Insurance as a Normal Good: Empirical Evidence for a Puzzle[1]

Jérôme Foncel[2]
EQUIPPE, University of Lille 3, France

Nicolas Treich
University of Toulouse (LERNA, INRA), France

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Abstract:

In this paper, we combine banking and car insurance data to examine the relationship between individual insurance demand and wealth. Controlling for the value of the car, we provide evidence for a positive relationship, suggesting that insurance is a normal good. This result contrasts with the common Decreasing Absolute Risk Aversion (DARA) hypothesis. However, we show that the investment in risky assets increases with wealth, which is consistent with DARA. Overall, our empirical results can hardly be consistent with expected utility theory.

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[2] Corresponding author. Address: Université Lille 3, Maison de la Recherche, BP 60149, 59653 Villeneuve d'Ascq, France. E-mail: jerome.foncel@univ-lille3.fr

1. Introduction

A primary theoretical result in insurance economics is that insurance demand should decrease with wealth (Mossin, 1968). A necessary and sufficient condition for this result is Decreasing Absolute Risk Aversion (DARA). Pratt (1964) and Arrow (1971) first advanced DARA as a sensible behavioral hypothesis, and used it to show that the demand for risky assets should increase with wealth. Since then, it has been common in economics to consider a utility function that has the DARA property. For instance, the class of power utility functions, which is frequently used in macroeconomics, has DARA. Also, DARA implies a positive third derivative of the utility, or prudence, which induces a precautionary savings motive (Leland, 1968). DARA is instrumental to obtain various sensible comparative statics results in multiple risks situations (see, e.g., Pratt and Zeckhauser, 1997, Kimball, 1993, Gollier, 2001). Experimental data (see, e.g., Binswanger, 1981, Levy, 1994) as well as empirical data (see, e.g., Chavas and Holt, 1996, Guiso et al., 1996) usually give support to DARA. Hence, there is an overall support for DARA in economics, and therefore in favor of the idea that insurance should decrease with wealth.

In contrast, it is often informally suggested by practitioners that insurance is a normal good, namely, that insurance demand increases with wealth. This may be based on the widespread belief that insurers prefer to target wealthy clients. There is also overwhelming evidence that the insurance sector has largely benefited from the economic growth since the industrial revolution (see, e.g., OECD, 2005). Furthermore, aggregate data on income and insurance premium reveal a strong positive relationship between per capita income and insurance demand (Beenstock et al., 1988; Enz, 2000). However, one can hardly conclude that insurance is a normal good only based on insurance practioners' beliefs and macro data. Indeed, one needs to distinguish the effect of a change in wealth on risk-aversion from the effect of a change in wealth on the value of insurable goods. Two different effects play a role. First, wealthier people should demand less insurance, because of DARA. Second, wealthier people buy more valuable goods and, thus should demand more insurance because the risk of loss increases. Hence, we need data including the value of the insured good to be able to isolate the first effect.

Our data were provided by a French banking company that sells car insurance products. These data allow us, we believe, to develop a fairly powerful test of the Mossin's prediction. The database contains information about 26,860 individuals including car insurance demand and car values. It also contains many pieces of information about individual financial wealth and portolio composition. Thus, we are able to study empirically the relationship between insurance demand and wealth, controlling for the effect of the value of the insured good. These data are described in more details in section 2 and in the Appendix A. The econometric analysis of these data leads us to find a strong positive relationship between insurance demand and wealth. These results are documented in the section 3 of the paper.

In addition, we use these data to test the above-mentioned theoretical result that the investment in risky assets increases with wealth under DARA (Pratt, 1964). We indeed find a strong positive relationship between investment in risky assets and wealth. Moreover, for a given wealth, we find that there is no relationship between insurance and portfolio choices. These results are documented in the section 4 of the paper. Overall, they can hardly be consistent with expected utility theory, even using a model that may account for the interaction between insurance and portfolio decisions, as we show in the Appendix B.

2. The Data

We use a dataset of 26,860 individuals, which contains detailed information on both the distribution of households' financial assets and the demand for car insurance in 1999. This database is drawn from the whole set of clients (more than 100,000 clients) of a French company located in the North of France. This company provides both insurance and banking services to its customers, i.e. casualty insurance as well as the traditional banking and financial products.[3]

2.1. The Car Insurance Data

In France two major types of policies are proposed by insurance companies: all-inclusive contracts, which implies that all kinds of damage are reimbursed whatever the liability of the driver (but the deductible if any); and third party insurance contracts in which the driver's company does not cover damages incurred to the driver's vehicle. The companies offer also different levels of deductibles as well as several optional choices. The company brings together the various insurance contracts into four categories: all-inclusive contracts with no deductible or low deductible (type-1 contracts); all-inclusive contracts with a high deductible (type-2 contracts); third party insurance contracts with low deductible (type-3 contracts); third party insurance contracts with high deductible (type-4 contracts). Note that these contracts are not perfectly ranked in terms of coverage since type-2 contracts do not necessarily offer more insurance coverage than type-3 contracts. We thus aggregate type 2-3-4 contracts into a "partial coverage" contract. Type-1 contract is denoted the "high coverage" contract.

In addition, the database provides information concerning the characteristics of the driver and his/her contract with the company. The attributes of the car are also available. Among others, we observe the body style of the car (sedan or wagon), the number of seats, whether the car is used for professional purpose only, the type of fuel supply (Diesel, fuel injection, etc…), the age of the car and its value (listed in the price guide for used car), the car's group (which is a function of the horsepower), the car's class (which is a function of the car's value), the engine's horsepower, and the maximum speed.

As far as the contract is concerned, we observe the value of the insurance premium paid for the period during which the car was insured, the length of the period during which the car was insured,[4] the insurance premium payment frequency over the reference year (annual, bi-annual, quarterly, or monthly), the multi-driver clause in the contract, and the duration of the specific current insurance contract.

We also observe individual-specific information about the driver, including whether he/she is a new driver, a proxy for his/her risk-exposure (i.e. the number of kilometers per year),[5] the value of his/her no-claims bonus, his/her gender, occupational status, age, geographical area, and the population density of the living area.

We exclude from the original sample the individuals with at least one missing value for the following variables: type of contract, premium, age of car, age of the individual. (No missing data for the other variables.) A total of 256 records are deleted. We denote by "sample A" the set of the 26,604 remaining individuals.

[3] In France, several firms propose both financial and insurance products.
[4] Indeed, all individuals are not insured for the whole year, either because they are new client or the contract has changed.
[5] The company surveyed its clients to get this information. Obviously, respondants may give biased answer.

