**Advantageous Selection in Private Health Insurance:**
**The Case of Australia**

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## Abstract

A basic prediction of theoretical models of insurance is that if consumers have private information about their risk of suffering a loss there will be a positive correlation between risk and the level of insurance coverage. We test this prediction in the context of the market for private health insurance in Australia. Despite a universal public health insurance system that provides comprehensive coverage for inpatient and outpatient care, roughly half of the adult Australian population also carries provide hospital insurance. The main benefit of private insurance is more timely access to elective hospital treatment. Like several recent studies using data on different types of insurance in other countries, we find no support for the positive correlation hypothesis. Indeed, individuals with private health insurance have a lower ex ante risk of hospitalization than those without such coverage. Because strict underwriting regulations create strong information asymmetries, this result suggests the importance of multi-dimensional private information. Several pieces of information suggest that the advantageous selection observed in this market is driven by the effect of income and risk aversion, both of which are positively correlated with insurance coverage and negatively related to the probability of being hospitalized.

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## 1. Introduction

A basic prediction of theoretical models of insurance is that when consumers have private information about their risk of suffering a loss - or, equivalently, if insurers are prohibited from using observable information on risk in underwriting - insurance markets will be prone to adverse selection. Market equilibria with adverse selection are characterized by a positive correlation between risk and the level of insurance coverage.[1] In extreme cases, low risk consumers can be driven from the market altogether.

A number of recent studies have tested this prediction using data from different types of insurance markets. While research on annuities markets finds evidence in support of the positive correlation hypothesis (Finkelstein and Poterba 2002, 2004, 2006), a number of studies on other types of insurance find either no correlation between risk and insurance coverage or a negative correlation. Examples include studies of health insurance markets in the U.S.[2] (Hurd and McGarry 1997; Cardon and Hendel 2001; Asinski 2005; Fang, Keane and Silverman 2008), the UK (Propper 1989), and Israel (Shmueli 2001), long term care insurance (Finkelstein and McGarry 2006), life insurance (Cawley and Philipson 1999) and auto insurance (Chiappori and Salanie 2000).

Broadly, there are two possible explanations for the finding that adverse selection is not an issue in insurance markets. One is that the information asymmetries that are central to theoretical models of insurance markets are not empirically important. According to this argument, insurers are able to obtain enough information from consumers to adequately predict their losses and set premiums accordingly. It is conceivable that in some cases, insurers will, in fact, have better information than consumers concerning expected losses. The second possible explanation is that there is multidimensional private information. That is, in addition to private information about the risk of experiencing a loss, there are other factors that cannot be used in

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[1] More generally, asymmetric information can lead to both adverse selection and moral hazard, both of which will result in a positive correlation between the level of coverage and ex post losses.
[2] A related literature examines risk selection in the context of employer-sponsored health benefits programs in which employees choose from a menu of insurance options. A common finding is that higher risk individuals tend to sort into plans that allow more flexibility, including greater choice of providers, while healthier employees are more likely to choose less costly, but more restrictive managed care plans. See, for example, Cutler and Reber (1998), Altman et al (1998), and Strombom et al (2002).

setting prices that positively influence the demand for insurance and are negatively correlated with the risk of suffering a loss. For example, if consumers who are more risk averse are also less likely to suffer a loss—perhaps because they are more inclined to undertake preventive efforts—the positive correlation between risk and insurance coverage due to adverse selection will be attenuated or perhaps even reversed.

In this paper, we investigate the issue of risk selection in the Australian market for private health insurance. Two features of this market make it an important case for understanding the general issue of risk selection and for informing regulatory policy. First, much of the prior research on risk selection in health insurance has used data from the US, which is an outlier among industrialized countries in both the importance of private insurance in financing health care and the link between coverage and employment. In contrast, Australia is typical of other developed countries in the way that private health insurance complements a universal public health care system. Second, in Australia the pricing of health insurance is highly regulated. Premiums are required to be community rated, meaning that for a given contract the same price must be charged to all consumers regardless of age, gender, health status or any other individual characteristics. By prohibiting insurers from basing premiums on readily observable risk factors, community rating essentially introduces a strong form of information asymmetry into the market, which simplifies the interpretation of our results. If the data reject the prediction of adverse selection, the explanation cannot be that information is effectively symmetric in this market.

Our analysis is based on two nationally representative surveys of Australian households. First, we use data from the Australian National Health Survey (NHS) to investigate the relationship between an individual's health risk and the probability that he or she holds private health insurance coverage. One health risk measure we use is an individual's predicted probability of being hospitalized, which we estimate as a function of demographic characteristics, self-assessed health and other measures of health status. This measure represents an empirical analog to the risk variable in Rothschild and Stiglitz (1976) and related theoretical models. Contrary to such models, but consistent with recent empirical research on other insurance markets, we find a negative correlation between risk and the probability of having health insurance coverage.

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In the second part of the analysis, we use data from the NHS as well as from another nationally representative survey, the Australian Household Expenditure Survey (HES) to test for preference-based explanations for this "advantageous selection." The analysis using the NHS exploits direct questions about the reasons for purchasing private health insurance. Some respondents give reasons that are suggestive of adverse selection—i.e., they purchased insurance because they are in poor health or expect to need inpatient care. As would be expected, people giving these reasons tend to be in poorer than average health. However, individuals giving this explanation represent a small percentage of all individuals with private insurance. The most common reason given for purchasing private insurance, which was given by roughly half of all insured respondents, is more suggestive of risk aversion: private coverage provides a sense of security or peace of mind. Individuals giving this response tend to be in slightly better health than people without private insurance.

Using the HES, we investigate individual decisions to purchase several different insurance products for which the risk of experiencing a loss are unlikely to be correlated. Specifically, we estimate a multivariate probit model of the demand for five types of insurance: health, home contents, appliance repairs, life and comprehensive car insurance. We also estimate models that include as outcomes whether or not an individual smokes or engages in different forms of gambling. The correlations among the error terms for these different purchases provide a test for the importance of preference heterogeneity as a determinant of the demand for insurance. We find that people who have private health insurance are significantly more likely to insure against other risks that are not likely to be correlated with health risks. These correlations remain large and statistically significant after controlling for income, wealth and consumer demographics.

