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A Dynamic Model of Demand for Private Health Insurance in Ireland

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ABSTRACT

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The Irish health care system offers a tax financed, universal entitlement to public care at a nominal user fee, nonetheless 50% of the Irish population purchase private health insurance. This paper empirically models the propensity to insure as a function of individual and household characteristics using panel data analysis and compares three alternate approaches; a static, chamberlain-mundlak and dynamic specification. Using panel data from 1994 to 2000, we consider whether propensity to insure is in fact a function of heterogeneity or of state dependence. A range of individual and household characteristics is shown to influence propensity to insure. Overall the positive effect of education and income and the negative effect of poor health status remain robust across three specifications. In moving toward a dynamic specification, we show that persistence is a highly significant determinant of demand for private health insurance and also that it reduces the size of the coefficients on the regressors. The latter point highlights that while education, income and, to a lesser extent, health status have very large effects on probability of insuring, these effects are overestimated where no attempt is made to control for unobserved heterogeneity or state dependence.

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1. Introduction

Although the Irish health care system offers a tax financed, universal entitlement to public care at a nominal user fee, nearly 50% of the Irish population have private health insurance. While originally established in the late 1950's to provide cover for the top 15% of earners (those initially excluded from the nominal fee, public health sector entitlement) the proportion of the population choosing private health insurance continues to grow. Irish health policy actively supports the private health sector, which benefits from a number of cross-subsidies, both direct and indirect, from public finances. This paper is motivated therefore by two concerns. Firstly what are the socio-economic and households characteristics of those who buy? Secondly, what role does policy play?

Most governments espouse equity of access as a goal of health systems, indeed the WHO use equity in financing & accessibility as criteria by which health system performance is judged, from a equity perspective then could policy be contributing to inequalities in access and quality of healthcare? Tax relief on private health insurance is justified on the grounds that it 'allows those with chronic health conditions to benefit from insurance at a reasonable cost'(Department of Health and Children 1999). However, this policy reduces the cost of insurance to everyone, not just the chronically ill. There is evidence to suggest that the Irish insurance system does not suffer from adverse selection. In fact it would seem that those with poor health status are less likely to be insured than those with good health[1]. This suggests that tax relief may not be having the desired effect. Posing the question, are the systems structures, as they pertain

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[1] See Doiron, Jones and Savage for a fuller discussion of the relationship between SAHS and the purchase pf private health insurance.

to, adequately protecting some of the more vulnerable, less healthy segments of the population?

Only a small literature pertaining to the Irish insurance system exists (Nolan and Wiley 2000; Harmon and Nolan 2001; Watson and Williams 2001). Only one Harmon & Nolan (2001) models the effects of individual and household characteristics on propensity to insure focusing on a cross-section analysis of propensity to insure in 1994. A number of individual and household characteristics are shown to influence the insurance decision.

In light of the availability of new data & indeed of the huge economic growth experienced in Ireland throughout the latter half the 1990's into the 2000, this paper aims to expand on this existing work with a more detailed panel data analysis. The method of estimation as allowed us exploit the panel nature of the data while attempting to control for unobserved individual specific effects. It has also facilitated the inclusion of a lagged dependent variable to consider the possible role of state dependence, that is persistence perhaps due to changing preferences or costs associated with the insurance state.

Drawing on literature relating to utility and insurance, a theoretical framework supporting an empirical investigation of the effect of individual and household characteristics on the propensity to insure is provided. While patterns of association are evident empirically, the extent to which they are function of observed heterogeneity or state dependence remain unclear. The robustness of certain individual and household effects to the inclusion of a lagged dependent variable is therefore of interest. The paper proceeds as follows. As the basis for the empirical investigation, a theoretical framework is established in Section 2. Section 3 is a short overview of the Irish health

and insurance system. Data and preliminary statistics are described in Section 4. Section 5 focuses on estimation. While results and conclusions are reported in Section 6.

2. Theoretical framework: Utility theory and Insurance

The decision to insure has been widely considered in theoretical literature pertaining to insurance in general and, more specifically, to health insurance (Arrow 1963; Feldstein 1973; Van De Ven and Van Praag 1981; Propper 1989; Besley 1991; Hopkins and Kidd 1996; Besley, Hall et al. 1998; Besley, Hall et al. 1999). The decision to insure is one of a discrete choice, to purchase private health insurance or not. A comparison of expected utility under insurance to expected utility under no insurance will inform the insurance decision (Besley, Hall et al. 1999; Propper 2000). It is anticipated that expected utility gain or loss from the decision to insure will be a function of determinants pertaining to material well-being (income, education, age, family characteristics) and medical need (age, sex, family characteristics, health status) (Van De Ven and Van Praag 1981; Propper 1989; Hopkins and Kidd 1996; Besley, Hall et al. 1999). The impact of material well-being and medical need on the propensity to demand private health insurance is therefore of interest.

To expand on this in a less formal discussion, the utility of having private health insurance (or not) is influenced by expected medical consumption or probability of sickness. Medical need is associated with uncertainty and as Arrow notes demand for medical services is "irregular and unpredictable" and "affords satisfaction only in the event of illness"(Arrow 1963). In line with this Propper (1989) observes, "health insurance can only be used in states of ill health". The utility of private health insurance

when sick therefore is greater than when well [2]. Certain individual and household characteristics are associated with a higher or lower risk of medical need, or to put in another way, with a higher or lower 'risk vulnerability' (Hopkins and Kidd 1996). Supported by the theory of adverse selection, it is expected that those with high-risk vulnerability are more likely to insure. Thus we might expect that those with poor health status or a chronic condition the elderly (due to decreasing health), the presence of children (due to higher expected medical consumption) and females (due to expected future consumption related to childbirth) will all have a positive effect on demand for private health insurance.

Splitting risk vulnerability into direct and indirect risk vulnerability facilitates some further consideration of the issues in the context of the Irish insurance system. Direct risk vulnerability refers to variables *directly* associated with medical need such as past or present health status/healthcare consumption[3]. On the other hand, *indirect* risk vulnerability is associated with characteristics that *do not reflect* past or present health status but are indirectly associated with medical need, as such, those with high indirect risk vulnerability have a higher expectation of medical need (e.g as suggested earlier, older people, females and those with children).

