Why Do Half of Households in the French Overseas Departments Not Purchase House Insurance?∗

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Preliminary Version

Abstract

In France comprehensive house insurance includes coverage against natural disasters. Whereas the French overseas departments are more exposed to natural risks than continental France, only 52% of households in overseas departments have purchased house insurance for their main home in 2006, against more than 99% in continental France. We explain simultaneously the probability of being insured and the insurance premium, and we model that the decision of purchasing insurance depends on insurance price. Our results do not reveal a supply limitation but a low demand for insurance. Firstly, households living in traditional individual dwellings - which often do not meet building standards and may have been built without permit - do probably not consider insurance purchase. Secondly, households rely on financial assistance by government, local authorities or relatives in case of natural disaster; they purchase comprehensive house insurance mainly to be covered against other risks included in the policy.

Keywords: natural disasters, house insurance, government assistance, overseas.

JEL classification: D12, G22, H81, Q54.

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1 Introduction

The French overseas departments are more exposed to natural risks than continental France. Martinique and Guadeloupe are strongly exposed to seismic activity (see Table 1). The islands suffered from major earthquakes in respectively 1839 and 1843. According to scientists, a major earthquake is foreseen in each island in the very next decades. Earthquakes of smaller intensity can more frequently occur, such as the Earthquake of Saintes on November, 21 2004 in Guadeloupe and the Earthquake of Nord-Martine on November, 29 2007.

Table 1 – Exposure to natural risks in the French overseas departments

<table>
<thead>
<tr>
<th>Major risks</th>
<th>Earthquakes</th>
<th>Volcanism</th>
<th>Hurricanes</th>
<th>Tsunamis*</th>
<th>Floods*</th>
<th>Landslides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guadeloupe</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>French Guiana</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Martinique</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>La Réunion</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Note: * designs a risk to which exposure is localized.

However, households living in the French overseas departments are less numerous to purchase insurance against natural disasters than in continental France. Indeed, in France, the guarantee against natural disasters is compulsorily included in comprehensive house insurance.¹ To our knowledge, no other natural disasters coverage is offered by insurers to French households. According to the Family Budget survey realized by the French National Institute for Statistics and Economic Studies (INSEE) in 2006, only 52% of households living in the French overseas departments had purchased a comprehensive house insurance for their main home, against more than 99% in continental France (see Table 2). The market penetration rate, that is the percentage of agents - here households - who purchase insurance, is known to be low overseas: these results confirm local reports, such as the ones by the French Association of Earthquake Engineering (see Balandier (2005), AFPS (2008)).

Table 2 – House insurance penetration rate

<table>
<thead>
<tr>
<th>Guadeloupe</th>
<th>French Guiana</th>
<th>Martinique</th>
<th>La Réunion</th>
<th>Continental France</th>
</tr>
</thead>
<tbody>
<tr>
<td>43%</td>
<td>52%</td>
<td>50%</td>
<td>59%</td>
<td>99%</td>
</tr>
</tbody>
</table>

Source: Family Budget survey by INSEE in 2006. 13 374 observations.

¹ House insurance covers the house and furniture against damages due to water, fire, explosions, electricity, lightning, storm, hail, snow, thief and attempt of thief, breaking of windows. Coverage against natural and industrial disasters is compulsorily included in the policy. House insurance also covers the civil liability of households living in and home assistance.
Measuring and explaining house insurance penetration rate overseas is a stake in terms of public policy for four main reasons relative to the precariousness of the uninsured, the system fairness, its balance and its possible incentives for prevention. Firstly, being uninsured against natural disasters implies being uninsured against all other risks covered by comprehensive house insurance - such as thief, fire, water damages and often civil liability. Secondly, the uninsured may be in precarious situations after disasters and may so benefit from government financial assistance, which is funded by the whole set of taxpayers and might be delivered in accordance with more or less discretionary criteria. Thirdly, analyzing house insurance penetration rate enables to predict the evolution of the overall balance of the natural disasters insurance regime and the evolution of the amount provided by government assistance. Fourthly, insurance can create incentives for collective or individual prevention, for example by a premium or deductible insurance modulation; the efficiency of this policy requires that exposed households have purchased insurance.

The contribution of this paper is twofold. Firstly, our structural model explains simultaneously the probability of being insured and the insurance premium by taking into account the fact that the decision of purchasing insurance depends on insurance price. We follow indeed a method built by labor economists. Laroque and Salanié (2002) explain simultaneously the participation decision on labor market and the labor cost by taking into account that the decision of working depends on wage. This fruitful method has not been applied until now (to our knowledge) to insurance economics. Many papers explain either insurance demand by premium or insurance price by demand. For example, Browne and Kim (1993) use the national insurance loading charges as a proxy for insurance price to explain the demand for life insurance; Outreville (1996) estimates life insurance premium at the equilibrium on insurance market by macroeconomics data on which depend life insurance demand and supply. True is that data about the insured and the uninsured are rare. However, Showers and Shotick (1994) use the 1987 Consumer Expenditure Survey, a comprehensive national survey on consumer expenditures, that is the American equivalent to the French Family Survey; the authors explain the demand for insurance with respect to households characteristics holding constant the overall unit price of insurance coverage. Secondly, our model brings concrete explanations of the low overseas penetration rate. Indeed, the low house insurance penetration rate can result from a low demand or from a restrained supply. Our results do not reveal a supply limitation but a low demand for house insurance. This elaborate model confirms this way the basic qualitative conclusions drawn by a preliminary version (see Calvet and Grislain-Letrémy (2010)).