## 2. Theoretical Background

A natural starting point for considering the issue of risk selection in insurance markets is the seminal paper by Rothschild and Stiglitz (1976). In their model, high and low risk consumers are differentiated by a single parameter, the probability of suffering a loss. When insurers can directly observe each consumer's risk type both types will be offered actuarially fair premiums and will choose to fully insure. When

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a consumer's risk type is private information, the model predicts adverse selection. In the presence of such asymmetric information, the only feasible equilibrium is a separating equilibrium in which high risks purchase a greater quantity of insurance than low risks. This prediction of a positive correlation between risk and insurance coverage is the focus of much of the empirical literature on risk selection.

The Rothschild-Stiglitz model applies most directly to cases where there is only private insurance and not purchasing coverage is equivalent to self-insuring. In the case of health insurance, this feature fits the US market, where for most non-elderly consumers private insurance is the only option available. However, in most industrialized countries, health care is financed primarily by the public sector and the private health insurance market is small and limited in scope. Olivella and Vera-Hernandez (2006) modify the Rothschild-Stiglitz model to account for the way the public and private sectors interact. They distinguish between two types of private insurance: supplemental, which provides reimbursement for co-payments and services not covered by public insurance, and substitute, which covers the same services as the public program, but provides patients access to more timely care and, perhaps, higher quality. The problem of adverse selection is most acute for substitute insurance. In this case, their model predicts a strong form of separation: high risks will purchase private insurance while low risks will rely entirely on the public system.[3]

Theoretical models of insurance in the Rothschild-Stiglitz tradition typically impose a single utility function across risk classes, an assumption which excludes correlation between risk preferences and risk class. Models that allow for heterogeneity in risk preferences can generate different results concerning risk selection. Hemenway (1990, 1992) notes that the standard adverse selection prediction can be reversed if individuals who are highly risk avoiding are both more likely to purchase insurance and more likely to take efforts to reduce the risk of experiencing a loss.[4] He gives several examples, such as the case of motorcycle riders. A model assuming that all consumers are equally risk averse would predict

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[3] Gans and King (2003) modify the Rothschild-Stiglitz model in a similar fashion and obtain comparable results. Finkelstein (2004) provides a good discussion of how the relationship between the coverage offered by public and private insurance can affect risk selection in the private market. Her conclusions are similar to those of Olivella and Vera-Hernandez.

[4] Hemenway refers to this result as "propitious selection." We follow the convention of more recent papers in referring to a negative correlation between risk and insurance coverage as "advantageous selection."

that motorcycle riders should be more likely then others to purchase health insurance because they face a greater risk of injury.  But, in fact, motorcycle riders are actually less likely to be insured, presumably reflecting a higher than average tolerance of risk.

De Meza and Webb (2001) show that advantageous selection can be generated with heterogeneity in risk aversion under imperfect competition.  Karagoyozova and Siegelman (2006) extend the model by allowing for flexible correlation between risk aversion and riskiness across a continuum of types and find that an advantageous selection equilibrium requires the insured have moderate uncertainty about their own riskiness.  Jullien, Salanie and Salanie (2007) develop a model that can imply positive, negative, or (approximately) zero correlation between risk and coverage.  In their formulation, advantageous selection requires private risk-aversion and a non-competitive insurance market.


3.  **Private Health Insurance in Australia**

In the framework of Olivella and Vera-Hernandez (2006), private health insurance in Australia mainly represents substitute coverage.  Private insurance can be purchased to cover the cost of hospital care as well as ancillary medical services, such as dental care, podiatry and chiropractic treatment.  Nearly 90 percent of contracts cover hospital care and hospital benefits account for roughly three-quarters of all benefits paid out by insurers.  Private insurance cannot cover outpatient physician services or other types of primary care, which are financed mainly by Medicare, the universal public insurance program, supplemented by out-of-pocket payments from patients.

While private insurance can be used to pay for a higher level of accommodation amenities in a public hospital, such as a private room, roughly 80 percent of all hospital days reimbursed by private insurance are in private facilities.  Private hospitals in Australia are generally smaller and less comprehensive than public hospitals and tend to focus on elective procedures for which capacity in the public system is constrained.  For instance, private hospitals perform roughly 70 percent of knee replacements and a similar percentage of cataract surgeries.  In 2006-07, the median time on a public hospital waiting list was 162 days for patients receiving knee replacements and 93 days for cataract surgery (AIHW 2008; Table

6.5). Thus, a primary rationale for purchasing private health insurance in Australia is to guarantee timely access to certain elective procedures.

In 1984, when the Medicare program was established, 50 percent of adults had private health insurance. Over the next 15 years, that percentage fell gradually but steadily. By 1997, the coverage rate was 32 percent (Buchmueller 2008). Beginning in the late 1990s, the Australian government enacted a set of policies aimed at increasing private insurance coverage.[5] In 1997, it introduced a means-tested premium subsidy and a supplemental income tax of one percent on higher income households that do not purchase private hospital insurance. In 1999, the means-tested subsidy was replaced with a 30 percent rebate on all purchases of private health insurance. Finally, in 2000 the government modified the community rating rules in a way to encourage younger consumers to take up and keep private coverage. According to a policy known as Lifetime Health Cover, consumers face a 2 percent surcharge on their insurance premiums for every year after age 30 that they delay purchasing coverage. So, for example, someone who first purchases insurance at age 40 will pay 20 percent more for any plan in the market than a 40 year old who has been continuously insured since the age of 30. After these policies went into effect, the percentage of Australians with private insurance coverage increased dramatically, from 31 percent in late 1999 to 45 percent by the end of 2000.

Many observers interpreted the decline in private insurance coverage between the mid-1980s and late 1990s as an adverse selection "death spiral" caused by the requirement that private insurance be sold on a community rated basis. Buchmueller (2008) uses aggregate enrollment data to compare the age profile of the private insurance risk pool with the general adult population. Data from 1997 confirm that the private insurance risk pool was older than the general population. However, several calculations suggest that age-related adverse selection is unlikely to account for more than a small fraction of the decline in coverage since 1984.

Barrett and Conlon (2003) investigate the issue of adverse selection using 1989 and 1995 data from the Australian National Health Survey (NHS). They estimate reduced form regressions in which private health insurance coverage is specified as a function of individual demographics and health status characteristics. Their results

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[5] For more details on these policies, see Hall et al (1999) and Butler (2002).

provide ambiguous evidence concerning risk selection. On one hand, they find a positive relationship between age and insurance coverage. The age gradient is steeper in 1995 than in 1989, which they interpret as evidence of a death spiral. On the other hand, the relationship between other risk proxies and insurance coverage are not suggestive of adverse selection. There is no significant relationship between insurance and the presence of chronic conditions and individuals who report their health as fair or poor are actually *less* likely to purchase private health insurance. Doiron et al. (2008) obtain a similar result for self-reported health in their analysis using NHS data from 2001.