Under community rating, as exists in the Irish system, there is no differentiation in premium price based on risk. We would expect therefore that those with high *indirect* risk vulnerability (given that there is no financial penalties for their increased risk) would be more likely to insure. On the other hand, although those with high *direct* risk vulnerability (poor past or present health) are not prohibited from insuring or indeed

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[2] Ignoring that given the state of uncertainty about states of health there may be some utility in being insured, particularly for the risk adverse

[3] For example, low direct risk vulnerability describes good health status whereas high direct risk vulnerability describes poor health status or a chronic condition

charged higher premia under community rating, under a pre-existing condition clause any health conditions experienced prior to the purchase of insurance are excluded from the terms of the cover for a period of five years. Thus the utility of private insurance take-up is less for those who already have specific health problems as they will have to wait a considerable period of time before they can use it.

In essence it might be suggested that the insurance system creates an incentive for those with high indirect risk vulnerability and a disincentive for those with high direct risk vulnerability (those who already suffer from specific medical conditions) to insure. Thus while factors such as age, the presence of children and females are all expected to have a positive effect on demand for private health insurance, it is anticipated, at least in an Irish context, that poor health status might be associated with a lower propensity to insure.

There is evidence of selection into insurance by income (Van De Ven and Van Praag 1981; Propper 1989; Besley, Hall et al. 1999). Income can determine the probability of purchasing private insurance in two ways. The first is the intuitive expectation that the higher the income the less the opportunity cost associated with the purchase of private health insurance in pure monetary terms (Hopkins and Kidd 1996). The second relates to the opportunity cost of time. With respect to the latter, Propper (1989) notes that one of the costs associated with the public sector is the cost of waiting (Propper 1989). To elaborate on this cost in the context of loss of time, it is noted that the cost of waiting is the opportunity cost of healthy time. It is assumed for those on a waiting list, stock of health is at less than its usual capacity. Therefore illness reduces the amount of healthy time available. The opportunity cost of healthy time, according to Propper (1989) is a function of income, source of income and the extent to which

individuals re-allocate their use of time. Both Hopkins and Kidd (1996) and Propper (1989) recognise that those with a greater constraint on uses of time have a higher the opportunity cost and conclude that "the value of time is probably higher for those who are employed rather than unemployed or not in the labour force, and those on higher incomes rather than lower incomes" (Hopkins and Kidd 1996)[4]. Besley et al (1998) also focus on the time loss associated with the public sector wait; they show a positive relationship between public sector waiting time and private insurance take-up.

Despite such evidence, Feldstein (1973) notes, with respect to the US, that income might negatively affect the decision to insure, remarking "for a given probability distribution of health expenses, higher incomes tends to make families more willing to assume risk which in turn reduces their demand for private insurance" and concludes therefore in relation his research that the effect of income is indeterminate. He notes that this insignificant income effect may represent a balancing of positive and negative income effects (Feldstein 1973). Hopkins also investigated this possibility and found this not to be the case in an Australian context.

Education may impact directly on the insurance decision via its role in health decision-making (Hopkins and Kidd 1996). This explanation follows from the assumption that education increases the efficiency of production of health (Grossman 1972). In short, those who are better educated may not only have greater knowledge and understanding of health information, but are also capable of making better health-

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[4] This is supported by the theory of household production as noted by Becker, G. (1965). "A Theory of the Allocation of Time." The Economic Journal **Vol. LXXV**(No. 299): 493-517., who recognises "that time use is affected by financial resource, and thus that the extent to which a time constraint bind is in the end an increasing function of the opportunity cost of time of an individual and other members of his/her household. The explicit prediction…is that otherwise identical people who's income are greater will feel more rushed for time " (Hamermesh 2004). This hypothesis is empirically supported by Hamermesh (2004), they find that those with higher incomes are more stressed for time, and conclude that "people with a higher value of time are more stressed for time, not only because they may work more, but because the command that they possess over goods makes them busy spending their incomes" Hamermesh, D. (2004). "Subjective Outcomes in Economics." Southern Economic Journal **Vol. 71**..

related decisions or formulating better mixtures of health inputs, of which insurance might be one. This might be one explanation as to why education is an important correlate of good health (Grossman 1999). Hopkins and Kidd (1996) and Van Praag (1981) both identify education and income as variables that impact on material well-being. Indeed those with higher education are also associated with being more future orientated. Becker and Mulligan (1997) argue causality between schooling and time-preference, that is, schooling causes time-preference for the future to rise. As such education fosters higher future time preference among individuals and by inducing investments that lower the rate of time preference for the present (in this case, private health insurance), they may potentially improve their future health. This leads to an expectation that those with a higher future time-preference may forgo income now in favour of better quality and faster access to health services (in the private sector) in the future.

Age and family characteristics, are also associated with material well-being through their impact on both 'stock of wealth'. Age may act as an important determinant of propensity to insure not only because it is a variable associated with high indirect risk vulnerability and thus increased expected medical consumption but also because it is also associated with increased stock of wealth. Stock of wealth generally increases as individuals/families get older and as both Van De Ven (1981) and Hopkins and Kidd (1996) note younger individuals and families are generally less well off. Specific family characteristics, relating to both family size and makeup, may influence medical need and material welfare. The composition of the family unit may impact on the decision makers attitude to risk (Hopkins and Kidd 1996)- for example, presence of a spouse/and or children may make an individual less likely to assume risk. In addition,

it also noted by Propper (1989) (Propper 1989) and Ngui et al (Ngui and Burrows 1990) that the "health of one family member may affect the utility of other family members", leading them to conclude that family composition may be a determinant of the decision to insure. On the other hand the presence of more family members, particularly dependents, may lead to a lower family wealth stock and hence lower the propensity to insure. In empirical literature marital status tends to be positively associated and dependent children negatively associated with the propensity to insure (Propper 1989; Hopkins and Kidd 1996; Harmon and Nolan 2001).