Before analyzing the insurance market, it is worth explaining the regulation of natural
disasters insurance. The French natural disasters insurance regime was created in 1982 and applied firstly only to continental land. As house insurance was there already widely subscribed at that time, the mandatory inclusion in house insurance guaranteed that the great majority of households in continental land were insured against natural disasters. This law has been enforced to the overseas departments since August, 1st 1990. Not as many households living in the French overseas departments had purchased house insurance at that time, even if purchasing house insurance is compulsory for tenants and is often required by banks as a condition for a mortgage. Furthermore, as stated by the law, the French state provides its unlimited guarantee to the insurance system and in return regulates the tarification of natural disasters coverage. The deductible is fixed; the comprehensive house insurance premium - or equivalently the natural disasters premium included in - increases with respect to the value at risk, but should not increase with respect to the probability of natural disasters. In other words, the exposed households do not pay more than the others.

Depending on the tarification implemented by insurers, the low house insurance penetration rate reveals a problem on the demand or on the supply side.

- If the house insurance premium does not depend on probability of natural disasters - as foreseen by the law -, the premium for exposed households is lower than the “right price for risk”, that is the actuarial premium. A great majority of households living in the French department overseas benefit so from a subsidy paid by the households living in continental France and should purchase house insurance. A low market penetration rate reveals a problem on the demand side.

- If insurers increase - slightly or even until the actuarial premium - the premium with respect to probability of natural disasters, households should buy insurance, if they are risk averse. A low market penetration rate still traduces a problem on the demand side.

- Insurers could even offer overpriced premia to limit the proportion of very exposed households in their portfolio. Indeed, several local sources report a disengagement by insurers overseas (see Balandier (2005), AFPS (2008) and Balandier and Audras (2005)); they describe for example huge amounts of house insurance premia and rejected annual renewals by insurers after earthquakes - even among households who did not suffer any

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2. Law n°82-600 of July, 13 1982 relative to the compensation of natural disasters victims.
3. Law n°90-509 of June, 25 1990 modifying the insurance code and extending the regime of compensation for natural disasters to overseas departments.
4. Section L431-9 in the insurance code.
5. The deductible is of € 380 for all hazards except the subsidence, to which only French Guiana is exposed. The deductible can be increased in jurisdictions which have suffered several natural disasters and made however no risk prevention plan (see annex I of the section L125-1 in the insurance code). As the majority of the jurisdictions in the French overseas departments have already undertaken or set up such plans, this rule has a small in these departments.
6. Section L125-2 in the insurance code.
damage. If insurers overprice house insurance for the premia for all or only the most exposed households, then only the most risk averse or only least exposed households should purchase house insurance. A low market penetration rate reveals in that case a problem on the supply side.

Basic statistics show that the means of premia paid and their budget weight are similar in the French overseas departments to the ones in continental France (see Table 3). However, these statistics do not take into account structural differences among territories. Besides, the premia offered to the uninsured could be significantly higher than the paid premia by the insured and so discourage these households to purchase insurance.

| Table 3 – House insurance premia paid and their budget weight |
|------------------|--------|--------|--------|--------|--------|
|                  | Guadeloupe | French Guiana | Martinique | La Réunion | Continental France |
| Premium (€)      | 260   | 194   | 284   | 242   | 285   |
| Budget weight    | 1.4%  | 1.0%  | 1.2%  | 1.4%  | 1.4%  |

Source: Family Budget survey by INSEE in 2006. 10 756 observations.

Our structural model enables to determine the tarification applied by insurers. Empirical evidence show that insurance premium does not vary within overseas departments with respect to local probability of natural disasters, nor between overseas departments and continental land. Thus, insurance is neither actuarial nor overpriced. As stated by the law, insurance premium is so uniform and the low market penetration rate reveals a problem on the demand side - and not on the supply one.

Under this tarification, almost all households living in the French overseas departments should get insured and the probability of purchasing insurance should increase with respect to their probability of natural disasters. However, empirical evidence show that this is not the case. Half of households are not only uninsured, but the probability of buying insurance does also not depend on the probability of natural disasters.

Insurance purchase is explained by occupancy status, since house insurance purchase is compulsory for tenants and often required by banks for mortgage delivery. Furthermore, living in a house decreases the demand for insurance, probably because many houses do not meet building standards. Indeed, traditional individual dwellings often do not meet these standards and some have even been built without permit; concerned households do not probably consider insurance purchase. Unfortunately, our data do not provide information about dwellings compliance with building standards and so do not enable us to quantify this effect. Still, this does not explain why probability of natural disasters does not impact
the decision of insurance purchase. In practice, households rely on financial assistance by
government, local authorities or relatives in case of natural disaster. This phenomenon
is named “charity hazard”. Indeed, households purchase comprehensive house insurance
mainly to be covered against other risks included in the insurance policy.