The results of studies like Barrett and Conlon (2003) and Doiron et al (2008) are difficult to interpret in terms of the positive correlation hypothesis. The positive correlation between insurance coverage and certain risk proxies, notably age, is suggestive of adverse selection, while the negative correlation between insurance and fair or poor self-reported health suggest advantageous selection. Interpretation is also made difficult by the fact that theory predicts a positive correlation between risk and insurance coverage conditional on the variables that insurers observe and are able to use in setting premiums. Any variables that cannot be used in underwriting should be thought of as private information, even if they are readily observable to both insurers and the econometrician. The regressions in these studies include an extensive set of demographic and socioeconomic controls that are not used in underwriting.

## 4. Testing for Selection into Private Health Insurance

In the first part of our analysis, we examine the relationship between risk and insurance coverage in Australia. We conduct multiple tests that provide evidence on whether selection in the market for private health insurance is adverse or advantageous. The analysis is based on the most recent data from the NHS, which were collected in 2004 and 2005. The 2004-05 NHS, which is conducted by the Australian Bureau of Statistics (ABS) is a representative sample of 19,501 private dwellings across Australia. Within each sampled household a random sub-sample of usual residents was selected for inclusion in the survey comprising one adult (18 years of age and over) and one child (under age years of 18). A total of 25,906 respondent records (19,501 adult records and 6,405 child records) are included in the data set.

Since we study the purchase of health insurance, it is not appropriate to consider children and other dependents as independent observations. So, from the initial adult sample we delete observations corresponding to persons aged less than 20, dependents, and those with missing information for insurance status. The remaining sample consists of 18,966 observations (8,639 males and 10,327 females).

The survey collected information on the health status of the population, including long term medical conditions; health–related behaviors, such as smoking, exercise and alcohol consumption; use of health services such as consultations with doctors and dentists, and hospital visits; private health insurance coverage; and demographic and socio–economic characteristics. The questions on insurance ask whether or not an individual has private insurance and whether that insurance covers hospital care, but provides no additional details on the comprehensiveness of that coverage. Thus, with these data we cannot test for evidence of a separating equilibrium in which both high and low risks purchase insurance but the high risk opt for more extensive coverage. Rather, like prior studies using survey data (e.g., Finkelstein and McGarry 2006; Fang et al 2008) we analyze the relationship between risk and the probability of having private hospital insurance coverage.[6,7]

A common approach taken in the literature to test the positive correlation hypothesis is to regress realized losses ($L$) on insurance coverage ($I$) conditional on the set of variables on which premiums are based ($X_{rating}$):

$$L = \alpha_1 + \beta I + X_{rating}'\gamma + \varepsilon_1 \qquad\qquad (1)$$

Since payments to hospitals make up the vast majority of claims paid by private insurers in Australia, we implement this strategy using hospital utilization as our dependent variable. Because Australian insurers are prohibited from using any risk factors in setting premiums, the most appropriate specification for testing the positive correlation hypothesis is a model with no covariates.

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[6] This focus on the extensive margin fits well with the prediction of Olivella and Vera-Hernandez's (2006) model of "substitute" private insurance.

[7] Just under 4 percent of the sample has private health insurance for ancillary services (such as dental care) but not for hospital care. Since our focus is on hospital insurance, we code these people as not having private coverage.

Table 1 reports results from this regression.  In the upper panel, the dependent variable equals one for individuals who report having been hospitalized in the prior 12 months and zero otherwise.  The model is specified as a linear probability model, which in the simple case of no covariates yields identical estimates as a logit or probit model.  While insurers are not allowed to charge different premiums to men and women, there may be gender-related differences in preferences and health risks that lead to different patterns of risk selection.[8]  Therefore, in addition to reporting estimates for the full sample of adults (column 1), we also report separate estimates for women (column 2) and men (column 3).

For all three estimation samples, there is no statistically significant difference between people with and without private insurance in the probability of being hospitalized.  In the full sample, 17.2 percent of individuals without private insurance and 17.4 percent of those with private coverage report having been hospitalized in the prior year.[9]  Since the coefficient $\beta$ reflects a combination of ex ante risk selection and ex post moral hazard, a significant positive estimate would not have had a clear interpretation.  However, because the moral hazard effect should be non-negative, we can interpret these null results as evidence against the hypothesis of adverse selection.

In the lower panel of Table 1 we report similar regressions in which the dependent variable equals one for individuals who visited a physician in the two weeks prior to the survey and zero otherwise.  Since in Australia private health insurance does not provide coverage for outpatient physician services, there can be no cause effect of insurance (i.e., no moral hazard) on this outcome.  Therefore, the difference in utilization will reflect only differences in risk between people with and without insurance.  For both men and women, the coefficient is negative and statistically significant, suggesting that adults with private hospital insurance are healthier on average than those without private coverage.

An alternative approach to testing for risk selection is to analyze the relationship between insurance coverage and ex ante measures of risk, rather than realized losses.  In theoretical models, heterogeneity in risk is represented by the probability of

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[8] A number of studies find that women are, on average, more risk averse than men (Barsky et al. 1997; Halek and Eisenhauer 2001; Hartog et al. 2002).  As we show below, patterns of hospital utilization differ by gender as well.

[9] We also cut the data several ways by age, but this had no material impact on the results.  While there is a strong positive correlation between age and utilization, we find no significant differences in utilization for working age (18 to 64) or older (65 and up) adults.

experiencing a loss. We can construct an empirical analog of this variable by regressing the same measure of hospital utilization used in (1) on a vector of individual characteristics. Because the NHS includes a rich set of health status variables that are known to consumers but which insurers are prohibited from using in pricing, the predicted values from this regression will allow us to distinguish high and low risk individuals in a way that is economically meaningful.