3. Overview of Irish health and health insurance system

The Irish health care system is an amalgam of public and private provision and financing. Its characterisation as a tax financed, universal public health system is somewhat misleading as it deviates from this model in a number of important ways. For those who qualify for a means-tested 'medical card', approximately 30% of the population, general practitioner services, public out and inpatient hospital services, and prescribed medication are all provided free of charge. For the remainder of the population, GP services are charged to the user on a fee-per-visit basis, public out and inpatient hospital services are heavily subsidised by the state and provided at a nominal user fee. Prescribed medication is paid for by the user up to a maximum monthly amount, the excess is then paid for by the state. Another distinctive feature of the Irish health system is the high proportion of the population with private health insurance, this despite the existence of a primarily tax-financed, universal public alternative.

The private health insurance system in Ireland was established in 1957, provided by a state-backed, non-profit, monopoly insurer, VHI, it was designed to cater for the

top 15% of earners who, at the time, were excluded from an entitlement to free or subsidised public health services. In 1987 nominal charges for outpatient and inpatient hospital care were introduced by the state, this was followed in the early 1990's with an extension of public healthcare entitlement to the whole population. Since its inception private health insurance in Ireland has operated under community rating. Income tax relief on premia has also been a significant feature of the system; however tax relief previously paid at the top-rate tax rate paid was reduced to the standard tax rate in the mid 1990's. Under the 1994 Health Insurance Act (Nolan & Wiley, 2000) the insurance market was opened to competition, however community rating was retained and in addition, risk equalisation was provided for. While it theoretically came into effect in January 2003, this has been postponed and continues to be an issue of contention between the two main insurers, VHI and BUPA, and the government. In 1996 BUPA entered the market and more recently, in 2004, a newly formed health insurance company, Vivas. VHI, however, retains a significant market share, 82% to BUPA's 13% (HIA 2003).With its origins to offer hospital cover to those not entitled to public care, private health insurance has mainly developed to provide cover for acute hospital care and typically covers all or most inpatient hospital expenses. Private outpatient hospital appointments are paid by the user on a pay-per-visit basis, as are GP services. There remains a high deductible on both these services; therefore insurance makes a negligible, if any, financial contribution to them. [5] In short, private health insurance cover in Ireland is synonymous with acute hospital inpatient care; cover rarely extends

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[5] Recently both insurers have begun to offer policies that make some contribution to GP, outpatient and other primary care costs but their impact on the market thus far has been negligible. Also it is important to note that our data set precedes the availability of this type of insurance policy.

beyond the costs associated with an acute hospital stay. Although the Irish health insurance system is one originally designed to cater for a small proportion of the population, there has been a steady and substantial rise in the numbers privately insured since the 1950's and currently close to 50% of the population are insured.

This relatively high demand for private health insurance is perhaps not altogether surprising given that Irish health policy actively supports the private health sector in a number of ways. It is government policy to continue to facilitate arrangements for private healthcare as the cost would otherwise fall on the state (Department of Health and Children 1999) A central tenet of the argument supporting this policy is not just the cost-saving to the public system when patients seek treatment in the private sector (thereby forgoing their public entitlements and in theory, freeing up of resources in the public sector for those that remain) but also the transfer of direct revenue to the public system from the private (via insurance payments, for example). However there is no research assessing the scale of these purported benefits to the public system (Nolan 2004). It is clear that private health insurance in Ireland is provided at below the true economic cost (Department of Health and Children 1999) and in turn, insurance companies are not charged the full economic cost for private patients in public hospitals.[6] In addition to this there are a number of other more indirect ways in which the public system supports the private sector; via tax relief on insurance purchase at 20%, tax breaks for private hospitals, a 20:80 public-private bed designation which is not strictly adhered to[7], a consultant contract which does not

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[6] Although attempt to measure the extent of cross-subsidy in monetary terms has been under taken by Nolan and Wiley (2001), this work concentrates mainly on areas of direct subsidy e.g. the difference between what the actual hotel cost of a private patient and that charged to the insurer.
[7] Nolan & Wiley (2001) note while there is 'substantial crossover of private patients to public beds' the flow in the opposite direction is much smaller.

specify the extent of time to public patients[8] plus reimbursement rules that favour the private patient.[9] Furthermore, no fees are charged for use of public hospital equipment & premises when treating private patients. Finally, more generally acknowledged problems with private medicine are also recognised. The public system absorbs cost of professional training, public hospital development & indeed, accident and emergency costs. Hence there seems to exist a sizeable resource transfer from public to private

4. Data & Preliminary Statistics

In exploring the demand for private health insurance in Ireland the Living in Ireland Survey 1994-2001 is used. This is the first to eighth wave of the Irish version of the European Community Household Panel (ECHP). As this is a household panel individuals from the same household could not be considered independent. Therefore we use a subset of the sample and focus on the household reference person (HRP) as identified by the survey[10]. Detailed information categorising individuals by insurance source is available. However following Besley et al (1999), who argue that provided individuals face the same costs in purchasing insurance, either out of pocket or lower wages, it is considered legitimate not to differentiate between them (Besley, Hall et al. 1999). The econometric analysis requires consecutive observations for the inclusion of lagged insurance and a common date of entry (to the panel) for initial conditions. Hence the panel is unbalanced with absorbing attrition. That is, individuals remain in the

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[8] While the 'type-2 consultant contract' designates a 33-hour week to the public sector, it does not specify the *extent* of their time commitment to public patients. In practice, public patients are typically left to be tended to by non-consultant hospital doctors (the salary of whom is also paid by from public health sector finances), facilitating specialists with this type of contract to concentrate on their private patients. The Health Service Executive however has recently deemed this type two contract untenable in the future.

[9] In addition to this, the manner of consultant reimbursement aids the preferential treatment of privately financed patients. Although salaried for public, specialists are paid on a fee per visit for private. As observed by Street and Duckett (1996) "public health systems have done little to alter the underlying incentives whereby those with the greatest control over the conditions of supply are rewarded rather than penalised for maintaining waiting lists".

[10] An alternative approach might be to examine the insurance decision in the context of the family unit as suggested by Propper (1989)

sample at subsequent waves until they have missing information on insurance status or are not interviewed at particular wave, and drop out due to attrition, individuals may exit the sample but no new individuals are added and individuals with missing data in 1994 are excluded.