2.2. The Banking Data

We gather financial assets under two categories, riskless and risky assets. Riskless assets include home savings plan (PEL), type-access savings account (CODEVI), short-term or fixed deposit (DAT), sight (demand) deposit (DAV), personal pension plan (PEP).[6] Risky assets include mutual fund (SICAV), investment trust or ISA (PEA), life insurance-savings (designed for retirement purposes), and various equities and bonds. We do not always observe the amount invested in these different assets, in particular for some equities and bonds. However, we observe the total amount invested in risky assets.[7]

It is obviously difficult, not to say impossible, to have a proper measure of individual wealth. Even though we do not observe the exact composition of individual portfolio, we observe total savings at the bank, composed of the total amount invested in risky and riskless assets, say the *financial wealth*. However, we have little information about individual loans (we only observe the amount of loan to repay) and no direct information about illiquid assets (like the value of the house). Yet, the database provides a variable entitled "patrimoine" by the bank (hereafter denoted *wealth index*) that is used by the company to assess the default risk of individuals. The way this variable was constructed is not fully available to us. However, for every individual, the wealth index is greater than the financial wealth (the average wealth index and financial wealth are respectively €13,510 and €10,870). This suggests that the bank adjusts upward the financial wealth to account for some information about illiquid assets and/or about loans. We consider that this wealth index constructed by the bank may be the best available information to us about total individual wealth, and we decide to use it as our proxy for wealth.[8] Moreover, in Appendix A-2, we report several descriptive statistics showing that the wealth index has effects consistent with the expected effects of a change in wealth.[9] We observe for instance that individuals with a higher wealth index enjoy a better occupational status and own more upper class cars. Furthermore, they smooth less the payment of the insurance premium across the year. We also find that the Pearson correlation coefficient between wealth index and age equals 0.21 (p-value<0.0001). Yet, notice that female have a higher wealth index than male in our sample.[10]

An important limitation must, however, be discussed. Indeed, 2,176 individuals have a wealth index equal to 0. Interestingly, we observe that all these people have a positive loan to repay (€15,775 on average). This may suggest that these individuals opened an account at this bank in order to subscribe a loan. This raises, more generally, the issue of individuals having several accounts at different banks. In that case, our data cannot provide a good proxy for wealth. There is no obvious way to address this issue since we do not observe the complete balance sheet of individuals. We nevertheless decide to exclude very low-wealth individual from the sample. We choose a lower bound, denoted l, of approximately €15 (exactly equals to 100 French Francs), which amounts to delete 2,312 individuals that have a wealth index strictly smaller than l. We compute some descriptive statistics to compare two sub-samples,

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[6] For PEL, CODEVI and DAV, we do not oberve the amount invested in these assets, but only whether there is ownership or not.

[7] Amounts are reported as of December 31 of the reference year, and thus do not represent an average of financial flows of the year.

[8] Note that the results presented in Section 3 and 4 are not qualitatively modified if the car value is added to the wealth index.

[9] These statistics are computed on sample C defined below.

[10] There are only 23% of females in our data. This suggests that, within an household, the male may be more often identified as the owner of the bank account. Consequently, the result that female have a higher wealth index may be due to a selection bias related to the marital status of females.

"sample B" including the set of individuals with a wealth index lower than €15, and "sample C" including the set of individuals with a wealth index larger than €15. The comparison betwen these two samples suggests that they are fairly similar. Hence, the selection bias induced by using sample C should be small.[11] Also, at the estimation stage, we find that the empirical results are not significantly affected by a change of this bound to l=€150.

Eventually, other financial information is available such as the ownership of a card (Visa or MasterCard debit card, withdrawal card, immediate or deferred debit card[12]), the duration of the relation of the individual with the bank and with the insurance company, and the financial incidents either at this bank and those recorded by the French issuing bank.[13]

2.3. Descriptive Statistics for the Wealth Index, Risky Assets and Insurance Coverage

We briefly present some descriptive statistics corresponding to sample C on our three main variables of interest. In Table 1, we display information about the distribution of wealth, investment in risky assets and insurance coverage across the population. Some readers may be surprised that so many individuals, that is 72.05%, do not hold risky assets. This figure is, however, in line with some findings in the literature. Guiso et al. (1996) for instance indicate that 74.6% of people in their SHIW do not hold risky assets.[14] This is often referred to to the "stock participation puzzle".

Observe also that more than a half of the population (54.3% exatly) chooses the high coverage contract. This figure may seem high given that theory predicts full coverage only if the insurance premium is actuarially fair. We recall, however, that individuals can only choose among a few contracts, and so full insurance may be optimal even under actuarially unfair insurance premium. Moreover, remember that the high coverage contract allows for small levels of deductible.

Table 1: Distribution of Wealth (€), Risky Investment (€) and Coverage

Variable	Mean	Q1	Median	Q3	St. Dev.	Min	Max
Wealth index	14,796	802	2,506	11,919	38,878	15.24	1,047,220
Risky assets	7,315	0	0	1,123	28,016	0	990,039
High coverage contract	0.543	0	1	1	0.498	0	1

The correlation matrix between these variables are displayed in Table 2 below.

[11] In particular, in sample B (resp. C), there is 82.3% of male (resp. 77%), the average car value is €3,547 (resp. €4,720), individuals are on average 42.6 year old (resp. 46.7), and the age of the car is 9.75 year (resp. 8.13). Occupational status that are coded OS1, OS2, OS3, OS4, OS5, OS6 and OS7 (see Appendix A-1 for the definition) represent 12.4%, 1.2%, 5%, 34%, 33.2%, 6.6% and 7.6% of the population (resp. 16.7%, 2.1%, 7.4%, 32.6%, 16.9%, 17.9% and 6.4%).

[12] Note that in France the ownership and the use of credit cards were quite unusual in 1999.

[13] The "Banque de France" records any payment default whatever the bank in which it occurs. This piece of information is available to any bank when it faces a new client.

[14] The SHIW is a stratified random sample of the Italian resident population.

Table 2: Correlation matrix

Variable	Wealth index	Wealth (log)	Risky assets	Coverage (high)
Wealth index	1	0.57	0.90	0.09
Wealth (log)	-	1	0.46	0.18
Risky assets	-	-	1	0.07
Coverage (high)	-	-	-	1

All *p-values* are strictly less than 0.0001. We introduce the logarithm of the wealth index in Table 2 because we assume in Section 3 and 4 that the wealth index is log-normally distributed. We observe that the wealth index and risky assets are strongly correlated and that the logarithm of the wealth index is significantly correlated with risky assets and coverage. We also notice that, although significant, the link between risky assets and coverage is weak.

Finally, we provide in Table A-2-5 descriptive statistics of the exogenous variables used in Section 3 and 4.

