{Education}_k)} \]

\[ \psi_k = \frac{\exp(b_0 + b_1 \text{RelLength}_k)}{1 + \exp(b_0 + b_1 \text{RelLength}_k)} \]

\( \hat{a}_1 < 0, \hat{b}_1 < 0 \)
Heterogeneity in share of naive households
Distribution of $\theta_{it}$