Considering a simple cancelation of government assistance after a disaster is clearly un-
reasonable. Regulatory incentives for house insurance purchase would enable to increase
the proportion of insured households and then to decrease ex-post assistance by govern-
ment and local authorities. This is all the most relevant, since we show that the existing
insurance purchase constraints at the moment of the setting in are operant.

The overseas situation gives an interesting echo to natural disasters insurance in the United
States, and especially flood insurance. In the United States, insurance is provided by the
federal state for some hazards, such as floods, or private for other hazards, such as earth-
quakes. Only few households purchase insurance in both cases (see Dixon et al. (2006),
Kunreuther (1984)).\(^7\) According to Kunreuther (1984), the low market penetration rate
against earthquakes partially results from a problem on the supply side.\(^8\) As flood insu-
rance is provided by federal government, there is no supply limitation of flood insurance.
Several studies dedicated to natural disasters insurance show that a key explanation for the
low demand for insurance from households is their biased perception of their risk exposure
(see Tallon and Vergnaud (2007) for a review), and not charity hazard (see Kunreuther
and Pauly (2006), Browne and Hoyt (2000)). However, as stated by Kunreuther and Pauly
(2005), “I[It will be interesting to see whether Hurricane Katrina changes this view [the
unexpectedness of federal assistance] given the highly publicized commitment by the Bush
administration to provide billions of dollars in disaster relief to victims”.

To study the natural disasters insurance market in the French overseas departments, we
have crossed the Family Budget survey by INSEE in 2006 - a comprehensive national
survey on households’ expenditures - with the data relative to exposure to natural disasters
provided by the French Ministry of Ecology. There is no exhaustive list of hazards covered
by the French natural disasters insurance regime.\(^9\) An order establishes whether an event is
a natural disaster and which period(s) and jurisdiction(s) are concerned. Insured households
and firms can benefit from the insurance compensation only if an order is published for the

\(^7\) In the United States, flood insurance is purchased by around half of the population in the exposed
areas “Special Flood Hazard Areas” - that is with a 100-year recurrence interval for flood - and by only
1% outside (see Dixon et al. (2006)).

\(^8\) Indeed, insurers in the United States fear a lack of capacity of private reinsuranc (see Kunreuther
(1984), page 211). This cannot be the case in France since government provides its unlimited guarantee to
the insurance system.

\(^9\) Natural disasters are defined by the law as “non insurable natural hazards mainly caused by anormal
intensity of a natural agent, when usual measures to prevent from these damages could not prevent their
occurring or could not have been taken” (our translation, section L125-1 in the insurance code).
considered event. Information about past sinistrality at the jurisdictional level is so public.
The overall number of orders in each jurisdiction from 1990 and 2006 is here used as a
proxy for probability of natural disasters. If local past sinistrality is a good assessment of
probability of natural disasters, the number of orders however does not reveal the intensity
of the different disasters. Indeed, as soon as one house is recognized as having damages by
a natural disaster, an order relative to the whole jurisdiction is published.

The paper is organized as follows. Section 2 presents the model assumptions. Section 3
determines insurance pricing; it concludes that the low market penetration rate reveals a
low demand for insurance from overseas households and not a limited supply from insurers.
Section 4 analyses the demand for insurance. Section 5 draws recommendations in terms
of public policy.

2 The model

We estimate a structural model to understand why numerous households in French overseas
departments do not purchase house insurance. We explain simultaneously the participation
on insurance market and the insurance premium by taking into account the fact that the
decision of insurance purchase depends on insurance price. We follow the method of Laroque
and Salanié (2002). The authors explain simultaneously the participation decision on labor
market and the labor cost by taking into account that the decision of working depends on
wage.

Assumptions. Firstly, we consider here the decision of purchasing insurance against
natural disasters, and not comprehensive house insurance. Certainly, in practice, French
households cannot purchase an insurance policy that covers only natural disasters, because
no such policy is offered to them. However, the decision of purchasing comprehensive house
insurance depends on the gain to be insured against all the risks covered by the insurance
policy; we do not observe the probability of all these losses and cannot compute this gain.
Furthermore, the pricing of the coverage of these other losses is assumed to be actuarial;
thus, if households are risk averse, including additional coverage that is actuarially priced
should increase the gain of purchasing insurance and so the demand for insurance.

Secondly, we assume that households have a unique choice of purchasing or not insurance
against natural disasters. In practice, contracts are standardized with restrained choices in
terms of coverage.

Thirdly, we assume that the insurers profit on the national market (overseas and continen-
tal France) and so the offered insurance premia do not depend on the number of insured
overseas households. This assumption relies on two stylized facts. Insurers maximize theirs
profits in a competitive market and offer house insurance at the national scale. Furthermore, according to the French National Statics Institute, population in the French overseas departments represents less than 3% of the overall population in continental land and in the overseas departments on January, 1st 2006.

The participation, that is the decision of purchasing insurance, and the insurance premium
as observed should both result from the confrontation of demand and supply on the market. Besides, they depend on each other and must be simultaneously determined at the equilibrium. However, because of the second and third assumptions, the insurance premia do not depend on households’ demand for insurance: the premium equation corresponds to a supply one.