3. Is Insurance a Normal Good?

In this section, we estimate the effect of the wealth index on the choice of insurance coverage. We regress the dichotomous decision of coverage on the wealth index and other explanatory variables using a Probit model. To control for the potential endogeneity of the wealth index, we specify a simultaneous equation system (hereafter denoted Model 1) :

$$\begin{aligned} y_{2i}^* &= \delta_{23} y_{3i} + \beta_2 z_{2i} + u_{2i} \\ y_{3i} &= \delta_{32} y_{2i} + \beta_3 z_{3i} + u_{3i} \end{aligned} \qquad (1)$$

where subscript i=1,...,N represents an individual, y_2^* is the latent variable associated to coverage choice and y_2 is its empirical counterpart taking value 1 if "high coverage" and 0 otherwise, y_3 is the logarithm of the wealth index, (z_2, z_3) is a vector of exogenous explanatory variables,[15] $(\delta_{23}, \beta_2, \beta_3)$ are parameters to estimate, and (u_2, u_3) have a bivariate normal distribution with means 0 and $\mathrm{V}(u_3) = s_3$, $s_2 = 1$, $\mathrm{Cov}(u_2, u_3) = \rho_{23}\sqrt{s_3}$. The first equation thus corresponds to a Probit equation and the second equation is a continuous regression in which we assume that the wealth index is log-normally distributed. Notice that u_2 and u_3 may be correlated (in this case $\rho_{23} \neq 0$), e.g., due to the effect of risk preferences. Hence, y_3 is endogenous in the Probit equation.

The model (1) has a mixed structure since it includes both a latent variable and its dichotomous realization. Moreover, we allow the wealth index to depend on the actual coverage decision y_2. Models with a mixed structure must, however, verify logical consistency conditions, that do not necessarily have a clear economic interpretation (see Maddala, 1983, Section 5.7 and 7.4). Here, the conditions reduce to $\delta_{23}\delta_{32} = 0$. Then, we

[15] Note that the usual exclusion conditions necessary for identification apply here. They also apply in the model presented in Section 4.

naturally impose $\delta_{32} = 0$ because we want to study the effect of wealth on the coverage choice through the estimation of δ_{23}.

Model (1) is estimated by the FIML method. The results are given in Table D-1 of Appendix D. The effect of the wealth index is positive and strongly significant (*t-value*=10.19). It means that the probability of choosing a high coverage contract increases with wealth. Not surprisingly, this probability also increases with the value of the car since the associated parameter is positive and strongly significant (*t-value*=70.95). Hence, we identify a "pure" effect of wealth on insurance coverage, independent from the relation between wealth and the value of the car. This result supports the idea that insurance is a normal good. It contradicts the standard prediction based on the DARA hypothesis.

Interestingly, Guiso and Jappelli (1998) also show that insurance increases with wealth, but they acknowledge that they do not control for the value of the insured good, and so their result does not necessarily contradict the DARA hypothesis. We also mention that a few papers have already shown that life insurance demand increases with wealth (Ferber and Lee, 1980, Eisenhauer, 1997). Life insurance models are, however, state-dependent utility models and so differ from standard state-independent utility models à la Mossin. In particular, life insurance models have to specify a bequest utility function and the notion of "DARA" is different since it depends on the properties of the bequest function (Karni, 1983). Thus, empirical results showing that life insurance demand increases with wealth need not contradict the classical DARA hypothesis based on a state-independent utility model.

Moreover, we find that insurance demand (i.e. the probability of choosing the high coverage contract) increases when the individual is older, a female, a new driver, and when he/she attended a special training before taking the driving exam. The duration of the specific contract for the current year as well as the duration of the relation between the insurance company and the client have a strong positive impact on insurance demand. Note that executives significantly demand less insurance than other occupational status. The highest coefficient corresponds to self-employed individuals. This result is consistent with the idea that those who face background risks are more risk-averse (Guiso et. al., 1996, Gollier, 2001), and may demand more insurance, other things equal. Finally, living in a high density area increases insurance demand.

We now briefly discuss the effect of the various variables on the *wealth index*. Being self-employed or executive people has a positive effect, while being employees or workers has a negative effect. Being older or having a longer relation with the insurance company or the bank has also a positive effect. In contrast, the payment frequency of the insurance premium has a negative effect on the wealth index, consistent with our findings in Section 2. Past occurrences of financial payment incidents has a negative effect as well. Holding a MasterCard or Visa debit card has a positive effect on the wealth index while holding a simple withdrawal card has a negative effect.

Finally, the correlation coefficient ρ_{23} is slightly negative ($\hat{\rho}_{23} = -0.157$) but significant (*t-value*=-6.78). This is consistent with the simultaneous equation approach that we adopted in the first place.

4. Wealth, Insurance and Risky Assets

Our previous results suggest that insurance is a normal good. This is in contradiction with the DARA hypothesis. But notice that this is not necessarily in contradiction with expected utility theory. Indeed, insurance is a normal good when the utility function is

Increasing Absolute Risk Aversion (IARA). Moreover, under IARA (resp. DARA) expected utility theory predicts that the investment in risky assets decreases (resp. increases) with wealth (Pratt, 1964). Hence, as we also have portfolio choice data, we can also study the relationship between wealth and the investment in risky assets, and relate it to the results on the relationship between wealth and insurance demand. To do so, we consider the same model as before, except that we add a new equation that pin downs the relationship between wealth and the demand for risky assets, accounting for the insurance coverage choice. With the same notations as in (1), we consider the following simultaneous equation system (hereafter denoted Model 2):

$$\begin{aligned} y_{1i}^* &= \delta_{12} y_{2i} + \delta_{13} y_{3i} + \beta_1 z_{1i} + u_{1i} \\ y_{2i}^* &= \delta_{21} y_{1i} + \delta_{23} y_{3i} + \beta_2 z_{2i} + u_{2i} \\ y_{3i} &= \delta_{31} y_{1i} + \delta_{32} y_{2i} + \beta_3 z_{3i} + u_{3i} \end{aligned} \tag{2}$$

where y_1^* is the latent variable associated to the observed investment in risky assets y_1 and z_1 is a vector of exogenous variables. The vector (u_1, u_2, u_3) has a trivariate normal distribution with means 0 and $\mathrm{V}(u_i) = s_i$ for $i = 1,3$, $s_2 = 1$, $\mathrm{Cov}(u_i, u_j) = \rho_{ij}\sqrt{s_i s_j}$.

Since the investment in risky assets is left-censored at 0, the first equation corresponds to a Tobit model. Again, we consider a mixed structure in which (y_1^*), (y_2^*) and (y_3) depend on the actual decisions. The issue of logical consistency is here more complex than in (1) because of the presence of simultaneous Tobit, Probit and continuous equations. We impose constraints $\delta_{21} = \delta_{31} = \delta_{32} = 0$ that are sufficient for the logical consistency to be verified, and that allow us to test the effect of wealth on both insurance and portfolio decisions. We use the FIML method to estimate the system of equations (2) and a tractable version of the likelihood is given in Appendix C.