The health variables include a five category measure of self-reported health (excellent/very good/good/fair/poor), which we interact with age (measured categorically according to five year intervals) to account for the possibility that survey respondents may implicitly assess their health relative to other people their age. Additional health measures include the number of long-term conditions plus indicator variables for several specific health conditions: angina, arthritis, asthma, cancer, diabetes, heart disease, and hypertension. The model also includes variables related to health behaviors: regular exercise (heavy, moderate, light and none), past and current smoking, and an indicator for problem drinking, which the ABS constructs on the basis of a battery of several questions. We also control for several demographic factors: education, employment, family structure, family income, immigrant status, and residence in a major city. We estimate separate models for men and women to account for differences in the utilization profiles.[10]

Table 2 summarizes the results from these regressions. We stratify the data first by gender and then by quintiles of the predicted values and report the means of several key variables for each quintile.[11] In addition to being more succinct, this tabulation provides a better sense than the coefficient estimates of how the fitted values capture heterogeneity in risk. (The full set of coefficient estimates is available upon request.) In the first row we report the mean value of the dependent variable for the different quintiles. Women in the fifth quintile of the risk distribution are 4 times more likely to have been hospitalized in the prior year than women in the first quintile

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[10] One concern with this regression is since that private insurance may have a causal effect on utilization, omitting insurance coverage from the right hand side may result in biased coefficient estimates. However, because we are not interested in the coefficients of the utilization equation per se, this is less of a concern. An alternative specification is to include insurance coverage as a regressor in the risk equation and then fix the value of that variable at the same level for all observations when forming the fitted values. This approach yields results that are nearly identical to the ones we report. Fang et al (2008), who also analyze the relationship between insurance coverage and a predicted measure of risk, also find that the results are invariant to the treatment of insurance.
[11] The risk quintiles reported in Table 2 are formed separately by gender.

(0.355 vs. 0.081). For men, there is more than a six-fold difference between the fifth and first quintiles (0.328 vs. 0.054).

In the male sample, there is a strong positive relationship between age and the probability of being hospitalized. In contrast, among women, younger age groups are disproportionately represented in the higher quintiles, presumably because of maternity stays. For both sexes, self-assessed health is a strong predictor of being hospitalized. Ninety-seven percent of men and 87 percent of women in the lowest risk quintile report their health as very good or excellent, while a majority in the top quintile for each sex report being in fair or poor health. The prevalence of long-term health conditions is also a strong predictor of hospitalization. Nearly two-thirds of women and three-quarters of men in the top quintile have five or more conditions.

In the lower part of the table we report data on health behaviors. The probability of being hospitalized is negatively related with the level of regular exercise. Among women, there is a positive relationship between current or past smoking behavior and the risk of being hospitalized. For men, this is true for being a former smoker, but not for current smoking. In contrast, meeting the NHS criteria for having an alcohol problem is not a significant predictor of hospitalization.

The last line in the table provides information on family income. In the NHS, income is reported as a categorical variable representing the decile of the income distribution, adjusted for family size and structure. In our regressions, we include a full set of dummy variables for the income deciles, but for brevity in Table 2 we report the mean decile for each risk quintile. Consistent with the well-documented positive relationship with income and good health, individuals from higher income families are disproportionately represented in the lower risk quintiles.

To test for risk selection, we regress the binary measure of private hospital insurance coverage, $I$, on the predicted probability of being hospitalized:

$$I = \alpha_2 + \delta \hat{L} + \varepsilon_2. \qquad\qquad (2)$$

Because $\hat{L}$ is simply a function of exogenous individual characteristics, it can be interpreted cleanly as a reflection of risk selection, rather than a combination of

adverse selection and moral hazard. Since it is a function of variables that are known to consumers but that insurers are prohibited from using in underwriting, models with one-dimensional private information would predict that $\delta$ should be positive.

Table 3 reports results from two alternative specifications. In the upper panel, we estimate a linear relationship between insurance coverage and the predicted probability of being hospitalized. To account for possible nonlinearities in the relationship between risk and insurance coverage, we also report models that replace the actual fitted values with indicators for the quintiles of the distribution of $\hat{L}$. The quintiles are formed separately for each estimation sample. The omitted category is the first quintile, which has the lowest risk of hospitalization.

The results provide strong evidence of advantageous selection into private hospital insurance coverage. In the full sample, the linear model implies that a 10 percentage point increase in the probability of being hospitalized is associated with a 6.5 percentage reduction in the probability of having private insurance. When we stratify the sample by gender, we see that the relationship between risk and insurance coverage is more strongly negative for women than for men. For women, private hospital insurance increases monotonically with the probability of being hospitalized. Women in the top quintile are 20 percentage points less likely to have insurance than those in the lowest (healthiest) quintile. For men, differences in insurance coverage among the first three quintiles are not statistically significant, but men in the fourth and fifth quintiles are significantly less likely to be insured than those in the lower quintiles. There is an 11 point gap in private insurance coverage between the first and fifth quintiles.

The finding of advantageous selection suggests the importance of other sources of private information that are negatively correlated with health risk and positively related to the demand for insurance. For example, individuals who are more risk averse or place a greater value on prevention may also be more likely to purchase insurance even though they have lower than average expected claims.[12] Prior studies have tested for the importance of multidimensional private information by augmenting regression equations like (1) and (2) with proxies for important

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[12] In their analysis of Medicare supplemental insurance in the U.S., Fang et al (2008) find that heterogeneity in cognitive ability among elderly Medicare beneficiaries is an important factor driving advantageous selection. It seems unlikely that such heterogeneity is a major factor in the Australian context. Even if it were, there are no proxies for cognitive ability in our data.

preference factors, such as consumers' risk tolerance, attitudes toward prevention, or cognitive ability. Unfortunately, the number of such variables in the NHS is quite limited. The most promising proxies for consumer preferences are the variables on smoking and exercise behavior.[13,14] Another important variable that may contribute to the negative relationship between risk and insurance coverage is income. Because they have a higher opportunity cost of time, higher income individuals may be willing to pay more to avoid public hospital waiting lists. In addition, recall that one of the policies enacted in the late 1990s to increase insurance coverage was a one percent income tax surcharge on higher income individuals who do not purchase insurance. This policy induces a negative correlation between income and the price of private insurance.