**Participation equation.** A household is treated as a single person. In the theoretical
model of demand for insurance drawn by Schlesinger (2000), each household chooses to
purchase or not natural disasters insurance in order to maximize its expected utility. The
utility function is denoted $U(\cdot)$ and is concave with respect to the income, denoted $w$. Following Chiappori and Salanié (2008), we choose $U(w) = \log(w)$. Households participate to insurance market if and only if their expected utility is higher if they are insured ($\alpha = 1$) than if they are not ($\alpha = 0$).

$$\alpha = 1 \Leftrightarrow EU(\alpha = 1) \geq EU(\alpha = 0).$$

The expected utility of insured households depends on insurance price. This price corres-
donds to the premium relative to natural disasters coverage, denoted $\pi$, as deductible is a constant fixed by government. We ignore this deductible for practical matters of model tractability and assume that insurance is complete.

$$EU(\alpha = 1) = \log(w - \pi),$$  
$$= \log(w) + \log(1 - \frac{\pi}{w}) < 0.$$
of their income. The probability of loss caused by natural disasters to its dwelling is denoted $p$. This probability is assumed to increase linearly with respect to the local past sinistrality, $s$, that is $p(s) = ps$.\footnote{Estimating separately $\delta$ and $p$ is not feasible in this model.}

$$EU(\alpha = 0) = p(s) \log((1 - \delta)w) + (1 - p(s)) \log(w),$$

$$= \log(w) - p_\delta s, \quad \text{with} \quad p_\delta = -p \log(1 - \delta) > 0.\footnote{We do not need in this model to normalize $\eta$ by its standard error, because a constant is added.}$$

We add a set of dummies, denoted $X$, to control for compulsory insurance and other incentives to purchase insurance. Besides, a hazard $\eta$ is attached to the decision of purchasing insurance. Both hazards are assumed to be normally distributed. As in Laroque and Salanié (2002), we add a term $\rho \epsilon$ that allows for a selection bias - that is for correlation between unobserved heterogeneity factors that affect insurance premium and the decision of purchasing insurance. We finally get

$$\alpha = 1 \iff EU(\alpha = 1) + XA + \eta + \rho \epsilon \geq EU(\alpha = 0),$$

$$\iff \log(w) + \log(1 - \frac{\pi}{w}) + XA + \eta + \rho \epsilon \geq \log(w) - p_\delta s,$$

$$\iff \log(1 - \frac{\pi}{w}) + p_\delta s + XA + \eta + \rho \epsilon \geq 0.$$

\textbf{Premium equation.} The natural disasters premium $\pi$ is a fixed part of comprehensive house insurance premium and these two premia should not depend on the probability of natural disasters. We denote $Y$ the set of variables explaining insurance premium - which includes the number of past natural disasters inside the jurisdiction $s$.

$$\text{if } \alpha = 1, \quad \log(\pi) = YB + \sigma \epsilon,$$

$$\text{if } \alpha = 0, \quad \pi = 0.\footnote{Note that, in theory, there may be no equilibrium in this insurance market, as proved by Rothschild}$$

Insurance pricing with respect to probability of natural disasters is a key issue, since it determines the equilibrium on insurance market. Our model enables to test three hypotheses relative to insurance pricing.

If the natural disasters insurance premium is uniform - that is equal to the average premium over all insured households -, it does not depend on local loss probability. In other words, the French overseas departments benefit from a subsidy from continental land and almost all households should get insured. The profit is so negative overseas and is balanced by the positive profit realized in continental land.\footnote{Note that, in theory, there may be no equilibrium in this insurance market, as proved by Rothschild}
If the natural disasters insurance premium is actuarial, the premium clearly depends on household’s loss probability. Under actuarial insurance, if there is no hazard linked to the decision of purchasing insurance nor to the premium, as households are risk averse, they should all get insured under actuarial insurance. If there are hazards, a very large majority of households get insured.

If the natural disasters insurance premium is overpriced for all overseas households or leastways for the most exposed ones, these households are discouraged from purchasing insurance. This implies that the premium depends on household’s loss probability and that the most exposed households are not insured.

Identification. The model can be summarized this way. Given an insurance premium, households get insured if and only if

\[
\begin{align*}
\alpha &= 1 \iff \log(1 - \frac{\pi}{w}) + p_s s + X A + \eta + \rho \epsilon \geq 0, \\
\text{u.c. if } \alpha &= 1, \log(\pi) = Y B + \sigma \epsilon, \\
\text{if } \alpha &= 0, \pi = 0.
\end{align*}
\]

Identification is a key matter in this type of model. Identification requires the existence of variables that are significant only in the participation equation. The variable that enables to identify our model is the type of housing.