An examination of the characteristics of those in our sample with and without private health insurance provides some interesting insights[11]. There exists a clear disparity with respect to percentage insured across both educational and income levels, suggesting that the selection into insurance by both those with higher incomes and better education is substantial. Only 20% of those with primary education have private health insurance, while 86% of those who completed third level are insured. Similarly, of those in the lowest income quartile only 16% were insured compared with 59% of those in the highest. This reinforces the expectation that propensity to insure is associated with both education and income.

ABOUT HERE- Table 1: percentage insured

Self-reported health status also registers a notable difference in percentage insured. Those with good health status are almost twice as likely to be insured (49%) compared with those with poor health status (23%). This does not seem to support the existence of adverse selection. Also worthy of note, those married or with partners have a higher percentage insured than those who are never married or without partners. Finally the 45-64 year old age group has the highest percentage insured.

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[11] The percentages reported here are from the HRP sample, however almost identical results are found for the full sample. See Appendix for a comparison of HRP and full sample descriptive statistics.

A comparison of variable means for both the full and HRP sample shows that the HRP sample is a little less educated, older, less likely to be either single (unmarried) or without a partner and with slightly poorer health status. In the full sample at wave 1 in 1994 40% of the initial sample were insured. The percentage insured continues to grow reaching over 48% by 2001, reflecting approximately the proportion insured in the population (Nolan and Wiley, 2001). This also reflects closely the percentage of the population insured in the sample of household representative person used here. Furthermore an examination of transitional probabilities suggests considerable persistence in the insured state. The first row (Table 3) (for both samples) shows the probability of being insured in time t conditional on being insured in t-1. While the second row represents the probability of being insured in time t conditional on being uninsured in time t-1. The results suggest that having insurance in year t-1 is a good indicator of whether you will insure in year t.

5. Statistical framework

In this section we model the decision to insure in a limited dependent variable framework. Using a binary indicator, the independent variable, I_{it}, represents the insurance state of individual *i* in time *t*, taking the value of 1 if the individual insures and 0 otherwise. As such, $I_{it} = 1(I_{it}^* > 0)$ where 1(.) is the indicator function taking a

value of unity if the expression in parenthesis is true and zero otherwise. The basic model is specified as:

$$I_{it}^{*} = \beta_{o} + \beta X_{it} + v_{it}, \qquad \text{where } i=1,2 \ldots.N, t=1,2\ldots7. \qquad (1)$$

A vector of individual and household characteristics as indicated by X_{it}. The v_{it} represents the composite error, it is composed of unobserved heterogeneity or unobserved time fixed effects a_i and the idiosyncratic error term u_{it}.

$$v_{it} = a_i + u_{it}, \qquad\qquad (2)$$

To control for individual specific unobserved effects, an unobserved effects binary response model was considered. In specifications (3) and (4) a_i represents the unobserved individual specific effect. Under random effects (3) we assume that a_i and u_{it} are normally distributed and independent of X_{it}.

$$I_{it}^{*} = \beta_{0} + \beta X_{it} + a_i + u_{it}, \qquad \text{where } i=1,2, 3\ldots.N; t=1, 2,3\ldots.N \qquad (3)$$

It is also assumed that there is no serial correlation in u_{it}. Independence between the a_i and the X_{it}, are necessary for consistent results. If the assumptions for RE hold then random effects model is the most efficient and thus the preferred estimator.

If it is assumed that the unobserved individual effects a_i are correlated with the X_{it} then a fixed effect specification is appropriate. Under the fixed effect specification correlation between the a_i and one or more of the X_{it} is assumed.

$$I_{it}^* = \beta X_{it} + a_i + u_{it}, \qquad \text{where i=1, 2,3....N; t=1, 2,3....N} \qquad (4)$$

Following from this, a Hausman test to determine random or fixed effects using logit rejects a random effects specification (3) and suggests a legitimate concern about unobserved effects. However, while a fixed effects specification would allow us control for unobserved effects correlated with the explanatory variables, there is a problem with using a fixed effects specification in this instance; it drops time invariant effects, both observed and unobserved, from the model. Thus it tells us nothing about variables that do not vary over time, many of which are variables of interest, such as education. As such, if our aim is to examine the individual and household effects, a model that tells us little about time-invariant effects is not ideal.

This prompted us to take another approach. To control for unobserved individual effects while also including explanatory variables such as education (which for the most part is not expected to change over time) we introduce a third specification (5), this takes the form of Mundlak-Chamberlain's Random Effects Model. This approach, dealing with individual effects correlated with the regressors, specifies the E ($X \mid a$) (Chamberlain 1984). A special case, associated with earlier work by (Mundlak 1978), uses the within-individual means of the regressors. If the assumption of independence between the a_i and X_{it} is violated the results will be inconsistent. We relax the

assumption that a_i is independent of the X_{it} and attempt to control for individual specific unobserved effects correlated with the X_{it} with the inclusion of $\bar{x}_i$, hence modeling the dependence between the a_i and X_{it}. Typically this has taken the form of a vector of time means of time-varying variables, the assumption being that the regression function of the a_i is linear in the time means of time-varying variables (Propper and Burchardt 1999; Arulampalam, Booth et al. 2000; Propper 2000). In this case we use only income as this variable is expected to do reasonably well at capturing unobserved personality traits associated with the decision to insure, like taste for quality etc.

In specification (5), $\bar{x}_i$ and a_i represent unobserved individual heterogeneity. The $\bar{x}_i$ is the part of the unobserved individual heterogeneity correlated with the X_{it} which we attempt to model and the a_i in now not correlated as in a normal random effects specification.

$$I_{it}^* = \beta_0 + \beta X_{it} + \bar{x}_i + a_i + u_{it}, \qquad \text{where i=1, 2,3....N; t=1, 2,3....N} \qquad (5)$$

While certain observable characteristics are shown to influence propensity to insure, demand for private insurance may persist for other reasons. Unobserved heterogeneity, such as attitude to risk or taste for quality, might affect demand for insurance, so might state dependence. The latter refers to a causal relationship between past and current insurance status. In short, an individual uninsured in year t-1 will behave differently in year t to an otherwise identical individual insured in year t-1. This might result from an individual changing preferences due to past experience of private insurance or as noted by Propper (2000) from the cost of information associated with changing insurance

status. Descriptive statistics give indications of very high insurance persistence. To facilitate examination of the effect of having insurance in year t-1 on propensity to insure in year t and thereby consider the effect of persistence, a dynamic random effects probit model, (including lagged dependent variable and correction term while also controlling for unobserved heterogeneity) is considered (Orme 1996; Arulampalam, Booth et al. 2000; Propper 2000). The model is specified as follows.

$$I_{it}^* = \beta_o + \beta X_{it} + \rho I_{i,t-1} + a_1 \overline{X}_i + \delta e_i + a_i + u_{it}, \text{ where i=1,2,....N; t=2,3....N} \qquad (6)$$

As before I_{it}^* represents the insurance state of individual i in time t. A vector of contemporaneous individual and household characteristics as indicated by X_{it}. The a_i represents unobserved individual heterogeneity and the idiosyncratic error term u_{it}.