To test whether preference heterogeneity or income effects explain the finding of advantageous selection, we re-estimate equations (1) and (2) adding dummy variables for current and former smokers, three categories of regular exercise behavior (heavy, moderate and light; no exercise is the omitted category) and a full set of indicator variables for the decile of equalized family income. Table 4 shows how the addition of these variables affects the estimated relationship between risk and insurance coverage. The results in the upper panel correspond to equation (1), where the dependent variable equals one for individuals who were hospitalized during the year and the coefficient of interest is on the indicator for private hospital insurance. The lower panel pertains to regressions of insurance coverage on our constructed risk measure.

Being a non-smoker or someone who regularly engages in heavy or moderate exercise regularly is positively correlated with having insurance and negatively correlated with the probability of being hospitalized. However, because the correlations are small[15] adding these variables to the regressions has very little effect

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[13] Barksky et al (1997) find that smoking is positively related to risk tolerance and a number of studies using data from different countries find a negative relationship between smoking and health insurance coverage (Buchmueller et al. 2004; Monheit and Vistnes 2004; Doiron et al 2008; Cutler et al 2008; Shokkaert et al 2009). Shokkaert et al also find that in Belgium people who regularly engage in sports activities are more likely to have supplemental health insurance coverage.

[14] Problem drinking is another potential proxy for risk tolerance (Cutler et al. 2008). For men, there is a small negative correlation between problem drinking and private insurance coverage (-0.06), but among women the two variables are not significantly correlated. For both genders, there is no significant correlation between problem drinking and hospitalization.

[15] The correlation between having never been a smoker and private insurance coverage is 0.135 and the correlation with never smoking and having been hospitalized in the past 12 months is -0.03. For heavy

on the residual correlation between insurance coverage and hospital utilization. In contrast, adding income has a substantial effect. When the dependent variable is the binary measure of hospital utilization, conditioning on income causes the estimated insurance coefficient to become positive and statistically significant at the .01 level. In the lower panel, adding income causes this coefficient on $\hat{L}$ to become statistically insignificant in the full sample and in the male sample. In the female sample, the coefficient is still negative and statistically significant, though much smaller in magnitude than the baseline model without covariates (-0.141 vs. -0.616).

## 5. Analyzing the Reasons for Purchasing Private Health Insurance

While the NHS does not contain many questions that can be used as proxies for risk tolerance or other aspects of preference heterogeneity, a question asked of people with private insurance provides some insights regarding the relationship between preferences and risk selection. These respondents were asked to give the reasons they purchased insurance. The ABS coded the most common responses to form 12 overlapping categories. Table 5 reports the percentage of respondents citing different reasons along with their mean risk characteristics. Note that because respondents could give multiple reasons, the percentages do not sum to 100 percent and the mean characteristics are not for mutually exclusive groups. However, because nearly half the respondents cited a single reason and roughly 90 percent gave three or fewer reasons, these results can be roughly interpreted as representing the characteristics of different consumer "types."[16]

The response category that corresponds most closely to the economic concept of risk aversion is that private insurance provides a "sense of security", "protection", or "peace of mind." This category of reasons was the most commonly given, cited by nearly half of all privately insured individuals. Individuals who gave this response appear to be slightly healthier than those who do not have private insurance in that they are less likely to report their health as fair or poor or to have recently seen a physician in the past two weeks. There is no significant difference between the two

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exercise, the corresponding correlations are 0.05 and -0.03; for moderate exercise the correlations are 0.07 and -0.03.

[16] See Viney et al (2008) for a more detailed analysis of how the responses can be grouped to form different consumer profiles and how the types differ in their utilization of hospital care.

groups in the rate of hospitalization or the number of chronic conditions. Thus, people who purchase insurance to obtain a sense of security contribute modestly to the advantageous selection we observe for the market as a whole.

Three sets of responses relate to the benefits of being treated as a private patient: shorter waits, the ability to receive care in a private hospital, and a greater ability to choose one's own physician. Forty-four percent of respondents gave one or more of these reasons. Comparing these respondents with individuals without private insurance provides mixed evidence on risk selection. Those who say they purchased insurance for reasons of choice or convenience are in better self-reported health than the uninsured, but have more long-term conditions. The predicted probability of being hospitalized, which incorporates these variables plus age and a number of specific conditions, is lower for this insured group. However, actual hospital utilization is slightly higher.

Nearly one in five people with private insurance say the purchase was motivated by financial considerations, such as a desire to avoid the tax penalty for not having private insurance. Given that the tax penalty is targeted at high income households it is not surprising that this group has significantly higher than average incomes compared to both adults without private health insurance and people who gave other reasons for purchasing insurance. All of the risk proxies indicated that this group is significantly healthier than average as well.

A slightly lower percentage (18.5 percent of the insured sample) explained their purchase of insurance by saying that they had always had it, their parents had it or that it was a condition of their job. Of all the response this is the most difficult to attach an economic interpretation to. While there is evidence that "status quo bias" may be an important factor influencing insurance decisions (Neipp and Zeckhauser 1985; Samuelson and Zeckhauser 1988; Strombom et al 2002), that explanation holds in employer-sponsored group insurance settings where re-enrolling in an insurance plan is the default option and employees are required to pay a small fraction of premiums. Employer-sponsored group insurance is not common in Australia, so it is unlikely that people giving this response were covered as part of such a group. Not only is this group's economic motivation difficult to interpret, but their observable characteristics does not reveal a clear story about risk selection. Because they are older, individuals giving this response are older have more long-term health conditions than people

without out insurance, though conditional on age they have better self-assessed health (data not reported). There is no significant difference in actual health care utilization between this group and individuals without private insurance.

In the last two columns we report information on people who said that they purchased insurance because they anticipated needing medical care either because of their age or because of a medical condition. These responses, which match most closely to the concept of adverse selection, are relatively rare, with less than 9 percent of the insured sample (less than 4 percent of the total sample) giving either one.[17] As we would expect, these groups are in significantly poorer health and have higher levels of medical care utilization than people who give other reasons for purchasing private insurance and those without private coverage.

## 6. Indirect Evidence on the Effect of Risk Preferences

The stated reasons for purchasing health insurance suggest the importance of heterogeneity in risk tolerance as a determinant of the demand for private health insurance in Australia. However, because the question was asked only of people with insurance, this evidence is not definitive. Another way to test for the importance of such preference heterogeneity is to see whether people who purchase private health insurance are more likely to insure against other risks that are uncorrelated with the risk of needing hospital care. We conduct such a test using data from the 2003-2004 Australian Household Expenditure Survey (HES), which provides detailed data on household spending patterns. The HES was conducted on a sample of 6,957 households. Information was collected from all persons aged 15 years and over in the selected household. We select a sample where the household reference person is at least 19 years old.