The main results are that insurance demand increases with the wealth index ($\delta_{23} = 0.195$, *t-value*=10.47) and that the investment in risky assets increases with the wealth index as well ($\delta_{13} = 1.259$, *t-value*=9.51). These results seem inconsistent with expected utility. Indeed, as we said above, expected utility predicts that the investment in risky assets and the demand for insurance should respond in an opposite direction to a change in wealth (being DARA or IARA). Yet, this is a similar variation of both decisions that we find in the empirical analysis. Nevertheless, this theoretical prediction must be qualified. Indeed, the usual prediction rests on the assumption that insurance and portfolio decisions are made *in isolation*. In other words, the possible interaction between the two risky decisions is not taken into account, while it is accounted in the empirical model (2).

In Appendix B, we thus consider a theoretical model in which insurance and portfolio choices are made simultaneously. Because it can be important for some results, we consider two versions of the model. In one version, presented in the Appendix B1, we assume that the insurance decision is continuous. In the other version, presented in the Appendix B2, we assume that the insurance decision is a binary choice, namely, there is either full or no insurance.[16] Also, we only consider second-order approximations, that is, we assume “small risks” (Samuelson, 1970). The main theoretical result is the following. Both versions of the model predict that insurance demand decreases with wealth under DARA, see Proposition 1-(i) and Proposition 2-(i). Moreover, both versions also predict that the investment in risky assets increases with wealth under DARA, see Proposition 1-(ii) and Proposition 2-(ii).

[16] The theoretical results carry over to the comparison of any two given levels of insurance coverage.

Hence, even if decisions are taken simultaneously, our theoretical predictions cannot be consistent with the relationships between the wealth index and insurance demand and the investment in the risky asset that we observe in our data.

Let us now discuss the effect of the other variables on portfolio decisions. Workers invest relatively less in risky assets than individuals with other occupational statuses. Moreover, there are no significant differences between all these other occupational statuses. Older individuals significantly invest more in risky assets than younger individuals, which is a fairly surprising finding. The duration of the relation with the bank as well as the decision not to smooth the insurance premium have both a positive effect on the investment in risky assets. Interestingly, we also find that payment incidents at the bank have a negative effect on the investment on risky assets, although payment incidents recorded by the French issuing bank have a positive effect.

The qualitative and quantitative interpretations of Wealth and Probit equations are quite similar to those obtained with model (1). Hence the effects of the various variables on the insurance decision do not change much compared to those described in the previous section. A notable exception is the car value variable. We observe that the correlation coefficient ρ_{13} between the Tobit and the Wealth equation is 0.4 and significant whereas ρ_{12} is not. This shows that the investment in risky assets and insurance coverage are not correlated through unobservable variates in our data.

Finally, our data allow us to study an interesting related question: Do more aggressive investors demand less insurance? Common wisdom suggests that the answer should be positive, due to a pure "risk-aversion effect". Indeed, it is expected that, for a given wealth, a less risk averse agent invests more in risky assets, and demands less insurance. But, again, when portfolio and insurance decisions are taken simultaneously, the answer is not clear *a priori* because the decisions may interact. One can imagine for instance that an aggressive investor may rationally decide to hold more, and not less, insurance policies, to somehow compensate for his risky financial position. This is a "background risk effect", which may lead the investor to behave in a less risk averse fashion. Hence, when two risky decisions are made simultaneously, which of the risk aversion or the background risk effects dominate is not clear *a priori*.

We then use both our theoretical and econometric model to study this new question. In proposition 1-iii), we show that the relation between insurance demand and the investment in risky assets must be negative, that is, the interaction between the risky decisions does not change the usual prediction. In other words, the risk aversion effect dominates. However, this result is, again, contradicted by our data. Indeed we find that there is no relation between both decisions, in the sense that insurance demand has no significant influence on the amount invested in risky assets ($\delta_{12} = -0.157$, *t-value*=-0.94).

In Appendix B2, we offer a potential theoretical explanation for this result. This explanation is based on the indivisibility in the choice of the insurance contract. Indeed, we show that the background risk effect associated with the decision not-to-purchase full insurance may partially reverse the risk aversion effect for some wealth levels. More precisely, an individual v who is more risk-averse than another individual u purchases a car insurance contract while individual u does not; but individual u may then invest less in risky assets because his car is not insured, and so because he faces a background risk. As a result, we show that we cannot expect to find a systematic theoretical relation between the investment in risky assets and insurance demand over all range all wealths, see Proposition 2-

(iii). Still, even in the model used in Appendix B2, we show that there must be a negative relationship between wealth and insurance demand, and this is not what we find in the data.

5. Conclusion

Overall, it is difficult to reconcile the set of our empirical results with standard theory based on expected utility. In particular, it is difficult to explain the observed positive relationship between insurance demand and wealth, even in a model that accounts for the interaction between insurance and portfolio decisions, and that can allow for indivisible insurance contracts. So, how to explain that insurance is a normal good? A few papers have shown that insurance demand may increase with wealth under DARA. But either these papers consider a model that is not applicable to car insurance data (Eisenhauer, 1997), or they demonstrate that the effect of wealth is ambiguous in a model with several decisions (Dionne and Eeckhoudt, 1984; Meyer and Meyer, 2005). In the following, we briefly discuss a few other arguments.

First, it is natural to believe that liquidity constraints may play a role. Indeed, relatively poor people may decide to turn down high coverage contracts because they may not have the available money to pay the corresponding insurance premium. Yet, remember that the insurance company allows its clients to smooth the premium over the year, up to monthly payments. Hence, it is fairly unlikely that our results may be due to liquidity constraints.

Second, one may argue that risk preferences and wealth might be correlated. Although it is uncommon to assume such a correlation, it can explain the result. Indeed, relatively rich people may decide to purchase more insurance because they are, for a given wealth, more risk-averse than poor people. This may counteract the DARA effect. We think, however, that this hypothesis is quite implausible since it is usually found that rich people are more tolerant to risk (see, e.g., Guiso and Paella, 2005). Moreover, this would contradict, again, our other result that the investment in risky assets increase with wealth.

Third, when studying insurance markets, it is common to address adverse selection problems. Consider the following argument. Under asymmetric information, it is well-known that there may be a separating equilibrium in which high-risk individuals buy full coverage, and low-risk buy partial coverage. Hence, under positive correlation between wealth and the probability of being high-risk, wealthier individuals may more often choose a high coverage contract. This argument can thus simply explain that insurance is a normal good. We, however, suggest that this argument is limited for at least three reasons. The first reason is that there may be no or small information asymmetries in the insurance market (Chiappori and Salanié, 2000). The second reason is that insurance companies, even under asymmetric information, must realize that wealthy individuals have more accidents, and then discrimate based on (proxies for) wealth. This would, in turn, make insurance coverage for the wealthy more costly, and depress insurance demand. The last reason is that it is usually observed that wealthier individuals develop more, and not less, prevention efforts (Hammitt, Liu and Liu, 2000). Thus wealthier individuals may more likely be low-risk than high-risk individuals.

