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A simple test for private information in insurance markets with heterogeneous insurance demand

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HIGHLIGHTS

- Propose a simple test for asymmetric information in insurance markets with heterogeneous insurance demand.
- First results using a finite mixture model to disentangle the type of selection, adverse selection or advantageous selection.
- Identify the existence of private information, without using direct evidence of private information.

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ABSTRACT

A positive correlation between insurance coverage and *ex post* risk indicates private information in insurance markets. However, this test fails if agents have heterogeneous risk attitudes. We propose a finite mixture model that conditions on unobserved types who differ in their risks preferences and detects asymmetric information even if heterogeneous risk attitudes exist. Our method identifies the existence of private information, without using direct evidence of private information.

1. Introduction

Economic theory suggests that the presence of private – or asymmetric – information has important implications for insurance markets. Adverse selection and moral hazard can lead to a sub-optimal provision of insurance and a decrease in welfare. One indicator for the presence of asymmetric information is a positive correlation between an individual's risk and the decisions to purchase insurance (Chiappori and Salanié, 2000). The empirical results, however, are mixed. Some studies find evidence of adverse selection (Finkelstein and Poterba, 2002). While some other studies report weak or no evidence of adverse selection (Chiappori and Salanié, 2000). Cohen and Siegelman (2010) give a comprehensive review of related empirical work.

One explanation for failure to detect private information is the presence of heterogeneous preferences for insurance. There may be advantageous selection, which means that more cautious people are not only more inclined to purchase insurance but also more likely to put effort in preventing risk exposures. Finkelstein and McGarry (2006), short F&MG, illustrate this for the market of long-term care insurance. They fail to find evidence for a positive correlation between the risk of entering a nursing home and the

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Table 1
Descriptive statistics.

Variable	Label	Mean	SD	Min	Max
NH	1 for nursing home utilization, 0 otherwise	0.163	0.369	0	1
LTCI	1 for long-term care insurance holding, 0 otherwise	0.108	0.311	0	1
X	Insurance company prediction	0.218	0.231	0.006	1
Z	Individual prediction	0.177	0.248	0	1
Prev	1 for taking preventive health activity, 0 otherwise	0.659	0.304	0	1
Seat	1 for always wear seat belt, 0 otherwise	0.768	0.422	0	1
W4	1 for being in the top quartile of wealth, 0 otherwise	0.285	0.451	0	1
W3	1 for being in the 3rd wealth quartile, 0 otherwise	0.270	0.444	0	1
W2	1 for being in the 2nd wealth quartile, 0 otherwise	0.243	0.429	0	1

Note: The sample consists of the elderly aged 78 on average in 1995 who reported long-term care insurance status and nursing home use from 1995 to 2000 from the Asset and Health Dynamics (AHEAD) cohort of the Health and Retirement Study (5119 observations).

decision of purchasing long-term care insurance.[1] However, at the same time they provide direct evidence for the existence of private information about the individual risk of entering a nursing home. They explain that the presence of asymmetric information is masked by heterogeneous risk attitudes and show that more cautious and wealthier individuals are more likely to purchase long-term care insurance and less likely to enter a nursing home. Fang et al. (2008) also provide evidence of advantageous selection in the Medigap market. The presence of both adverse selection and advantageous selection may create insignificant or even negative correlations between an individual's risk exposure and the decision to purchase insurance even with private information.

This paper presents the first results using a finite mixture model to disentangle the type of selection (adverse or advantageous) and detect the private information in the presence of heterogeneous preferences for insurance. The advantage of this method is that an incomplete set of variables that explain the individual heterogeneity is normally sufficient to produce consistent estimates in the insurance demand and risk exposure equations, and to detect private information if it exists. We apply this model to the sample of F&MG. We find that – as predicted – the two types of agents behave differently. Conditional on public information and the type of an individual we obtain a statistically significantly positive correlation between *ex post* risk and the insurance purchases. This provides the evidence of the existence of private information. We confirm the finding of F&MG without relying on direct evidence of private information.

The paper is organized as follows, in Section 2, we describe the data and econometric methods, and present the results. Section 3 concludes.

2. Data, methods and results

2.1. Data

We illustrate our estimation procedure by applying it to the data assembled by F&MG where direct evidence for private information is available. F&MG apply an actuarial model used by many insurers to calculate a variable that reflects the company prediction of nursing home use which is used to determine premiums. This company prediction captures the available public information, *X*. Based on a survey question, F&MG construct a measure of private beliefs about the likelihood of moving into a nursing home. We use the private believes as a proxy for private information, *Z*,— capturing some but not all of the private information of individuals. The data also contain information about wealth and proxies for risk attitudes. The proxies for risk attitudes are self-reported seat belt usage and whether individuals undertook preventative healthcare measures, such as flu shots or cancer screenings. For more detailed information about sample and variables see F&MG.

Table 1 displays the descriptive statistics. 11% of the individuals have long-term care insurance in 1995 and 16% enter a nursing home at some point from 1995 to 2000.

2.2. Econometric method

F&MG estimate a bivariate probit model of long-term care insurance holdings and nursing home utilization as follows:

$$NH^* = X\beta + u, \qquad NN = 1 \quad \text{if } NH^* > 0, 0 \text{ otherwise},$$
$$LTCI^* = X\delta + \varepsilon, \qquad LTCI = 1 \quad \text{if } LTCI^* > 0, 0 \text{ otherwise} \qquad (1)$$

with

$$\begin{pmatrix} u \\ \varepsilon \end{pmatrix} \Big| X_i \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right]$$

where *NH* is a binary variable for nursing home utilization between 1995 and 2000. *LTCI* is a binary variable for long-term care insurance holding in 1995. Omitting the private information in (1) leads to a positive correlation ($\rho > 0$) (Chiappori and Salanié, 2000). The error terms follow the standard bivariate normal distribution.

However, if individuals have heterogeneous risk preferences, the correlation between the error terms is no longer indicative of the presence of asymmetric information, but reflects a combination of asymmetric information and heterogeneous taste in insurance. F&MG demonstrate that two types of people purchase insurance: individuals with private information that they are high risk (the ***B*** *old* type) and individuals with that have a strong taste for insurance but with lower risk (the ***T*** *imid* type). In aggregate, those with more insurance are not higher risk. Hence, the standard positive correlation test will fail to detect the presence of private information if we mix individuals with heterogeneous risk preferences.[2]

We propose a simple and intuitive test for asymmetric information, based on the finite mixture model. As pointed out by Deb and Trivedi (1997), the finite mixture model provides a natural representation of heterogeneous preference since each latent class can be seen as a "type" of individual. It can also be seen as a discrete approximation of an underlying continuous mixing distribution, which does not need to be specified. Empirically supported by F&MG and Fang et al. (2008), we will start with the simplest case

[1] Long-term care insurance allows individuals to insure themselves against the cost associated with entering a long term care facility, such as a nursing home.

[2] As shown in Table 3 from F&MG (2006), the standard positive correlation tests are unable to reject the null hypothesis of zero correlation in the long-term care insurance market.