Expenditure data are collected based on personal interviews and a diary detailing all expenditures over a two week period. From these data we create indicator variables for positive expenditures on six types of insurance: health, sickness and accident, life, home contents, appliance, and car (coverage beyond the minimum legal requirement). We also observe spending related to two types of risky behavior:

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[17] Overall, 15.9 percent of the insured sample (7.3 percent of the full sample) gave either or both of these responses.

smoking and gambling. We identify smokers as individuals with positive
expenditures on tobacco products. The survey provides expenditure data for five
forms of gambling: lottery tickets, lotto cards, off-track betting, poker machines and
other forms of gambling.

Table 6 presents mean values for the variables used in our analysis, for the full
sample and separately by private health insurance status. Fifty-three percent of the
AHES has private health insurance. Note that it is not possible to determine whether
this insurance covers hospital care, though the evidence from the NHS and other
sources suggests that over 90 percent of private policies do.[18] The raw data suggest a
strong association between health insurance purchase and the purchase of other kinds
of insurance. For example, about 90 percent of those with health insurance also have
home contents insurance, compared with 58 percent of those without private health
cover. There is a similar gap for comprehensive car insurance. Individuals with
private health insurance are more than twice as likely to hold a life insurance policy or
to have personal accident insurance. Similar to the results from the NHS and data
from other countries, we see that people without health insurance are about twice as
likely to smoke as those with coverage. In contrast, differences in gambling are small
and tend to go in the opposite direction.

As in the NHS, the HES data reveal a strong relationship between income and
insurance coverage. Thus, it is not clear from cross-tabs whether the positive
correlation among different types of insurance coverage indicates the importance of
heterogeneity in risk tolerance, or if there are simply strong income effects for all
types of insurance. To try to distinguish between these two possibilities, we estimate
a multivariate probit model in which the dependent variables are indicators for
positive expenditures on health insurance and the 11 other expenditure categories
listed in Table 6. The model is estimated by the method of maximum simulated
likelihood using the GHK simulator (Cappellari and Jenkins 2003). In addition to

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[18] In the NHS, 49.7 percent of the sample has some type of private insurance, including coverage that
only applies to ancillary services. The difference between the two samples is partly explained by the
fact that the NHS sample includes slightly more adults in their twenties, who have low rates of
insurance coverage.

income, the explanatory variables include wealth, housing tenure, and basic demographics (age, gender, family structure). [19]

Our main interest is in estimated correlations among the residuals, which are reported in Table 7. Income and wealth have positive and statistically significant effects on the purchase of all types of insurance. However, even when we adjust for these and other variables, the error terms of all the insurance equations are positively and significantly correlated. The correlations with health insurance range from .076 for insurance covering appliance repair to .310 for home contents insurance. This pattern provides further evidence that risk aversion is an important determinant of the demand for private health insurance in Australia.

Smoking is also negatively correlated with health insurance and three other types of insurance (life, home contents and car). Because there is a negative relationship between income and smoking, these regression-adjusted correlations are slightly larger than unadjusted ones. In the case of health insurance, the raw correlation between smoking and health insurance coverage is -0.174 and the regression-adjusted correlation is -0.182. These estimates are very close to the raw correlation between current smoking and private insurance in the NHS (-0.198). These results provide further support for the idea that smoking can be seen as a proxy for risk tolerance.

Expenditures on various forms of gambling are positively correlated with each other and with smoking. These correlations are large and statistically significant. However, we find no significant correlation between gambling and the purchase of any type of insurance. One possible explanation is that the dichotomous measures that we analyze group casual and serious gamblers into a single category and, therefore, do not capture meaningful variation in risk tolerance. That is, the decision of whether or not to buy a lottery ticket or to place a bet on a horse race appears to be driven by preferences that are uncorrelated with risk aversion.

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[19] We undertook a number of specification tests to establish that the full 12-equation model is preferred to more restricted specifications. A test of the full multivariate probit against 12 individual probit regressions has a LR statistic of 1,061, which is well above the critical test value. We also test for a block-diagonal specification, comparing the full model to two separate 6-equation multivariate probits. The LR statistic = 246 and the full model is preferred. We test the full model against a 5 insurance equation and a 7 tobacco and gambling equation. Again, the full model is preferred.

## 7. Conclusions

In this paper we analyze the nature of risk selection into private health insurance in Australia. In this market, underwriting regulations prohibit insurers from using any information on consumer risk in setting premiums. Under these circumstances, theoretical models with one-dimensional private information would predict a positive correlation between insurance coverage and expected claims. That is, there should be adverse selection.

We test this prediction using data from a nationally representative household survey that provides information on both private insurance for hospital care and hospital utilization. As in other recent studies using data on other types of insurance in other countries, our results do not support the positive correlation hypothesis. We find no statistically significant differences in hospital utilization between adults covered by private hospital insurance and those without such coverage. Privately insured individuals are actually less likely to report a recent physician's visit. Since private insurance in Australia provides no reimbursement for outpatient care, this result can be interpreted as evidence that the privately insured group is healthier than the group without private coverage. We also compare the two groups in terms of their predicted probability of hospitalization, calculated as a function of health status and other individual characteristics. This comparison also suggests that individuals who purchase private insurance are in better health than those who rely entirely on the public health care system. Thus, our results are consistent with advantageous, rather than adverse selection.

Given the information asymmetries induced by the underwriting regulations, this finding suggests that there must be other factors that positively affect the demand for private health insurance but are negatively related to expected claims. Two possible factors are risk aversion and income. Several pieces of evidence suggest that both are strong determinants of private insurance coverage in Australia. When asked why they purchased it, the most common reason given by consumers is that private health insurance provides a sense of security. People with private health insurance are also significantly more likely to purchase five other types of insurance for risks that are likely to be uncorrelated with the need for hospital care. Consumers who purchase private insurance for reasons related to risk aversion appear to be in slightly better health than individuals without such coverage. Income also has a strong effect on the

demand for private insurance and is negatively related to health risk.  In contrast, the type of behavior that would produce adverse selection—individuals buying insurance because they anticipate needing medical care—appears to be relatively rare.