Maximum likelihood. Our estimation relies on maximum likelihood. We denote \( \varphi(\cdot) \) and \( \Phi(\cdot) \) the probability density function and the cumulative density function of centred normal distribution with unit variance. The likelihood is

\[
\begin{align*}
\text{if } \alpha &= 1, \quad \text{prob} = \frac{1}{\sigma} \varphi \left( \frac{\log(\pi) - Y B}{\sigma} \right) \Phi \left( \frac{\log(1 - \frac{\pi}{w}) + p_s s + X A + \rho \log(\pi) - Y B}{\sigma} \right), \\
\text{if } \alpha &= 0, \quad \text{prob} = 1 - \int_I \Phi \left( \log \left( 1 - \frac{\exp(Y B + \sigma \epsilon)}{w} \right) + p_s s + X A + \rho \epsilon \right) \varphi(\epsilon)d\epsilon.
\end{align*}
\]

We use the method exposed by Laroque and Salanié (2002) to approximate the integral that appears in the likelihood. By denoting \( \epsilon_i \) the \( i \)-th \( m \)-quantile, that is \( \Phi(\epsilon_i) = \frac{i}{m} \),

\[
\int_I \varphi(\epsilon) \varphi(\epsilon)d\epsilon = \frac{1}{m} \sum_{i=0}^{m-1} F(\epsilon_i),
\]

where \( \bar{\epsilon}_i = m \left[ \varphi(\epsilon_i) - \varphi(\epsilon_{i+1}) \right] \).

and Stiglitz (1976). In particular, the authors show that, under imperfect information with two classes of customers, there is no pooling equilibrium. A uniform premium offered to low and high risk customers is refused by low risk customers, since insurance is overpriced for them. Only the high risk customers are insured and the premium is indeed actuarial. The French insurance system can present a pooling equilibrium, since natural disasters insurance does not correspond to separated contracts. It is included in comprehensive house insurance, which is widely purchased in continental France.

16. If \( \epsilon = \eta = 0 \), as \( U \) is concave, the Jensen inequality implies insurance purchase.
The results are quite robust with respect to the laws of the two hazards and the choice of \( m \).

3 Insurance pricing

The natural disasters premium corresponds to a fixed part (12\%) of the premium relative to other damages covered by house insurance (such as thief, fire, water damages or storm), that is all other damages except the civil liability guarantee (section L125-2 in the insurance code).\(^{17}\) Table 4 presents the results of the estimation of the premium equation. Note that these results take into account the presence of a selection bias (see Table 7). Consistently, the insurance premium increases with respect to potential losses that depend on furniture and building value. Firstly, the premium increases with respect to standard of living and number of rooms of the dwelling, which are respectively positively correlated with furniture and building value. Secondly, the premium also depends on the occupancy status, because the policy coverage - mainly inclusion of furniture coverage - depends on this status.

Furthermore, the insurance premium does not depend on local past sinistrality. Thus, insurance premium does not vary within overseas departments with respect to local probability of natural disasters. The premium only depends on the unobserved probabilities of other risks covered by comprehensive house insurance policy. These unobserved probabilities are captured by the hazard \( \epsilon \).

If the premium is not actuarial, it is still possible that insurance premium varies between overseas departments and continental land. Insurance premia could be uniformly higher overseas, because these departments are on average more exposed than continental land. This would correspond to the pricing of a global probability of natural disasters in the overseas departments. Table 5 presents the results of the estimation of house insurance premia paid in France. We find that house insurance premium is not higher in the French overseas departments than in continental land for a household of comparable characteristics.\(^{18}\) Thus, comprehensive house insurance and the guarantee against natural disasters are not actuarial neither overpriced. As stated by the law, these insurance premia are so uniform and the low market penetration rate reveals a problem on the demand side - and not on the supply one.

Note that, in this last regression, we consider only the paid premia and not all - paid and offered - premia. As a matter of fact, including the premia offered to the uninsured would

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\(^{17}\) We denote \( \pi \) the premium of the natural disasters guarantee, \( \pi_H \) comprehensive house insurance premium and \( \pi_{CL} \) the premium of the civil liability guarantee. We get \( \pi = \frac{0.12}{1 + 0.12}(\pi_H - \pi_{CL}) \). On average, the premium of the civil liability guarantee amounts to \( \text{€} \) 26 in 2006 (see FFSA (2006)).

\(^{18}\) We do not include the number of past natural disasters in this regression, since these disasters correspond to very different events in continental France and overseas.
Table 4 – Estimation results: premium equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard error</th>
<th>Pr &gt;</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constante</td>
<td>2.497</td>
<td>0.095</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td><strong>Standard of living</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First quintile of standard of living</td>
<td>-0.062</td>
<td>0.070</td>
<td>0.380</td>
<td></td>
</tr>
<tr>
<td>Second quintile of standard of living</td>
<td>-0.140</td>
<td>0.070</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Third quintile of standard of living</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth quintile of standard of living</td>
<td>0.074</td>
<td>0.058</td>
<td>0.201</td>
<td></td>
</tr>
<tr>
<td>Fifth quintile of standard of living</td>
<td>0.219</td>
<td>0.055</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td><strong>Number of rooms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 or 2 rooms</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 rooms</td>
<td>0.252</td>
<td>0.064</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>4 rooms</td>
<td>0.434</td>
<td>0.063</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>5 rooms</td>
<td>0.572</td>
<td>0.073</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>6 rooms</td>
<td>0.680</td>
<td>0.080</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td><strong>Occupancy status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenant</td>
<td>-0.431</td>
<td>0.046</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Homeowner or home-buyer</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First quartile : less than 5 orders</td>
<td>-0.182</td>
<td>0.048</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Second quartile : 5 or 6 orders</td>
<td>-0.00009</td>
<td>0.047</td>
<td>0.999</td>
<td></td>
</tr>
<tr>
<td>Third quartile : 7 to 9 orders</td>
<td>0.029</td>
<td>0.061</td>
<td>0.638</td>
<td></td>
</tr>
<tr>
<td>Fourth quartile : 10 orders or more</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sigma</td>
<td>0.293</td>
<td>0.123</td>
<td>0.017</td>
<td></td>
</tr>
</tbody>
</table>

Source: Family Budget survey by INSEE in 2006. 2 874 observations. Ref denotes the reference modality.

not change the result, because they are in average lower than the paid ones (see Table 6).