$I_{i,t-1}$ is a lagged dependent variable representing the insurance state in the previous year. The $\overline{x}_i$ is mean income, the time-varying explanatory variable, of individual i over time and is included to pick-up possible correlation between the time-varying regressors and any unobservable heterogenity (following Chamberlain (1984), Mundlak (1978) and outlined in Arulampalam, Booth et al (2000), Propper (2000)), it allows us to model the dependence between the a_i and the X_{it} by assuming the regression function is linear in the means of the time varying covariates, in this case income. δe_i signifies the 'initial condition' correction term. The a_i represents unobserved individual heterogeneity; it is the individual specific and time-invariant random component.

In addition, in dynamic panel modelling, with a limited number of time periods, correlation between the a_i (unobserved heterogeneity) and the initial observation may result in inconsistent results (Hsiao 1986; Propper 2000). To correct for this a correction term is added. In the spirit of Heckman's standard selection model, a reduced form equation for the initial condition is modelled (Heckman 1981a; Heckman 1981b; Orme 1996; Arulampalam, Booth et al. 2000; Propper 2000). This process involves two main steps. Firstly an estimation of a reduced form model for initial observation I_{i1}. This includes vector z, all the explanatory variables including time varying means but also additional 'presample information' following Propper (2000), who uses the argument that parental factors may influence initial demand but not subsequent changes, we use occupation of parent main breadwinner, age and sex. η_i represents a composite error term. For a further discussion of this methodology see Booth (2000). The reduced from model is specified as follows.

$$I_{i1}^* = \lambda' z + \eta_i \qquad \text{where i=1,2,....N; t=1} \qquad (6)$$

From the reduced form equation, a generalised probit error, correction term e_i, is generated. This takes the form

$$e_i = (2y_{i1} - 1)\phi(\lambda' z_i)/(\Phi(\{2y_{i1} - 1\}\lambda' z_i) \qquad (7)$$

This is used as an additional repressor in the dynamic model to account for the correlation between the initial condition and unobserved heterogeneity.[12]

5. Results & Discussion

In exploiting the panel, the impact of certain individual and household characteristics to privately insure were examined using both a fixed effect model and the random effect probit models as described above. A test for selection bias (which works for both random and fixed effect specifications), including a lead of selection indicator, as outlined by (Verbeek and Nijman 1992) and in Wooldridge (2002) was also included. This determined that attrition was not a problem.

5.1 Fixed Effects

The fixed effect analysis while controlling for unobserved effects tells us nothing about time invariant effects. It includes only those who change their insurance status during the 8 years. That is, those who moved for 0 to 1 or 1 to 0 (1 indicating those with private health insurance, 0 indicating those without). Hence only two variables are included in the model and both remain significant. Income (log, equivalised) shows a strong positive and significant effect as does poor self assessed health status. However as fixed effects models do not produce coefficients for time fixed effects and this is not necessarily desirable for our purposes, an appropriate strategy was to use a random

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[12] The new error component a_i has Var ($a_i \mid I_{i1}$), which is heteroscedastic. However according to Orme (and following Orme (1996), Arulampalam (2000) and Propper (2000)) in cases of small values of rho there is no need to worry about inconsistent parameter estimates. The usual t-test for the initial conditions term is a test for non-zero rho.

effect specification that controls for unobserved heterogeneity. If problems of omitted variable bias can be solved within a random effects specification, this is more efficient.

ABOUT HERE- Table 4: Fixed effects model

5.2 Random Effects Model

The probit coefficients for three specifications of the random effect model are now considered. As I_{it}^* is a latent variable and inherently unobservable, it is not measured in any kind of natural units rendering the interpretation of the coefficients to assume a qualitative meaning (Jones, Rice et al. Forthcoming)**.** Thus the focus first will be on the sign, relative size and significance of the regressor coefficients. For the dynamic model we will also consider, using partial effects, the effect of the covariate on the probability of having private health insurance.

5.2.1 Static Model

The first specification (3) is a random effect probit, it is assumed that there is no correlation between the unobserved individual specific effect and the X_{it}. Consonant with the theoretical discussion, the coefficient on education, as with income is large, positive and very significant. (Income is defined here as the aggregation of net disposable income for all household members, the income variable included in this analysis is log equivalised income). The propensity of choosing private insurance seems to rise substantially with education, with a stark contrast in propensity to insure for those with no qualifications or primary to those with third-level qualifications. A similar relationship is shown to be the case with respect to income, itself a positive

correlate of education (Van De Ven and Van Praag 1981). This perhaps not unsurprising given that the opportunity cost of purchasing insurance is less for those who are better off.

Greater demand for medical services during reproductive years associates females with a higher risk vulnerability and therefore an expectation of higher propensity to insure (Hopkins and Kidd 1996). Research from the UK however finds that despite the fact that females are more likely to demand health services they are less likely to be insured (Propper and Burchardt 1999). While females are shown here to have a lower propensity to insure in this case, it is worth noting the nature of our sample and the context of our focus, which is on the household representative person. Although 50% of those insured in the population are female, there is a much higher proportion of males to females (3:1) in this sample . Females in the HRP sample have a lesser propensity to insure than their male counterparts.