We conclude that that it is difficult to rationalize that insurance is a normal good under standard preferences. Certainly, non-standard preferences may explain the result, but a lot of work might be needed to pin down a “plausible” behavioral hypothesis, and validate it empirically. In any case, such a work may be very valuable since it may help better understand the tremendous rate of growth of the insurance sector in our economies.

Appendix A: Description of Variables

A-1- Definition of Variables

All variables below take 1 if true and 0 otherwise.Variables with * are continuous variables.

OS(I): Occupational status; I=1 (craftsman, retail dealer, self-employed), I=2 (profession, executive), I=3 (office manager), I=4 (employee), I=5 (worker), I=6 (retired), I=7 (non-worker).

MALE: Gender

NEWDRIVER: Driving license for less than 3 years.

KMS*: number of kilometers per year.

CLASS(I): Class of the car taking values I=A, B, C, D, E, F, G, H, J, X, Y, Z. The value of the car is increasing from A to X. Classes Y and Z correspond to very old vehicles.

GROUP(I): Group of the car taking values I=A, B, C, D. The power of the vehicle is increasing from A to D.

BONUS*: Value of the driver's no-claims bonus. Increases with sinistrality.

AGE*: Age of the driver.

AAC: Special driving training from 16 to 18 year old.

NORTH: Geographical area corresponding to the department "Nord".

PDC: Geographical area corresponding to the department "Pas-de-Calais".

ZONE(I): Population density; I=1,2,3,4, from high density area to low density area.

B_OLD*: Duration of the relation of the individual with the bank.

I_OLD*: Duration of the relation of the individual with the insurance company.

INCID_BDF: Financial incident recorded by the French issuing bank.

INCID_B: Financial incident occurred at the individual's bank.

MASTERC: Ownership of a MasterCard debit card.

VISA: Ownership of a Visa debit card.

WITHDRAW: Ownership of a withdrawal card.

DIFER: Ownership of a differed debit card.

SEAT(I): Number of seats in the car; I=2,4,5,7,OTHER.

EXCDRIVE: Exclusive driver.

CONT_AGE*: Duration (in days) of the current insurance contract during the reference year.

CARVAL*: Car value.

FREQ(i): Insurance premium payment frequency, i=1,2,4,12 (monthly, quarterly, bi-annual, annual).

CAR_AGE: Age of the car.

LPOWER: Engine's power less than 60 hp DIN.

LSPEED: Maximum speed less than 140 km/h.

A-2- Descriptive Statistics

Table A-2-1: Average Wealth by Occupational Status

Occupational status	Average wealth index	Standard deviation	Number of observations
1	24,362	47,619	4,057
2	26,005	71,657	552
3	12,314	28,551	1,791
4	8,653	22,709	7,918
5	6,251	20,982	4,117
6	25,824	56,653	4,333
7	11,830	34,757	1,524

Table A-2-2: Average Wealth by Gender

Gender	Average wealth index	Standard deviation	Number of observations
Female	16,659	43,061	5,593
Male	14,239	37,519	18,699

Table A-2-3: Average Wealth by Car's Class

Class	Average wealth index	Standard deviation	Number of observations
A	15,382	39,222	9,814
B	13,281	34,006	8,437
C	13,823	40,207	3,452
D	16,937	41,884	1,564
E	17,142	41,884	1,564
F	21,331	46,489	208
G	25,164	41,304	140
H	19,655	37,493	31
J	126,142	325,772	10
X	81,630	167,752	10
Y	41,784	62,095	18
Z	21,077	79,899	96

Table A-2-4: Average Wealth by Payment Frequency of the Insurance Premium

Frequency	Average wealth index	Standard deviation	Number of observations
Annual	25,383	53,395	10,456
Bi-annual	10,603	24,849	6,483
Quarterly	5,183	11,641	784
Monthly	3,230	9,256	6,569

Table A-2-5: Descriptive Statistics for Other Variables

Variables	Mean	Standard dev.	Min	Max
OS(1)	0.167	0.373	0	1
OS(2)	0.021	0.149	0	1
OS(3)	0.074	0.261	0	1
OS(4)	0.326	0.469	0	1
OS(5)	0.169	0.375	0	1
OS(6)	0.179	0.383	0	1
OS(7)	0.064	0.242	0	1
MALE	0.770	0.421	0	1
AGE (year)	46.71	15.24	18.13	94.56
CARVAL (€)	4,720	4,350	94.6	39,759
I_OLD (year)	2.155	2.023	0	11.97
CLASS(A)	0.404	0.491	0	1
CLASS(B)	0.347	0.476	0	1
CLASS(C)	0.142	0.349	0	1
CLASS(D)	0.064	0.245	0	1
B_OLD (year)	15.07	10.18	0	73
NEWDRIVER	0.101	0.301	0	1
DIFER	0.064	0.245	0	1
FREQ_1	0.430	0.495	0	1
FREQ_2	0.267	0.442	0	1
FREQ_12	0.270	0.444	0	1
INCID_B	0.008	0.091	0	1
INCID_BDF	0.031	0.173	0	1

MASTERC	0.267	0.442	0	1
CAR_AGE (year)	8.129	4.639	0	46
WITHDRAW	0.092	0.290	0	1
KMS	11,929	9,092	0	98,000
VISA	0.019	0.138	0	1
AAC	0.018	0.132	0	1
BONUS	0.585	0.146	0.5	1.83
EXCDRIVE	0.356	0.479	0	1
CONT_AGE (day)	287.2	119.6	1	365
GROUP(B)	0.438	0.496	0	1
GROUP(C)	0.224	0.417	0	1
GROUP(D)	0.058	0.233	0	1
LPOWER	0.532	0.499	0	1
LSPEED	0.212	0.409	0	1
SEAT(4)	0.023	0.150	0	1
SEAT(5)	0.915	0.404	0	1
SEAT(7)	0.007	0.084	0	1
PREMIUM (€)	339.5	172.4	49.58	2,708
ZONE(2)	0.428	0.431	0	1
ZONE(3)	0.233	0.422	0	1
ZONE(4)	0.010	0.101	0	1

Appendix B: the Economic Model

An agent maximizes expected utility and has an increasing, concave and three-times differentiable von Neuman-Morgenstern utility function $u(.)$. His initial wealth is w_0. Out of this wealth, the agent faces a risk of loss $\tilde{L}$. This risk is insurable. Let $a\pi$ be the market insurance premium that he must pay to get al if the realized loss is $\tilde{L}=l$. Hence a is interpreted as insurance demand. The agent may also invest on the stock market. There are two assets on the market, a riskless asset with a rate of return r and a risky asset with a random rate of return $\tilde{R}$. Let y_1 be the amount invested in the risky asset. The agent's expected utility is thus

$$Eu((w_0 - y_1 - \pi a)(1+r) + y_1(1+\tilde{R}) - \tilde{L} + a\tilde{L}),$$

or equivalently,

$$Eu((w_0 - \pi)(1+r) + y_1(\tilde{R} - r) + (1-a)(\pi(1+r) - \tilde{L})),$$

where E is the expectation operator over the random variables $\tilde{R}$ and $\tilde{L}$ (subscripts for the expectation operator(s) will not be denoted). Now assume $E\tilde{R} \geq r$, namely the expected return of the risky asset is larger than the return of the riskless asset. Also assume $\pi \geq E\tilde{L}/(1+r)$, namely the insurance premium is actuarially unfair. Under these assumptions and a straightforward change in notations, expected utility reduces to

$$Eu(w + y_1\tilde{X}_1 + y_2\tilde{X}_2) \tag{B1}$$

with $E\tilde{X}_1$ and $E\tilde{X}_2$ positive, and where $y_2 \equiv (1-a)$ is the level of risk retention on the insurance market.