We can easily explain this finding. Indeed, insurance premium increases with respect to standard of living and basic statistics show that the uninsured have a lower income than the insured. Certainly, theory predicts that, if absolute risk aversion is decreasing with respect to income, the demand for insurance with actuarial premia decreases with respect to income (see Schlesinger (2000)). However, here, premia are not actuarial but uniform with respect to the probability of natural disasters over the whole territory. Overseas households benefit so from an insurance subsidy from continental land and high income households are indeed more subsidized than low income ones. Wealthy households have so a stronger incentive to purchase insurance. Probably, other sociologic effects can be evoked.

4 Why this low demand?

As the low market penetration rate reveals a problem on the demand side, it is worth identifying the key determinants of insurance demand. Table 7 presents the results of
our estimation for the participation equation. Occupancy status is a key determinant of insurance purchase. Tenants and even more home-buyers have a higher probability of purchasing insurance than homeowners. Indeed, purchasing house insurance is compulsory for tenants and often required by banks as a condition for a mortgage. These constraints are so operant. However, 70% tenants and 77% home-buyers are insured, which is certainly much more than the rest of the population, but still lower than 100%. This can be explained by
the fact that some tenants or home-buyers choose not to renew their insurance contracts the years following their settling in.19

Type of housing has a key role in our model, since it explains the decision of purchasing insurance but not the premium and enables so to identify our model. Households living in an apartment have a higher probability of purchasing insurance. Several explanations can be found. Living in an apartment implies an additional liability with respect to neighbors in case of damage and can provide an incentive to purchase insurance. Most of all, in the French overseas departments, traditional individual dwelling - that is made of light materials as wood or sheet metal, of heterogenous quality - represents in 2006 13% of dwellings (see Castéran and Ricroch (2008)). These dwellings often do not meet building standards and may have been realized without building permit. In Martinique, illegal building concerns 30% of individual dwellings according to DIREN (2005); from 30% to 40% of individual houses in the French Antilles and in La Réunion according to Olive and Riviere (2010); this proportion would be even higher in French Guiana according to the French National Statics Institute as quoted by Garnesson and Hecquet (2007). One can easily figure that these households have a smaller probability of being insured. Firstly, their dwelling could not be insurable.20 Secondly, they may not ask for insurance, because the value of their traditional dwelling is small in comparison with the deductible. Traditional dwelling partially explains the low demand for insurance from overseas households. Unfortunately, our data do not provide information about dwellings compliance with building standards and we are so unable of quantifying this effect.

However, it remains that the decision of purchasing insurance does not depend on local past sinistrality. Certainly, the fact that the probability of purchasing insurance does not decrease with respect to local past sinistrality confirms so that the uninsured are not the most exposed ones and are not discouraged to purchase insurance by insurance pricing. Nevertheless, the probability of purchasing insurance should increase with respect to probability of natural disasters. Under this uniform tarification, we should find an illustration of adverse selection, here not because of imperfect information but because of regulation: offering a uniform premium should lead to a selection of the most exposed households. Given this subsidized tarification, almost all households living in the French overseas departments should get insured and the probability of purchasing insurance should increase with respect to their probability of natural disasters. However, empirical evidence show

19. In the United States, mortgage purchase is also a key element of demand for flood insurance (see Browne and Hoyt (2000), Office (1983)), since bank or financial institutions can require the purchase of flood insurance to deliver a mortgage. Besides, many households do not renew their flood insurance policies (see Kunreuther and Pauly (2005) page 97).

20. Building permit can be required by insurers. This check is often done by insurers not before selling the contract but before paying compensation after a loss.
that this is not the case. Half of households are not only uninsured, but the probability of buying insurance does also not depend on the probability of natural disasters. How our result can be explained?

Table 7 – Estimation results: participation equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard error</th>
<th>Pr &gt;</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constante</td>
<td>-0.380</td>
<td>0.131</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td><strong>Occupancy status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenant</td>
<td>0.617</td>
<td>0.067</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Home-buyer</td>
<td>1.209</td>
<td>0.085</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Homeowner (or free stayer)</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overseas department</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>-0.458</td>
<td>0.084</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>French Guiana</td>
<td>-0.338</td>
<td>0.114</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Martinique</td>
<td>-0.225</td>
<td>0.076</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>La Réunion</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of housing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment</td>
<td>0.520</td>
<td>0.071</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of past natural disasters since 1990</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of orders</td>
<td>-0.004</td>
<td>0.014</td>
<td>0.778</td>
<td></td>
</tr>
<tr>
<td><strong>Selection bias</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rho</td>
<td>0.656</td>
<td>0.017</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
</tbody>
</table>

Source: Family Budget survey by INSEE in 2006. 2874 observations. Ref denotes the reference modality.