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**Table 1. The Relationship Between Healthcare Utilization and Private Insurance**

|  | All Adults | Women | Men |
|---|---|---|---|
| **A. Hospitalized in past 12 months (0,1)** | | | |
| Dependent variable mean | 0.175 | 0.193 | 0.152 |
| Difference: Privately insured minus uninsured | 0.000 | 0.005 | -0.005 |
|  | (0.006) | (0.008) | (0.008) |
| **B. Had a doctor visit in the past 2 weeks (0,1)** | | | |
| Dependent variable mean | 0.274 | 0.310 | 0.232 |
| Difference: privately insured minus uninsured | -0.025** | -0.018 | -0.031** |
|  | (0.007) | (0.010) | (0.010) |
| Number of observations | 16983 | 9101 | 7882 |

Notes: The differences reported in each panel are from a linear probability model in which the independent variable is an indicator variable that equals one for individuals with private hospital insurance. Robust standard errors in parentheses.
* * = p-value < .01; * = .01 < p-value < .05

**Table 2. Selected Individual Characteristics by Predicted Probability of Being Hospitalized**

| | Women | | | | | Men | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Quintile: | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Prob(hospitalized) | 0.081 | 0.129 | 0.172 | 0.227 | 0.355 | 0.054 | 0.086 | 0.122 | 0.179 | 0.328 |
| Age | | | | | | | | | | |
| 20 to 29 | 4.1% | 15.8% | 16.8% | 17.7% | 18.3% | 23.1% | 17.6% | 18.9% | 11.7% | 4.0% |
| 30 to 39 | 14.6 | 19.4 | 20.3 | 26.0 | 20.5 | 33.6 | 22.5 | 21.1 | 17.4 | 5.5 |
| 40 to 49 | 38.9 | 21.9 | 16.5 | 11.9 | 8.9 | 21.9 | 29.2 | 23.7 | 18.9 | 13.6 |
| 50 to 59 | 29.1 | 19.1 | 13.9 | 10.6 | 10.2 | 15.3 | 17.7 | 21.0 | 19.3 | 15.3 |
| 60 to 69 | 9.2 | 11.9 | 13.0 | 16.1 | 11.0 | 4.7 | 6.8 | 10.3 | 18.9 | 24.8 |
| 70 and older | 4.0 | 11.8 | 19.7 | 17.6 | 31.1 | 1.4 | 3.2 | 5.0 | 13.7 | 36.8 |
| Self-reported health | | | | | | | | | | |
| Excellent | 40.8% | 24.4% | 15.4% | 8.6% | 6.2% | 45.6% | 24.3% | 11.3% | 5.3% | 1.8% |
| Very Good | 46.7 | 43.7 | 35.0 | 31.5 | 17.3 | 51.9 | 51.7 | 39.0 | 17.8 | 7.4 |
| Good | 11.2 | 27.7 | 39.5 | 38.8 | 21.1 | 2.2 | 21.4 | 40.7 | 56.2 | 29.2 |
| Fair/Poor | 1.6 | 4.2 | 10.1 | 21.1 | 55.0 | 0.3 | 2.7 | 9.0 | 20.7 | 61.6 |
| Number of Long Term Conditions | | | | | | | | | | |
| 0 | 15.7% | 10.9% | 8.3% | 5.7% | 2.5% | 31.9 | 18.2 | 9.9 | 1.0 | 0.3 |
| 1 | 26.0 | 18.3 | 13.1 | 10.3 | 7.4 | 41.4 | 29.1 | 16.1 | 3.7 | 0.6 |
| 2 | 22.9 | 20.6 | 16.5 | 13.3 | 8.1 | 19.8 | 27.3 | 27.5 | 14.3 | 2.9 |
| 3 | 17.0 | 17.0 | 16.5 | 13.0 | 7.8 | 3.4 | 12.5 | 21.0 | 26.3 | 11.3 |
| 4 | 9.7 | 13.4 | 14.4 | 12.8 | 8.9 | 2.5 | 7.9 | 13.9 | 21.4 | 11.6 |
| 5+ | 0.9 | 19.9 | 31.3 | 44.9 | 65.4 | 1.1 | 4.9 | 11.5 | 34.6 | 73.4 |
| Health Behaviors | | | | | | | | | | |
| Current smoker | 19.6% | 19.9% | 21.9% | 23.1% | 24.1% | 27.5% | 29.8% | 29.6% | 27.6% | 21.5% |
| Former smoker | 19.1 | 24.3 | 24.6 | 30.5 | 37.2 | 26.0 | 31.5 | 31.5 | 42.0 | 55.7 |
| Heavy exercise | 5.7 | 4.8 | 3.6 | 2.3 | 1.7 | 13.2 | 9.1 | 8.1 | 4.4 | 2.2 |
| Moderate exercise | 32.3 | 28.5 | 21.6 | 17.0 | 13.0 | 27.8 | 26.7 | 25.8 | 25.3 | 21.9 |
| | | | | | | | | | | |
| Income decile | 6.1 | 5.5 | 5.1 | 4.5 | 3.6 | 7.8 | 7.3 | 7.0 | 6.0 | 4.3 |

Notes: Risk quintiles are based on predicted values from a regression of hospital utilization (0,1) on individual health status and demographic characteristics. See text for the full set of independent variables.

**Table 3. The Relationship Between Hospital Insurance and Health Risk**

|  | All Adults | Women | Men |
|---|---|---|---|
| Probability of being hospitalized ($\hat{L}$) | -0.542** | -0.616** | -0.504** |
|  | (0.033) | (0.047) | (0.048) |
| Risk quintile 2 | -0.007 | -0.065** | 0.026 |
|  | (0.011) | (0.016) | (0.017) |
| Risk quintile 3 | -0.036** | -0.082** | 0.008 |
|  | (0.011) | (0.016) | (0.017) |
| Risk quintile 4 | -0.096** | -0.153** | -0.048** |
|  | (0.011) | (0.015) | (0.017) |
| Risk quintile 5 | -0.158** | -0.199** | -0.113** |
|  | (0.011) | (0.015) | (0.017) |
| Number of observations | 18966 | 10327 | 8639 |

Notes: Robust standard errors in parentheses. $**$ = p-value < .01; $*$ = .01 < p-value < .0