B-1 Optimal Choices under “Small Risks”

We assume from now that risks $\tilde{X}_1$ and $\tilde{X}_2$ are “small”, or “compact”, in the sense of Samuelson (1970). Assuming “small risks” imposes a strong restriction on the admissible set of probability distributions. This set, however, includes various standard probability distributions such as Normal distributions or Brownian processes. This restriction guarantees that a second-order approximation is valid in the sense that it leads to the same solution as the general problem (B1). It also insures that the Tobin’s portfolio separation theorem that we assumed in the first place holds. Assuming “small risks”, we can approximate the objective as

$$Eu(w + y_1\tilde{X}_1 + y_2\tilde{X}_2) = u(w) + E(y_1\tilde{X}_1 + y_2\tilde{X}_2)u'(w) + \frac{1}{2!}E(y_1\tilde{X}_1 + y_2\tilde{X}_2)^2 u''(w) \tag{B2}$$

Differentiating equation (B2) with respect to y_2 and equating to zero gives

$$y_2^* = \frac{E\tilde{X}_2}{E\tilde{X}_2^2}\frac{u'(w)}{-u''(w)} - y_1^*\frac{E\tilde{X}_1\tilde{X}_2}{E\tilde{X}_2^2} \tag{B3}$$

This expression links the optimal insurance decision y_2^* to the optimal portfolio decision y_1^*. Observe that the quantity shows that the optimal decision without portfolio investment opportunities ($y_1^* = 0$) would only depend on the mean and the variance of the insurable risk as well as on the risk aversion of the decision-maker. This quantity increases with wealth under DARA, consistent with the Mossin's result that optimal insurance $a = (1 - y_2^*)$ decreases with wealth under DARA. The second quantity $y_1^* \frac{E\tilde{X}_1\tilde{X}_2}{E\tilde{X}^2}$ reflects the effect of the portfolio decision on the optimal insurance decision. Assuming that $\tilde{X}_1$ and $\tilde{X}_2$ are independent, and since their expectation is positive and y_1^* is positive as well, this quantity is positive. Exhibiting a similar expression as (B3) for y_1^*, and solving for these two equations, we obtain:

$$y_2^* = \frac{E\tilde{X}_2}{E\tilde{X}_2^2} \frac{u'(w)}{-u''(w)} [\frac{E\tilde{X}_1^2 - (E\tilde{X}_1)^2}{E\tilde{X}_1^2 - (E\tilde{X}_2)^2 (E\tilde{X}_2^2)^{-1} (E\tilde{X}_1)^2}] \quad \text{(B4)}$$

Observe that since $(E\tilde{X}_2)^2 (E\tilde{X}_2^2)^{-1}$ is lower than one, the expression into bracket is lower than one as well. This shows that the opportunity to invest in the stock market reduces y_2^* and thus increases insurance demand. Moreover this shows the optimal insurance demand $(1 - y_2^*)$ decreases with wealth under DARA, even when portfolio investment opportunities are present. Moreover, simplifying both expressions y_i^* by eliminating risk aversion, we obtain a linear relationship between y_1^* and y_2^* that is thus independent from risk preferences. This relationship is obviously consistent with the classical Tobin's separation theorem that the optimal mix of market securities does not vary with risk aversion. These results are summarized in the following proposition.

Proposition 1: *Assume "small risks" in the sense of Samuelson (1970). Then,*

- i) *insurance demand decreases with wealth if and only if the individual has DARA,*
- ii) *the investment in risky assets increases with wealth if and only if the individual has DARA,*
- iii) *insurance demand varies negatively with the investment in risky assets, and this variation is independent from the risk-aversion of the individual.*

B-2 Indivisible Insurance Contract

Assume now that y_2 can only be 0 or 1, i.e. only full insurance and no insurance are offered. Under "small risks", it is easy to understand that y_2^* equals 1 if and only if

$$E(y_1^{*0}\tilde{X}_1)u'(w) + \frac{1}{2!}E(y_1^{*0}\tilde{X}_1)^2 u''(w) \le E(y_1^{*1}\tilde{X}_1 + \tilde{X}_2)u'(w) + \frac{1}{2!}E(y_1^{*1}\tilde{X}_1 + \tilde{X}_2)^2 u''(w) \quad \text{(B5)}$$

where

$$y_1^{*0} = \frac{E\tilde{X}_1}{E\tilde{X}_1^2}\frac{u'(w)}{-u''(w)} \text{ and } y_1^{*1} = \frac{E\tilde{X}_1}{E\tilde{X}_1^2}\frac{u'(w)}{-u''(w)} - \frac{E\tilde{X}_1 E\tilde{X}_2}{E\tilde{X}_1^2} \quad \text{(B6)}$$

The two expressions in (A6) represent respectively the optimal portfolio choice under full insurance ($y_2^* = 0$) and no insurance ($y_2^* = 1$).Observe that in both cases the optimal demand for risky asset increases with wealth under DARA. Moreover, comparing these expressions, observe that there is less demand for the risky asset under no insurance ($y_2^* = 1$). This is a "background risk effect". The next step consists in identifying the conditions so that no insurance is optimal. Replacing expressions (A6) into (A5) and rearranging terms the inequality in (A5) becomes

$$\frac{1}{2}\frac{-u''(w)}{u'(w)}(E\tilde{X}_1^2 E\tilde{X}_2^2 - (E\tilde{X}_1 E\tilde{X}_2)^2) \le (E\tilde{X}_1 E\tilde{X}_2^2 - (E\tilde{X}_1)^2 E\tilde{X}_2) \qquad \text{(B7)}$$

It is easy to see that both sides of this inequality are positive. Hence this inequality holds true if and only if risk aversion is sufficiently small, which is intuitive. As a result, there is a unique level of wealth at which the individual switches from full insurance to no insurance under DARA. Importantly, this level is larger when the individual is more risk averse. This means that under DARA there exist wealth levels at which a more risk averse individual would demand more risky assets because he would still have full insurance for these levels. These results are summarized in the following proposition.