Many objections could be raised. Low risk households could be more risk averse and their probability of purchasing insurance would be so as high as the one of high risk households. However, basic statistics show that women and households who have purchased full coverage insurance for their car are more exposed to natural risks than the others.21 This difference in terms of risk aversion should on the contrary increase the gap in terms of insurance purchase between high and low risks. Similarly, one could assume that traditional individual dwellings are realized in low risk areas. However, the correlation between local past sinistrality in terms of natural disasters and the fact of living in a house is significative and negative - but quite low (-0.05). Furthermore, there is no significative correlation between occupancy status and past sinistrality. Finally, location department and past sinistrality at the jurisdictional level are certainly correlated; the same model without the variable of location department states that the decision of purchasing insurance depends on local past sinistrality. Nevertheless, given that the number of past natural disasters

21. Levin et al. (1988), Powell and Ansic (1997) and Halek and Eisenhauer (2001), Jianakoplos and Bernasek (1998) show that women are more risk averse than men. Nevertheless, risk aversion depends on contextual framework (see Schubert et al. (1999)).
inside each jurisdiction presents a high variability among each of the four departments, we conclude that location department impacts the decision of purchasing insurance but that local past sinistrality does not.

One could also argue that cognitive biases lead households to underestimate their probability of natural disasters and reduce this way their demand for insurance. Indeed, the impact of cognitive biases on insurance purchase is enhanced by Kunreuther (1984). Viscusi and Zeckhauser (2006) show that more than 90% of interviewed people in the framework of a national survey in the United States believe to be exposed to less than or to the average fatality risk. However, the bias should here be so strongly different among households that it could exactly balance the difference of risk exposure among them; this seems unrealistic.

A fruitful explanation relies on “charity hazard”, which designs the fact of relying on government financial assistance in case of a disaster. Stylized facts underline the importance of government assistance in the French overseas departments. The rescue fund for overseas compensates partially households for damages due to natural disasters. Are eligible households who have not purchased house insurance and who are in a difficult economic and social situation. Compensation is dedicated to essential furniture in the main home. In extraordinary conditions, compensation for repair or reconstruction of the main home can be given to landowners; the rate of real estate goods compensation is between 20% and 30%. Note that this compensation only applies for main homes that have not been built in a forbidden area nor without building permit nor are precarious (mobile homes). Assistance to households consists indeed in a small part of the overall budget (see Table 8).

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>€1,287,500</td>
<td>€2,104,000</td>
<td>€92,700</td>
</tr>
<tr>
<td>Local authorities</td>
<td>€5,787,300</td>
<td>€7,975,900</td>
<td>€9,191,000</td>
</tr>
<tr>
<td>Farmers</td>
<td>€51,575,800</td>
<td>€3,897,100</td>
<td>€3,057,400</td>
</tr>
<tr>
<td>Other firms</td>
<td>€1,203,300</td>
<td>€1,146,000</td>
<td>€511,200</td>
</tr>
</tbody>
</table>

Source: French Ministry for Overseas, General Delegation for Overseas.

Other types of financial assistance for reconstruction can be organized by government, local authorities or provided by family and neighbors. Note that the fact that some types of financial assistance for reconstruction can be organized by government, local authorities or provided by family and neighbors. Note that the fact that some types of financial assistance for reconstruction can be organized by government, local authorities or provided by family and neighbors.

22. Order relative to the implementation of help facility by the rescue fund for overseas. Completer à terme avec date et lien internet légifrance.

23. For example, in French Polynesia, following the Storm Oli from February, 1st to 6th 2010, financial assistance relies on a convention between the Ministry for Overseas and the Caisse des Dépôts et Consignation. (See http://www.outre-mer.gouv.fr/?10-millions-d-euros-pour-la-reconstruction-de-logements-en-polynesie.html).
financial assistance decrease with respect to income also explains that the uninsured have on average a lower income than the insured. Wealthy households not only benefit from a higher insurance subsidy, but low income households also benefit from more assistance in case of loss if they are uninsured.

Providing ex post assistance creates a typical Samaritan’s dilemma, as it reduces households’ incentives to purchase insurance ex ante. As households expect assistance, they purchase comprehensive house insurance mainly to be covered against multiple other risks included in the policy, such as thief or fire. However, the decision of purchasing insurance does not depend on the probability of natural disasters. Even if government assistance is important, one cannot assume that almost full compensation would be provided to the uninsured by government, local authorities and/or relatives. Except if households anticipate that overall assistance by different third parties would fully compensate them. This assumption is indeed reasonable. Firstly, after natural disasters, official declarations can make the uninsured believe that they can rely on compensation if a natural disaster occurs. For example, after the Earthquake of Saintes on November, 21 2004 in Guadeloupe, several declarations reveal that French government promises that financial assistance will be provided to the uninsured. Secondly, these declarations have all the more weight, since households may not know precisely the amount and the criteria of government assistance allocation. Households are not only imperfectly informed, but the importance of government assistance was also until 2010 determined after the disaster has occurred, since each disaster was followed by a particular order that specified the details of assistance allocation. Financial assistance by local authorities seems to be still designed once the disaster has occurred. Help from relatives is also very probably determined ex post.