In general, adverse selection is a common feature of insurance markets. Despite this in many health systems those with poor health tend to have a lower probability of being privately insured (Dorion, Jones et al. 2006). It has been suggested this result might be driven either by unobserved heterogeneity or cream skimming. However the fixed effect specification and the chamberlain random effects model (specification (4)) attempts to control for this, nonetheless in both models the coefficient on self assessed health remains negative and significant. One explanation muted in our theoretical framework is the joint impact of both community rating and the pre-existing condition clause, which in the context of the Irish insurance market might result in those with poorer health having a lower propensity to insure. Indeed the results tend to bear this

out; the analysis suggests that those with poor SAHS are less likely to be insured than those with good or very good SAHS.

Those who are single (never married) and those without partners have a lower propensity to insure than those who are or have been married and those who have partner respectively. This suggests that both the presence of a partner in a cohabiting arrangement are more likely to be insured as are those who are or have a one stage been married. The numbers of children, adults and elderly (over 65's) in the household all have a negative and significant effect on propensity to insure. Intuitively the presence of children might be expected to have a positive effect of propensity to insure, for example if parenthood increases risk adversity. However a negative coefficient for children as been found elsewhere (Hopkins and Kidd 1996; Harmon and Nolan 2001). One suggested reason for this is unlike for the adult population treatment of children tends to be more uniform between public and private sectors. The impact of dependents on both family income or stock of wealth may contribute to the latter result. Our results show that the propensity to insure increases with age, however it does take on a quadratic form that suggests a smoothing of the curve, or a slower growth, as age increases.

We have already considered the presence of unobserved effects may have rendered random effects probit coefficients inconsistent. Nonetheless they provide an interesting point of comparison with the results for other two models (Specification 5 and 6) where we attempt to control for unobserved effects using, a random effects specification, the Mundlak-Chamberlains Random Effects Model and finally for state dependence via for the inclusion of a lagged dependent variable.

5.2.2 Mundlak-Chamberlain Model

It is found that coefficients specifically on education and income, particularly large using specification (3), are sizeably reduced when unobserved effects (5) and then state dependence are controlled for (6).

Focusing first on specification (5), Chamberlains random effects model, a time mean of income is assumed to capture any individual unobserved effect associated with the explanatory variables. By definition is it assumed that these unobserved effects are associated with income. Such unobserved effects might include taste for quality, risk adversity or stock of wealth. Controlling thus for unobserved individual specific effects, the coefficients on many covariates, while remaining significant, are smaller in size. This is particularly true of the variable for income, but not unsurprising given that introduction of the time mean for income. There are two possible interpretations; the Mundlak-Chamberlain interpretation views this variable as presenting unobserved individual effects leaving the coefficient on income to represent that true income effect when unobserved effects are controlled for. However another interpretation would be to view the time mean as a permanent or long run income effect, with the coefficient on the income variable as the effect of a transitory income shock or current income. The aim here is to specifically to control for unobserved heterogeneity and thus we will veer toward the Mundlak-Chamberlain interpretation. However in interpreting the true effect of income, some acknowledgement that longer income effects, viewed as stock of wealth perhaps, are captured by the time mean along with other unobserved effects. Although the size of the coefficient on income has halved compared to the random effect specification (3), the effect of 'current' income is both positive and significant. The coefficient of time mean representing 'unobserved effects' is very large, positive

and significant, suggesting that unobserved individual heterogeneity is an important determinant of propensity to insure. Precisely what unobserved effects might be driving this result however is unknown. However the main focus here is not the time mean variable itself but to what extent the other regressors remain robust to its inclusion.

Education remains robust to the inclusion of unobserved effects. While there is some reduction in the overall size of the coefficients, the effect remains large across all levels of education; third-level education remains the strongest determinant of propensity to insure across education levels and across the covariates.

The size, sign and significance of the coefficient on health status remain more or less equal to that of the previous specification, with only very small reduction in coefficient size. Those who have poor health status have a lower propensity to insure to those with good health status. Combined with the fixed effects specification, this result seems to provide rather strong evidence that individual unobserved heterogeneity is not driving this result. Somewhat contrary to findings that suggest individual unobserved heterogeneity as a reason for the negative effect of health status on demand for private health insurance (Dorion, Jones et al. 2006). A more in-depth examination of the question to shed further light on this matter with respect to the Irish data would be useful, certainly the use of a better measure of health might help.   Age remains a positive and significant, while the coefficient on female remains negative, however the significance of the coefficient on the latter is weaker then is specification (1) remaining significant only at the 10% level. Those never married or no partner are still less likely to have insurance. However the coefficients on number of children and adults are now insignificant in the presence of unobserved effects, while the number of elderly, remaining significant has an even stronger negative effect**.**

5.2.3 Dynamic Model

Supported by evidence of considerable persistence from transitional probabilities examined earlier, Specification (6) includes not only the time mean of income to model the dependence between the a_i and the X_{it}, but also a lagged dependent variable (to capture state dependence) and a correction term (to correct for the initial condition problem). We also report marginal effects.

Despite controlling for both unobserved effects and state dependence, with the inclusion of a lagged dependence variable, the effect of education is still large and significant. This suggests that over and above having insurance last year (year t-1), education matters and significantly so. The probability of being privately insured increases substantially with levels of education. The marginal effects of education level report a stark contrast between those who have primary or no qualifications to those with third-level qualifications. Compared with those who have primary or no qualifications the probability of having primary insurance increases by 16% for those with lower second level or junior cert qualifications, 29% for those with upper second or leaving cert qualifications and finally by 43% for those with third level. This is a substantial increase in probability to insure given educational attainment.

Indeed of those who were not insured last year, the better educated are more likely to insure this year. Similarly, for those who were insured, the better educated are most likely to retain it. It also is interesting to note, despite the strong persistence effect, which we will discuss shortly, education still matters. Given that we control for other socio-economic and family characteristics such as income, this might be explained by a number of possibilities. For example, the higher educated may formulate a better

mixture of health-generating inputs, of which insurance might be one (Grossman, 1972). They might also have preferences for higher quality healthcare, which is perceived as a benefit of insurance. Similarly there may be some unobserved effect relating to education, but not to income, influencing the result[13].

