The sustainability of credit to low income mortgagors:
a risk management perspective

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Introduction and Objectives

- To give access to homeownership to low income households is an objective of credit policy for housing in many countries. However, if lower income borrowers generate more risk, the issue of the sustainability of homeownership is raised.

- A criterion of sustainability is the ability to maximize the success of borrowers, i.e. to give access to homeownership to selected low income borrowers at an acceptable risk level for the borrowers and the lenders.

- Low income borrowers face two types of financial constraints:
  - Down-payment constraint;
  - Income constraint limiting their repayment capacity.

- Their borrowing ability depends upon the availability of instruments helping to disentangle financial constraints:
  - Adjustable rate mortgages;
  - Public financial assistance mechanisms.
In this paper, we adopt a lender’s risk management perspective, what means measuring risk at the portfolio level. Thus, to measure credit risk, we rely on economic capital:

> Economic capital is the amount of capital needed to maintain the solvability of the lending institution for a given horizon at a given confidence level (protection against unexpected losses).

The higher the default risk of borrowers using loans with given characteristics, the higher are economic capital requirements, and the less sustainable is a credit policy oriented towards such borrowers, from the lender’s perspective.
Plan

- The role of loan characteristics and the position of the paper in the literature
- The multifactor credit risk modeling
- The data
- The results
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In France, public financial assistance programs to promote homeownership provide various types of financial aid:

- Interest rate subsidies which reduce financial charges and deferred amortization (Prêt à taux zéro, PTZ): relax repayment as well as down-payment constraints
- Access to housing allowances (Prêt conventionnés PC, Prêt à l’accession sociale, PAS): relax repayment constraints
- State guarantee (Prêt à l’accession sociale).

They potentially increase the solvency of low income borrowers.

- Housing allowances attached to PC loans help absorbing income fluctuations: reduce credit risk.
- Deferred amortization and zero interest rate: increase credit exposure, ambiguous effect on risk.
Such public assistance programs are conditional to income ceilings:

- PAS and PC are only available to low income borrowers.
- PTZ are available to medium-income borrowers.

Baseline scenario: 2 adults + 2 children, 2007 thresholds and allowance’s formulas
Fixed vs. adjustable interest rate loans

- Theory predicts that ARM borrowers are riskier than FRM borrowers:
  - Less risk aversion
  - Relax financing constraints: lower monthly repayments.
  - Higher exposure to income risk
Default rates could be linked to loans characteristics:

- Interest rate choice:
  - Campbell and Cocco (2003) show that ARMs are riskier for wealth-constrained borrowers with high LTV loans.
  - Posey and Yavas (2001): riskier borrower have a preference for ARMs.

- Loans giving access to public financial support:
  - Ergungor (2010): default rates are conditionned by the availability of state financial support to low-income borrowers.
  - Avery and Brevoort (2011) find that areas served by lenders covered by the Community Reinvestment Act (CRA) experienced lower delinquency rates and less risky lending.
  - Goldberg and Harding (2003) observe that low-income borrowers benefiting from a down payment program exhibit higher default propensities.
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Credit losses within a multi-factor framework

- We consider a multifactor credit risk model (Lucas et al., 2001, Tasche, 2006).
- Defining $u_i$ as obligor’s $i$ loss given default (LGD) and $1_{D_i}$ his default indicator, credit losses are defined as:

$$L = \sum_{i=1}^{n} u_i 1_{D_i}$$

- Default occurs when: $1_{D_i} = 1 \iff U_i = w_i ' s + \sqrt{1 - w_i ' R w_i} \varepsilon_i < \Phi^{-1}(\bar{p}_i)$

- Assuming perfect granularity of the portfolio and multivariate normal distribution of risk factors, credit losses can be approximated by (conditional) expected credit losses:

$$L \approx \sum_{i=1}^{n} u_i \Phi \left[ \frac{\Phi^{-1}(\bar{p}_i) - w_i ' s}{\sqrt{1 - w_i ' R w_i}} \right]$$
Econometric methodology: GLMM

- The credit risk parameters (defaults thresholds and sensitivities to systematic risk factors) are estimated using a GLMM probit/binomial model.

- The default rate is modeled as:

\[
P(\text{default}|\gamma_t) = \Phi\left[ x_{ti}' \mu_r + z_{ti}' \gamma_t \right] \]

- Here, the random effects are latent to a segmentation of borrowers according to loans characteristics, associating one risk factor for each segment.

- Consider successively two segmentations:
  - Access (or not) to public financial support
  - ARMs vs. FRMs
VAR and allocation of capital ratio

- Computation of the distribution of losses by Monte Carlo simulation (using the outputs – i.e. risk parameters – of the econometric analysis).

- Then, properties of Value-At-Risk (VaR) allow to compute marginal contributions of given portfolio’s sub-segments as partial derivatives of the portfolio VaR (Gouriéroux et al., 2000, Tasche, 1999). Thus, it is possible to measure which part of unexpected losses can be attributed to each segment of the portfolio.