5 Public policies recommendation

To conclude, dwelling incompliance with building standards and charity hazard explain that numerous households in the French departments overseas do not purchase house insurance. In the French overseas departments, traditional individual dwelling remains important but is in decline - except in French Guiana (see Garnesson and Hecquet (2007)) - : it represents in 2006 13% of dwellings against 23% in 1996 in these departments (see Castéran and Ricroch (2008)). Building aid is already in place (see Tjibau (2004)). Assessments and recommendations about social housing have been drawn by Bolliet et al. (2006).

Concerning charity hazard, one can argue that ex post assistance by government or local authorities is not that much different from ex ante insurance subsidy from continental land to the overseas departments. Thus, raising the proportion of insured households would not
be a key issue. Coate (1995) answers this very precise objection. Firstly, ex post assistance by government and local authorities is inefficient because “T[here is no reason to expect the rich to choose the level of protection that is optimal for the poor person”. In practice, assistance may rely on approximate loss assessments or, even worse, discretionary decisions. Secondly, natural disasters assistance is provided by the public and the private sectors; “because of the [this] free-rider problem, the level of charity given is not even optimal from the viewpoint of the rich”. 24 Thirdly, providing ex post assistance does not make individuals refrain from living in exposed areas nor from improving building structures, which increases their future losses and so the burden for the whole society. Certainly, in France, this effect also partially applies to the insured because of uniform insurance premia: as the premium is the average of all actuarial premia, living in exposed areas increase the common uniform premium. However, a premium or deductible insurance modulation cannot create efficient incentives for prevention if the most exposed households are not insured. 25

Providing incentives for house insurance purchase is all the most urgent, that, as recalled by Herring (2005), the lower is the proportion of insured people, the higher the importance of financial relief is and so the lower the willingness to purchase insurance is. This vicious circle is declined at a small scale of family, friends’ circle or neighborhood: as explained by Kunreuther and Pauly (2005), social norms impact the decision of insurance purchase: individuals may decide to buy insurance - or not - because they know others who did so. One of the reasons given by the authors is that, the lower is the proportion of insured people, the higher the likelihood to receive some government assistance is and so the lower the incentives to purchase insurance are; in other words, charity hazard is more often observed when risk is collective. They also mention another explanation based on mimetism phenomenon: individuals may think that their relatives have similar preferences to them or have already spent the search costs of gathering information on risk, insurance and/or relief. To break this circle, it is crucial to develop insurance coverage in order to then decrease ex post financial assistance.

Considering a simple cancelation of government assistance after a disaster is clearly unreasonable. Economic or regulatory incentives for house insurance purchase would enable

24. Besides, government assistance may distort the fiscal system, but this point is less relevant in France, since households living in continental land are on average richer than the ones living in the overseas departments. On the contrary, in the United States, for example after Hurricane Andrew in 1992, to limit public debt, ex post government assistance was “counterbalanced by a proportional reduction of social budget. The poor were thus forced to fund the rich’s damages” [our translation] (see Davis (1998) as quoted by Favier and Pfister (2007)).

25. The individual insurance deductible can be increased in jurisdictions which have suffered several natural disasters and made however no risk prevention plan (annex I of the section L125-1 in the insurance code). This rule has a small impact in overseas departments, where the great majority of jurisdictions have made or started such plans. For now, implementing premium modulation for comprehensive firm insurance is under debate.
to increase the proportion of insured households and then to decrease ex-post financial
assistance by government or local authorities. Concerning economic incentives, there is
already a direct insurance subsidy: through the uniformity of the premium, transfers from
safe to exposed areas reduce the insurance cost for overseas households. This subsidy - in
place since 1990 - is not sufficient, since half of households living in the French departments
overseas were still not insured in 2006. Other regulatory measures - targeting the uninsured
and also checking insurance renewal - could be operant. This is all the most relevant, since
the existing insurance purchase constraints at the moment of the setting in are operant.

Références


Balandier, P. 2005. Rapport de mission de l’AFPS sur le séisme des Saintes (Guadeloupe)

Balandier, P, and Audras, F. 2005. Un an après, observations sur le traitement des
bâtiments très endommagés à Terre-Bas et Terre-de-Haut. Technical report, Rapport
réalisé à titre personnel et bénévole.

Technical report, Inspection générale des finances, Conseil national des ponts et chaussées, Inspection générale de l’administration,


*The Journal of Risk and Insurance* 60 :616–634.

Calvet, L. and Grislain-Letrémy, C. 2010. La faible couverture des ménages des
DOM face aux catastrophes naturelles : analyse de la souscription de l’assurance habitation.
*Études et documents, Ministère de l’écologie, de l’énergie, du développement

Castéran, B. and Ricroch, L. 2008. Les logements en 2006 le confort s’améliore, mais
pas pour tous. Technical Report 1202, INSEE Première.


Direction Régionale de l’Environnement Martinique.