Current income is also positive and significant. Those with high current income have a higher propensity to insure. An 11% increase in the probability of having private health insurance is reported if current income is doubled. While this indicative of an income-gradient with respect to probability to insure, it also suggests that an immediate short-term increase in income would not result in substantial increases in demand for private health insurance. However we must qualify this latter statement and the seemingly modest result by acknowledging that unobserved effects variable, the time mean for income, might include longer-term income effects. If interpreted in this way the income effect rises sharply with a 42% increase in insuring. Finally, while a positive and significant effect of income on propensity to insure is not unexpected, some argument has been made to support the hypothesis that high-income families are more likely to assume risk and not insure because if necessary they can afford out-of-pocket payments for private health services. The positive and significant coefficient does not lend itself to this explanation.

In line with the findings of Harmon and Nolan (2001) who do not find significant self-selection of those with poor health into insurance, the effect of poor health status on propensity to insure remains both negative and significant. Those with

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[13] Another explanation might be the influence of some employment effect. Although the numbers with employer-bought insurance is small, employer-bought health insurance is associated with employment requiring higher levels of education

poor health have a 10% less probability of being insured than those with good health.[14] This coefficient is not really affected by the inclusion of the lag and perhaps not unexpectedly. Overall the results show that those with poor health status are less likely to insure than those with good health status. However when we focus specifically on those with poor health, those with no insurance in t-1 are much less likely to be insured that those insured in year t-1. This is suggestive that insurance status in year t-1 affects whether those who have poor health status in year t are insured or not. This may be explained by the insurance state changing preferences or a high cost for changing status, in the context of the Irish system there exists a six-month waiting time for all conditions and a five-year wait for preexisting conditions if you drop out and then decide to re-insure at a later date.

Finally, given that we might expect the utility of insurance for those with poor health to be higher; those with poor health are still less likely to retain insurance than those with good health. Indeed, as already mentioned, insurance is primarily used in the acute hospital sector, so those who are insured typically have no costs for an inpatient care. This suggests for some, given their specific health condition, there is no benefit or utility in remaining insured. This might pertain to those with chronic illness who primarily require care non-acute/outpatient care. Furthermore if the treatment for their poor health in the public sector equates to that in the private sector then there is perhaps no utility for being insured. In addition, although tax relief is granted on the grounds that it enables the chronically ill to avail of private health insurance at a reasonable cost, those with poor health status are shown to have lower probability of being private insured than those with good or very good health. From the perspective of the insurance

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[14] A further exploration of this counter-intuitive result and the exact nature of this relationship would require better indicators of health than a subjective health measure.

company the rules of provision work well and seem to guard adequately against adverse selection.

The coefficient for the lagged dependent variable representing state dependence is very large, positive and significant indicating a strong persistence effect. Indeed the marginal effect of private insurance in t-1 shows a very strong persistence effect, those who had insurance last year, holding everything else equal, are 67% more likely to insure this year. A high degree of persistence reveals that once insured those with private insurance tend to keep it. What is clear also it that an individual uninsured in year t-1 will behave differently in year t to an otherwise identical individual insured in year t-1. Thus the state of insurance in year t-1 influences your state in t. Again this might be due to past experience of insurance creating a change of preference, the cost of information associated with changing preference or the cost of changing from insurance to no insurance, which in Ireland takes the form of loss of a six month 'entry' wait or a five year wait for pre-existing conditions (Propper 2000).

Although the size of the coefficient is large, with transitional probabilities (Table 3) above 90% we might have expected an even greater effect. One explanation might be for those with certain characteristics in the population of household representatives, the better educated, wealthier, healthier and insured last year have an extremely high probability of being insured in year t. In short these characteristics are almost fully predictive of the insured state. On the other hand while insurance in t-1 is highly predictive of insurance in year t, the fact remains that that those insured in t-1 with the lowest education, lower income and poor health status are much less likely to be insured in t, than their better-off counterparts. On another note, this high degree of persistence may also have some policy uses. For example a short-term incentive to

entice adults under 30 into the insurance market may be quite effective. Recent worries regarding the age profile of the insurance pool has led to a proposal of a small change in the rules of provision; those who insure after 30 will be charged an extra 2% levy per year. What the result here shows that if the non-insured can be enticed to purchase private insurance the probability of them retaining it in the future is extremely large.

Overall the positive effect of education and income and the negative effect of poor heath status remain robust across three specifications. The better educated, higher income and healthier have a higher propensity to insure. What is clear also is that there is a high degree of persistence.

6. Conclusions

In this paper we show that the insured are better educated, wealthier and healthier than the uninsured. This in itself is not necessarily peculiar. However in the Irish context it poses some particular issues for the policymaker. Much of private medicine is carried out within the public hospital sector and is perceived to be of a higher quality[15]. There are potentially large direct and indirect subsidies from public finances in support of private health insurance and the private health sector. These subsidies are justified on the grounds that insurance is, thus, both generally affordable and aids those such as the chronically ill in insurance take-up. However policy aimed at promoting insurance take-up (through incentives such as community rating and cross-subsidization), as a way in

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[15] The private sector is perceived as having a higher quality than that offered by the public sector (with waiting times to specialist supportive of this) (Watson, D. and J. Williams (2001). "Perceptions of the Quality of Health Care in the Public and Private Sectors in Ireland: Report to the Centre for Insurance Studies Graduate Business School, UCD." Books and Monographs Series, ESRI No. 163.

which to deliver quality healthcare, needs to address that it is primarily successful at encouraging those at the higher ends of the education and income distributions, and those with better health to insure.

In moving toward a dynamic specification we show that persistence is a highly significant determinant of demand for private health insurance and also that it reduces the size of the coefficients on the regressors. The latter point highlights that while education, income and, to a lesser extent, health status have very large effects on probability of insuring, these effects are overestimated where no attempt is made to control for unobserved heterogeneity or state dependence. From an insurance provider perspective this high degree of persistence might have some policy uses. Recent worries regarding the age profile of the insurance pool has prompted attempts to exact a small change in the rules of provision, which would result in those who insure after 30 to be charged an extra 2% levy per year on premia. What our results suggests is that if the non-insured can be enticed to purchase private insurance the probability of them retaining it in the future is extremely large (this again might be due to a change in preferences or the costs associated with changing status i.e. cost of information or waiting). As such, a short-term incentive to entice adults under 30 into the insurance market may be quite effective.