**Table 4.  The Relationship Between Insurance Coverage and Risk Conditional on Health Behaviors and Income**

*1.    Dependent Variable = 1[hospitalized in the last 12 months]*

| | All Adults | | | Women | | | Men | | |
|---|---|---|---|---|---|---|---|---|---|
| Private hospital insurance | 0.000 | 0.005 | 0.035** | 0.005 | 0.015 | 0.033** | -0.005 | -0.003 | 0.030** |
| | (0.006) | (0.006) | (0.006) | (0.008) | (0.008) | (0.009) | (0.008) | (0.008) | (0.009) |

*2.    Dependent Variable = 1[has private hospital insurance]*

| | All Adults | | | Women | | | Men | | |
|---|---|---|---|---|---|---|---|---|---|
| Prob. of hospitalization | -0.653** | -0.477** | -0.046 | -0.616** | -0.481** | -0.141** | -0.504** | -0.489** | -0.021 |
| | (0.034) | (0.033) | (0.033) | (0.047) | (0.048) | (0.046) | (0.048) | (0.049) | (0.052) |
| Covariates: | | | | | | | | | |
| Smoking, and exercise | N | Y | Y | N | Y | Y | N | Y | Y |
| Income | N | N | Y | N | N | Y | N | N | Y |

Notes: There are two smoking variables (dummies for current and former smokers) and three exercise variables (dummies for heavy, moderate and light).  Models that condition on income include indicator variables for each decile of family income adjusted for family size and composition. Robust standard errors in parentheses.  * * = p-value < .01; * = .01 < p-value < .0

**Table 5. Risk Characteristics by Reasons Given for Purchasing Health Insurance**

| | Has Private Hospital Insurance? | | Reason Given for Purchasing Private Health Insurance | | | | | |
| | No | Yes | Sense of Security | Greater Choice | Financial Reasons | Always Had it | Elderly/ Aging | Health Condition |
|---|---|---|---|---|---|---|---|---|
| Percent of Sample | 54.0 | 46.0 | 21.3 | 20.5 | 8.8 | 8.5 | 3.9 | 3.9 |
| (percent of insured sample) | | (100.0) | (46.5) | (44.7) | (19.3) | (18.5) | (9.6) | (8.5) |
| | | | | | | | | |
| Mean characteristics | | | | | | | | |
| Fair or poor health | .233 | .127** | .118** | .129** | .086** | .149** | .186** | .317** |
| No. of long-term health conditions | 2.85 | 2.91* | 2.84 | 3.05** | 2.68** | 3.11** | 3.78** | 3.68** |
| Predicted prob. of hospitalization | .184 | .160** | .157** | .164** | .139** | .175** | .193* | .216** |
| | | | | | | | | |
| Hospitalized in last 12 months | .172 | .174 | .163 | .194** | .136** | .179 | .217** | .281** |
| Had a MD visit last 2 weeks | .281 | .260 | .253** | .267 | .212** | .272 | .305 | .397** |
| | | | | | | | | |
| Income decile | 4.35 | 6.60** | 6.59** | 6.48** | 7.71** | 6.23** | 5.41** | 5.87** |

Notes: The groups formed by the different reasons for purchasing insurance are not mutually exclusive. Asterisks indicate that the difference between the mean for a particular insured group and the mean for the group without insurance is significant at the .01 (**) or .05 (*) level.

**Table 6. Other Insurance Purchases and Risky Behaviors by Health Insurance Status**

| | | Has Private Health Insurance? | |
| | **Full Sample** | **No** | **Yes** |
|---|---|---|---|
| **Insurance Coverage** | | | |
| Health insurance | 0.529 | 0.000 | 1.000 |
| Personal accident insurance | 0.115 | 0.068 | 0.158 |
| Life insurance | 0.180 | 0.114 | 0.239 |
| Home contents insurance | 0.746 | 0.582 | 0.892 |
| Car insurance | 0.714 | 0.584 | 0.830 |
| Appliance | 0.052 | 0.040 | 0.062 |
| | | | |
| **Tobacco use and gambling** | | | |
| Tobacco | 0.237 | 0.315 | 0.167 |
| Lottery | 0.050 | 0.041 | 0.058 |
| Lotto | 0.307 | 0.271 | 0.338 |
| Off-track betting | 0.029 | 0.022 | 0.034 |
| Poker machines | 0.058 | 0.061 | 0.055 |
| Other gambling | 0.139 | 0.122 | 0.155 |

Notes: Data are from the Australian Household Expenditure Survey. Insurance coverage and smoker status are inferred from positive expenditures on each type of insurance and cigarettes or other tobacco products. With some forms of gambling, winnings are coded as negative expenditures. Therefore gamblers are identified as observations with either positive or negative expenditures.

**Table 7: Residual Correlations from a 12 Outcome Multivariate Probit Model**

| | Insurance | | | | | | Smoking | Gambling | | | | |
| | Health | Accident | Life | Home contents | Car | Appliance | | Lottery | Lotto | Off-track | Poker machine | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Health** | 1 | | | | | | | | | | | |
| **Accident** | 0.125* | 1 | | | | | | | | | | |
| **Life** | 0.142* | 0.103* | 1 | | | | | | | | | |
| **Home contents** | 0.310* | 0.142* | 0.083* | 1 | | | | | | | | |
| **Car** | 0.194* | 0.053 | 0.093* | 0.330* | 1 | | | | | | | |
| **Appliance** | 0.076* | 0.100* | 0.070 | 0.108* | 0.072 | 1 | | | | | | |
| **Smoking** | -0.182* | -0.019 | -0.107* | -0.177* | -0.159* | -0.019 | 1 | | | | | |
| **Lottery** | 0.037 | 0.038 | -0.012 | 0.039 | 0.078* | -0.078 | 0.023 | 1 | | | | |
| **Lotto** | 0.041 | 0.041 | 0.017 | 0.112* | 0.075* | 0.048 | 0.091* | 0.177* | 1 | | | |
| **Off-track Betting** | 0.054 | -0.034 | -0.055 | -0.009 | -0.023 | -0.106* | 0.133* | 0.017 | 0.289* | 1 | | |
| **Poker Machine** | -0.024 | 0.004 | 0.038 | 0.020 | 0.057 | -0.057 | 0.195* | 0.168* | 0.320* | 0.206* | 1 | |
| **Other Gambling** | 0.010 | 0.051 | 0.032 | 0.053 | 0.085* | -0.004 | 0.083* | 0.091* | 0.254* | 0.207* | 0.319* | 1 |

Notes: * = statistically significant at the .05 level