Proposition 2: *Assume "small risks" in the sense of Samuelson (1970) and assume that there may be either full or no insurance. Then,*

i) *when wealth increases the individual switches from full insurance to no insurance if and only if the individual has DARA,*

ii) *for a given insurance decision (either full or no insurance), the investment in risky assets increases with wealth if and only if the individual has DARA,*

iii) *there is no systematic relation between the investment in risky assets and insurance demand.*

Appendix C: The Likelihood of the Tobit/Probit/Continuous Model

The observations can be divided into four sets:

$$S_1 : y_{1i} > 0,\ y_{2i} = 1$$

$$S_2 : y_{1i} > 0,\ y_{2i} = 0$$

$$S_3 : y_{1i} = 0,\ y_{2i} = 1$$

$$S_4 : y_{1i} = 0,\ y_{2i} = 0$$

The likelihood of the sample is $L = \prod_{j=1}^{4} \prod_{i \in S_1} L_{ji}$ with:

$$L_{1i} = \prod_{i \in S_1} \int_{-\gamma_{23} y_{3i} - \beta_2 z_{2i}}^{+\infty} f\left(y_{1i} - \gamma_{12} - \beta_1 z_{1i}, u_2, y_{3i} - \beta_3 z_{3i}\right) du_2$$

$$L_{2i} = \prod_{i \in S_2} \int_{-\infty}^{-\gamma_{23} y_{3i} - \beta_2 z_{2i}} f\left(y_{1i} - \beta_1 z_{1i}, u_2, y_{3i} - \beta_3 z_{3i}\right) du_2$$

$$L_{3i} = \prod_{i \in S_3} \int_{-\gamma_{23} y_{3i} - \beta_2 z_{2i}}^{+\infty} \int_{-\infty}^{-\gamma_{13} y_{3i} - \gamma_{12} - \beta_2 z_{2i}} f\left(u_1, u_2, y_{3i} - \beta_3 z_{3i}\right) du_1 du_2$$

$$L_{4i} = \prod_{i \in S_4} \int_{-\infty}^{-\gamma_{23} y_{3i} - \beta_2 z_{2i}} \int_{-\infty}^{-\gamma_{13} y_{3i} - \beta_2 z_{2i}} f\left(u_1, u_2, y_{3i} - \beta_3 z_{3i}\right) du_1 du_2$$

In order to make computations tractable, and in particular to prevent from calculating double integrals, we transform the expressions above in order to evaluate only univariate and bivariate standard normal distribution functions. For that purpose, we decompose the joint densities into the product of marginal and conditional densities.

<u>Case 1</u>: $i \in S_1$

Let us denote $v_{1i} = y_{1i} - \gamma_{12} y_{2i} - \beta_1 z_{1i}$, $v_{2i} = \gamma_{23} y_{3i} + \beta_2 z_{2i}$ and $v_{3i} = y_{3i} - \beta_3 z_{3i}$. The joint density in case 1 is decomposed into $f_{2|13}\left(v_2 \middle| v_1, v_3\right) f_{1|3}\left(v_1 \middle| v_3\right) f_3\left(v_3\right)$. The mean of $v_2 | v_1, v_3$ is $\mu_{2|13} = \begin{pmatrix} v_1 & v_3 \end{pmatrix} V_{13}^{-1} V'_{2|13}$ with $V_{13} = \begin{pmatrix} s_1 & s_{13} \\ s_{13} & s_3 \end{pmatrix}$ and $V_{2|13} = -\begin{pmatrix} s_{12} & s_{23} \end{pmatrix}$. The variance of $v_2 | v_1, v_3$ is $\omega_{2|13} = s_2 - V_{2|13} V_{13}^{-1} V'_{2|13}$. The mean of $v_1 | v_3$ is $\mu_{1|3} = u_3 s_{13} / s_3$ and its variance is $\omega_{1|3} = s_1 - s_{13}^2 / s_3$. Then L_{1i} writes

$$L_{1i} = \Phi\left(\frac{v_{2i} - \mu_{2|13}}{\sqrt{\omega_{2|13}}}\right) \left|\omega_{1|3}\right|^{-0.5} \phi\left(\frac{v_{1i} - \mu_{1|3}}{\sqrt{\omega_{1|3}}}\right) \left|s_3\right|^{-0.5} \phi\left(\frac{v_{3i}}{\sqrt{s_3}}\right)$$

Where ϕ and Φ are respectively the probability density and the cumulative density functions of the standard normal distribution.

Case 2: $i \in S_2$

This case is identical to case 1 except that $v_{2i} = -\gamma_{23} y_{3i} - \beta_2 z_{2i}$ and $V_{2|13} = \begin{pmatrix} s_{12} & s_{23} \end{pmatrix}$.

Case 3: $i \in S_3$

Let us denote $v_{1i} = -\gamma_{12} y_{2i} - \beta_1 z_{1i}$, $v_{2i} = \gamma_{23} y_{3i} + \beta_2 z_{2i}$ and $v_{3i} = y_{3i} - \beta_3 z_{3i}$. The joint density in case 3 is decomposed into $f_{12|3}(v_1, v_2 | v_3) f_3(v_3)$. The mean of $(v_1, v_2)|v_3$ is $\mu_{12|3} = v_3 s_3^{-1} V'_{12|3}$ with $V_{12|3} = \begin{pmatrix} s_{13} \\ -s_{23} \end{pmatrix}$. The variance of $(v_1, v_2)|v_3$ is $\omega_{12|3} = V_2 - V_{12|3} s_3^{-1} V'_{12|3}$ with $V_2 = \begin{pmatrix} s_1 & -s_{12} \\ -s_{12} & s_2 \end{pmatrix}$. The standardized variables writes $\tilde{v}_{1i} = \left(v_{1i} - \mu_{12|3}^{(1)}\right) \Big/ \sqrt{\omega_{12|3}^{(1,1)}}$ and $\tilde{v}_{2i} = \left(v_{2i} - \mu_{12|3}^{(2)}\right) \Big/ \sqrt{\omega_{12|3}^{(2,2)}}$. The correlation coefficient is $\rho = \omega_{12|3}^{(1,2)} \Big/ \sqrt{\omega_{12|3}^{(1,1)} \omega_{12|3}^{(2,2)}}$. The term L_{3i} then writes

$$L_{3i} = \Phi_B(\tilde{v}_{1i}, \tilde{v}_{2i}, \rho) |s_3|^{-0.5} \phi\left(\frac{v_{3i}}{\sqrt{s_3}}\right),$$

where Φ_B denotes the bivariate cumulative density function of the standard normal distribution with correlation coefficient ρ.

Case 4: $i \in S_4$

This case is identical to case 3 except that $v_{2i} = -\gamma_{23} y_{3i} - \beta_2 z_{2i}$, $V_{12|3} = \begin{pmatrix} s_{13} \\ s_{23} \end{pmatrix}$ and $V_2 = \begin{pmatrix} s_1 & s_{12} \\ s_{12} & s_2 \end{pmatrix}$.