A lower probability of having insurance for those with poor health suggests that adverse selection is not a problem. This despite the fact that the system is community rated. For insurance companies this is good news and suggests that a pre-existing condition criteria design to combat the problem is working well. For the uninsured however specifically those with poor health or a chronic condition this is more worrisome. Some cross-subsidies from public to private, such as tax-relief on insurance

premia, have been justified on the grounds that they aid those with chronic illness purchase insurance. What it does in fact do is lower the price of insurance to the insured, using taxpayer revenue that everyone pays, including many of those uninsured with ill health. It could be argued that government policy thus facilitates targeting. In short, in so much as it can under a community rated system, it reinforces the insurer preference, and thus works in the interest of the insurance company.

In this system, with stated equity goals, the close intertwining of the public and private sector, the problematic nature of the dual waiting lists system, the perceived quality differences in the public and private sector coupled with an insurance system that seems to encourage a certain profile of insured, policy might be viewed as contributing to inequities to access and quality of care.

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Table 1: Percentage insured

	Full Sample			HRP Sample		
	% Insured	% Not Insured	N	% Insured	% Not Insured	N
Overall	43	57	44,886	43	57	20,666
Primary	20	80	15,911	20	80	9,452
Lower Second	40	60	10,301	44	56	4,419
Upper Second	57	43	12,231	64	36	3,751
Third level	79	21	6,113	86	14	2,982
Female	43	57	22,717	32	68	5,064
Male	43	57	22,169	54	46	15,602
Single (never married)	33	67	12,747	30	70	2,994
Married	47	53	32,139	45	55	17,672
No partner	31	69	16,388	26	74	6,275
Partner	50	50	28,477	50	50	14,378
Income 25	18	82	11,204	16	84	4,974
Income 50	38	61	11,205	40	60	4,624
Income 75	54	46	11,209	51	49	5,345
Income 100	60	40	11,203	59	41	5,701
Age 17-29	37	63	9,549	35	65	1,243
Age 30-44	47	53	12,451	48	52	5,761
Age 45-64	51	49	14,857	49	51	8,104
Age 65 +	29	71	8,029	29	71	5,558
Poor Health	26	74	8,794	23	77	4,921
Good Health	47	53	36,017	49	51	15,713
Chronic condition	30	70	9,099	23	72	4,976
No chronic	46	54	35,526	47	53	15,593

*HRP; Household Representative Person

Table 2: Variable means

Sample	FULL	HRP
N	44886	20666
Have insurance	0.43	0.43
Lower second	0.23	0.21
Upper second	0.27	0.18
Third level	0.14	0.14
Age	46	53
Female	0.51	0.25
Single	0.28	0.14
No partner	0.37	0.30
Children	0.96	0.92
Adults	2.59	2.08
Elderly	0.38	0.40
Income (equiv)	223	234
Poor SAH	0.20	0.24
Chronic	0.20	0.24

Table 3: Transitional Probabilities

Wave	1 1994	2 1995	3 1996	4 1997	5 1998	6 1999	7 2000	8 2001
Percent insured								
Full	39.9	40.8	42.5	42.4	44.1	46.0	46.6	48.3
HRP	40.6	41.0	42.2	42.0	43.3	45.2	45.2	47.0
Conditional Probabilities								
Full								
Prob(Yt=1/Yt-1=1)		91.2	92.8	91.9	94.0	94.0	94.1	96.5
Prob(Yt=1/Yt-1=0)		6.38	6.81	6.17	6.94	7.81	6.36	6.39
HRP								
Prob(Yt=1/Yt-1=1)		92.6	93.7	93.2	95.0	94.9	94.5	94.5
Prob(Yt=1/Yt-1=0)		5.3	6.0	5.2	6.2	7.0	5.0	5.0
Sample size								
Full (44886)	9880	7861	6487	5595	4909	4121	3225	2808
HRP (20666)	3922	3370	2931	2666	2436	2115	1702	1524

Table 4: Fixed Effects Logit

Insurance status	Coeff		Std. Err.
Log equiv. income	0.270	**	0.119
Poor health status	-0.400	***	0.150
Time Dummies	YES		
log likelihood = -1237.8336			
Number of obs = 3564			

Table 5: Random Effects Probit

	Static (3)		Chamberlain (5)		Dynamic (6)	
Insurance status	Coeff.	Std. Err	Coeff.	Std. Err	Coeff.	Std. Err
lower second	0.87 ***	0.08	0.72 ***	0.08	0.42 ***	0.06
Upper second	2.00 ***	0.10	1.60 ***	0.10	0.76 ***	0.07
Thirdlevel	3.21 ***	0.13	2.46 ***	0.13	1.15 ***	0.10
Age	0.22 ***	0.02	0.25 ***	0.02	-	-
Age squared	0.00 ***	0.00	0.00 ***	0.00	-	-
Female	-0.38 ***	0.11	-0.27 **	0.12	-	-
Single	-0.45 ***	0.14	-0.48 ***	0.14	-0.24 **	0.10
Nopartner	-0.79 ***	0.13	-0.67 ***	0.13	-0.51 ***	0.08
No. of children	-0.09 ***	0.03	0.02	0.03	0.00	0.02
No. of adults	-0.09 ***	0.03	-0.01	0.03	0.06 **	0.02
No. of elderly	-0.89 ***	0.09	-1.01 ***	0.09	-0.77 ***	0.06
Log equiv. income	1.07 ***	0.06	0.38 ***	0.06	0.29 ***	0.07
Poor health status	-0.41 ***	0.06	-0.36 ***	0.06	-0.26 ***	0.06
Private t-1	-	-	-	-	1.96 ***	0.06
correction	-	-	-	-	0.83 ***	0.05
Time mean	-	-	2.57 ***	0.11	1.10 ***	0.10
Time Dummies	YES		YES		YES	
Regions	YES		YES		YES	
_cons	-11.25 ***	0.54	-21.52	0.71	-8.24 ***	0.41
Log likelihood	-5623.5		-5331.3		-2603.5	
Number of obs	20513		20513		14322	
rho	0.8173		0.8164		0.277	

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level