- Advantages of a multi-factor approach:
  > The capital allocation accounts for the portfolio’s heterogeneity.
  > Allows detecting potential concentration of losses (i.e. situations of strongly correlated defaults) within particular sub-segments of the portfolio.
Implementation of the multifactor approach

- First portfolio’s segmentation
  - Only Free market loans
  - Mix of free market loans and a PTZ
  - Only regulated loans

- Second portfolio’s segmentation
  - All fixed rates
  - Mix of fixed and adjustable rates
  - Only adjustable rate
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Data

- Large portfolio of French housing loans:
  - The lender is a major player in the French market of loans benefiting from state financial assistance.
  - 344,000 borrowers’ files representing more than 500,000 loans
  - Complete ratings history of borrowers: internal ratings system with 4 grades (3 + default)
  - On a quarterly basis over the period: Q4-2006 – Q2-2010

- Loans dedicated to personal homeownership only (accession à la propriété)
- We assume the lender has an incentive to control and to manage his (credit) risk.
- Loan and borrower characteristics:
  - Type of loan: loans benefiting from public financial assistance versus loans contracted of the “free” market
  - Type of interest rate: FRM versus ARM
  - Variables entering the internal rating: LTV, maturity, income, profession, housing status...
## Descriptive statistics

<table>
<thead>
<tr>
<th>Segmentation</th>
<th>Interest rate type</th>
<th>Type of loan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Fixed rate only</td>
<td>(2) Adjustable rate only</td>
</tr>
<tr>
<td>% of borrowers</td>
<td>54.6</td>
<td>9.4</td>
</tr>
<tr>
<td>Average EAD (euros)</td>
<td>78700</td>
<td>99500</td>
</tr>
<tr>
<td>Average quarterly PD%</td>
<td>0.26</td>
<td>0.37</td>
</tr>
<tr>
<td>Maturity &gt; 20 years</td>
<td>0.38</td>
<td>0.46</td>
</tr>
<tr>
<td>LTV at origination&gt;80%</td>
<td>0.54</td>
<td>0.62</td>
</tr>
<tr>
<td>Age (% older than 36 years)</td>
<td>0.47</td>
<td>0.62</td>
</tr>
<tr>
<td>Previous position (% tenants)</td>
<td>0.63</td>
<td>0.40</td>
</tr>
</tbody>
</table>
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The capital ratio is the highest in the “free market + PTZ” segment. Borrowers having only access to the PTZ in terms of public financial assistance have the highest credit risk.

The lowest capital ratio is in the segment of (low-income) borrowers using regulated loans.

> Public assistance mechanisms targeted on the lower income borrowers effectively help to overcome financial constraints, without leading to higher risk.
Same credit risk for borrowers using fixed rate only and adjustable rate only, although their default rates are different.

Borrowers using (at least) two loans with different interest rates (fixed and adjustable) are riskier. These borrowers face higher financing constraints they try to relax adding an adjustable rate loan to a fixed rate loan.

Borrowers with only adjustable rate loans have a different profile: they borrow on average the same level, but have on average higher income.

Different motivations for adjustable rate borrowing?

**Capital ratios (quarterly)**

<table>
<thead>
<tr>
<th>Panel A Interest rate segmentation</th>
<th>Single factor model</th>
<th>Interest rate model</th>
<th>IRBA model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed rate only</td>
<td>0.22%</td>
<td>0.14%</td>
<td>0.91%</td>
</tr>
<tr>
<td>Adjustable rate only</td>
<td>0.21%</td>
<td>0.13%</td>
<td>0.89%</td>
</tr>
<tr>
<td>Both types of interest rates</td>
<td>0.22%</td>
<td>0.31%</td>
<td>0.92%</td>
</tr>
</tbody>
</table>
### VaR and marginal contributions: results

As a robustness check, combine two dimensions: type of loan and type of interest rate.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Number of borrowers</th>
<th>Proportion of borrowers</th>
<th>Economic capital ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed rate/Market loan</td>
<td>96839</td>
<td>28%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Fixed rate/PTZ loan</td>
<td>18881</td>
<td>5%</td>
<td>0.41%</td>
</tr>
<tr>
<td>Fixed rate/PC loan</td>
<td>76374</td>
<td>22%</td>
<td>0.11%</td>
</tr>
<tr>
<td>Adjustable rate/Market loan</td>
<td>38004</td>
<td>11%</td>
<td>0.11%</td>
</tr>
<tr>
<td>Adjustable rate/PTZ loan</td>
<td>0</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>Adjustable rate/PC loan</td>
<td>17735</td>
<td>5%</td>
<td>0.11%</td>
</tr>
<tr>
<td>Both rates/Market loan</td>
<td>9093</td>
<td>3%</td>
<td>1.08%</td>
</tr>
<tr>
<td>Both rates/PTZ loan</td>
<td>17774</td>
<td>5%</td>
<td>0.22%</td>
</tr>
<tr>
<td>Both rates/PC loan</td>
<td>69491</td>
<td>20%</td>
<td>0.18%</td>
</tr>
</tbody>
</table>
Results show that borrowers using regulated loans benefiting from public assistance are on average safer than those borrowing without assistance in a ‘free’ market, what means that public assistance helps to solve potential solvency problems.

However, borrowers mixing the two kinds of loans (PTZ and free market loans) in order to get a larger amount of credit display the highest level of risk.

- These borrowers, not eligible to PC/PAS loans, buy relatively more expensive dwellings with higher loan-to-value loans.
- What suggests that these borrowers try to overcome higher financing constraints.
- These medium-income borrowers are exposed to economic shocks when they are constrained to disentangle financial constraints.
- Lender-driven results? Lender “invest” in medium income borrowers in order to capture future saving streams.

Adjustable rate loans are not necessarily riskier. They are riskier when borrowers use adjustable rate loans to overcome financing constraints.
Thanks