Appendix D: Empirical Results

Table D-1: Model 1

	Wealth (Regression)		Insurance Coverage (Probit)	
Variables	Estimate	t-student	Estimate	t-student
INTERCEPT	2.223	16.94	-0.118	-0.01
OS(1)	0.603	12.15	0.299	5.97
OS(2)	0.531	6.63	-0.121	-1.79
OS(3)	0.186	3.23	0.232	4.38
OS(4)	-0.100	-2.23	0.228	5.24
OS(5)	-0.126	-2.57	0.120	2.52
OS(6)	0.358	6.46	0.262	4.97
MALE	-0.243	-9.34	-0.132	-5.66
AGE	0.099	8.94	0.472	4.47
CARVAL	0.049	6.23	0.328	70.95
I_OLD	1.301	2.18	0.128	20.73
CLASS(A)	0.012	0.19	0.535	8.57
CLASS(B)	-0.154	-2.49	0.561	9.55
CLASS(C)	-0.107	-1.73	0.416	7.38
CLASS(D)	-0.220	-3.32	0.240	4.36
B_OLD	0.352	28.79	-	-
NEWDRIVER	-0.385	-10.45	0.341	9.67
DIFER	-0.096	-2.07	-	-
FREQ_1	0.900	13.63	-	-
FREQ_2	0.227	3.40	-	-
FREQ_12	-0.435	-6.51	-	-
INCID_B	-1.289	-13.00	-	-
INCID_BDF	-0.255	-11.14	-	-
MASTERC	0.300	11.54	-	-
CAR_AGE	-1.218	-2.92	-	-
WITHDRAW	-0.591	-14.15	-	-
KMS	-0.051	-3.98	-	-
VISA	0.194	2.26	-	-
AAC	-	-	0.300	4.10

BONUS	-	-	-0.226	-0.03
EXCDRIVE	-	-	-0.297	-12.38
CONT_AGE	-	-	0.122	13.38
GROUP(B)	-	-	-0.054	-1.93
GROUP(C)	-	-	-0.240	-5.83
GROUP(D)	-	-	-0.546	-9.13
LPOWER	-	-	0.064	0.02
LSPEED	-	-	-0.660	-16.33
SEAT(4)	-	-	0.915	1.25
SEAT(5)	-	-	-0.063	-1.35
SEAT(7)	-	-	-0.001	0.00
PREMIUM[17]	-	-	0.049	0.34
ZONE(2)	-	-	-2.294	-33.91
ZONE(3)	-	-	-2.474	-35.42
ZONE(4)	-	-	-2.439	-23.31
Wealth Index	-	-	0.130	10.19

Covariance Matrix		
Parameters	Estimate	t-student
s_3	2.734	111.68
ρ_{23}	-0.157	-6.78
Mean Log-likelihood	-2.425	

[17] Since the insurance premium is both individual and contract specific, we need to predict the premium for the contract that was not chosen. Thus the variable PREMIUM corresponds to log(P1/P0) where P1 is the (predicted or observed) premium associated to high coverage and P0 is the (predicted or observed) premium associated to partial coverage.

Table D-2: Model 2[18]

	Wealth (Regression)		Insurance Coverage (Probit)		Risky investment (Tobit)	
Variables	Estimate	t-student	Estimate	t-student	Estimate	t-student
INTERCEPT	2.756	14.00	-0.267	-0.01	-10.13	-20.37
OS(1)	0.601	7.85	0.208	2.75	-0.019	-0.17
OS(2)	0.547	4.45	-0.128	-1.26	-0.061	-0.25
OS(3)	0.216	2.40	0.175	2.17	0.022	0.12
OS(4)	-0.104	-1.47	0.210	3.18	-0.111	-0.71
OS(5)	-0.111	-1.45	0.120	1.66	-0.387	-2.38
OS(6)	0.380	4.48	0.236	2.95	-	-
OS(7)	-	-	-	-	0.015	0.09
MALE	-0.227	-5.58	-0.124	-3.49	-0.072	-0.76
AGE	0.043	2.49	0.023	1.47	0.272	7.95
CARVAL	0.002	0.20	0.310	40.27	0.067	6.75
I_OLD	0.412	4.50	0.117	12.15	-	-
CLASS(A)	-0.192	-2.01	0.418	4.21	-	-
CLASS(B)	-0.342	-3.70	0.469	5.03	-	-
CLASS(C)	-0.262	-2.81	0.335	3.79	-	-
CLASS(D)	-0.348	-3.47	0.194	2.30	-	-
B_OLD	0.035	18.23	-	-	0.047	8.10
NEWDRIVER	-0.345	-6.04	0.334	6.05	-	-
DIFER	-0.100	-1.43	-	-	-0.026	-0.16
FREQ_1	0.866	8.76	-	-	0.556	4.05
FREQ_2	0.229	2.31	-	-	-	-
FREQ_12	-0.440	-4.48	-	-	-	-
INCID_B	-1.271	-9.76	-	-	-2.446	-4.03
INCID_BDF	-0.250	-6.96	-	-	0.439	4.04
MASTERC	0.292	7.25	-	-	0.466	4.66
CAR_AGE	-4.824	-7.89	-	-	-	-
WITHDRAW	-0.578	-9.18	-	-	-	-
KMS	-0.003	-1.83	-	-	-	-
VISA	0.139	1.17	-	-	-	-

[18] These results are obtained with a randomly drawn sample of 10,133 observations from sample C.

AAC	-	-	0.322	3.11	-	-
BONUS	-	-	-2.592	-0.21	0.896	3.50
EXCDRIVE	-	-	-0.291	-7.99	-	-
CONT_AGE	-	-	0.113	8.10	-	-
GROUP(B)	-	-	-0.059	-1.40	-	-
GROUP(C)	-	-	-0.249	-3.90	-	-
GROUP(D)	-	-	-0.565	-5.94	-	-
LPOWER	-	-	0.301	0.07	-	-
LSPEED	-	-	-0.659	-10.25	-	-
SEAT(4)	-	-	0.395	0.33	-	-
SEAT(5)	-	-	-0.098	-1.32	-	-
SEAT(7)	-	-	0.001	0.00	-	-
PREMIUM	-	-	0.285	1.31	-	-
ZONE(2)	-	-	-2.164	-20.13	-	-
ZONE(3)	-	-	-2.321	-20.82	-	-
ZONE(4)	-	-	-2.338	-13.79	-	-
NORTH	-	-	-	-	0.664	2.12
PDC	-	-	-	-	0.418	1.86
Wealth Index	-	-	0.195	10.47	1.259	9.51
Coverage	-	-	-	-	-0.157	-0.94

Covariance Matrix		
Parameters	Estimate	t-student
s_1	5.878	13.77
s_3	2.724	68.15
ρ_{12}	-0.073	-1.33
ρ_{13}	0.400	5.20
ρ_{23}	-0.289	-8.44
Mean Log-likelihood	-3.244	

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