GP Reimbursement And Visiting Behaviour In Ireland

David Madden, Anne Nolan• and Brian Nolan

Working Paper No. 9

Subsequently published in D. Madden, A. Nolan, B. Nolan (2005). GP Reimbursement and Visiting Behaviour in Ireland (with David Madden and Brian Nolan). Health Economics, Vol. 14, No. 10, pp. 1047-1060.

Research Programme on "Health Services, Health Inequalities and Health and Social Gain"

This programme is supported by the Health Research Board, and is being carried out by researchers at the Economic and Social Research Institute (ESRI), University College Dublin and the University of Ulster.

• **Working Papers are not for publication and should not be quoted without the prior permission of the author(s)**

Correspondence to: Anne Nolan, Economic and Social Research Institute, 4 Burlington Road, Dublin 4, Ireland. Tel: + 353 1 667 1525; Fax: + 353 1 668 6231; Email: anne.nolan@esri.ie

SUMMARY

In Ireland, approximately 30 per cent of the population ("medical cardholders") receive free GP services while the remainder ("non-medical cardholders") must pay for each visit. In 1989, the manner in which GPs were reimbursed by the State for their medical cardholder patients was changed from fee-for-service to capitation while other patients continued to pay on a fee-for-service basis. Concerns about supplier-induced demand were in part responsible for this policy change. The purpose of this paper is to examine the extent to which the utilisation of GP services is influenced by the reimbursement system facing GPs, by comparing visiting rates for the two groups before and after this change. Using a difference-in-differences approach on pooled micro-data from 1987, 1995 and 2000, we find that medical card eligibility exerts a consistently positive and significant effect on the utilisation of GP services. However, the differential in visiting rates between medical cardholders and others did not narrow between 1987 and 1995 or 2000, as might have been anticipated if supplier-induced demand played a major role prior to the change in reimbursement system.

KEY WORDS: GP Utilisation; Reimbursement; Supplier-Induced Demand; Difference-in-Differences

ACKNOWLEDGEMENTS

This research forms part of the research programme "*The Provision and Use of Health Services, Health Inequalities, and Health and Social Gain*" funded by the Health Research Board and undertaken by researchers from the Economic and Social Research Institute, University College Dublin and the University of Ulster. The authors would like to thank two anonymous referees, Arnaud Chevalier, and participants at the Twelfth European Workshop on Econometrics and Health Economics for helpful comments on an earlier version of the paper.

"GP REIMBURSEMENT AND VISITING BEHAVIOUR IN IRELAND"

1. INTRODUCTION

One of the most important relationships in health economics is that between the patient and the primary care physician or GP (general practitioner). As a result of asymmetric information between the GP and patient, an agency relationship develops where the GP acts as an agent for the patient in terms of decisions about health care. The extent to which the GP will act as a "perfect" agent (in the sense that his decision is precisely that which the patient himself would choose if he had the same knowledge as the GP) may be affected by the financial incentives facing the GP, including most obviously their reimbursement system.[1]

Perhaps the most celebrated example of self-interest on behalf of the GP is the phenomenon known as "supplier-induced-demand" (SID) whereby the GP is able to influence the demand for their service by shifting the demand curve to the right. For example, suppose the GP has a "target" level of income which he wishes to achieve each month and suppose there is an exogenous increase in the number of GPs in his locality. The rightward shift of the supply curve of GPs will lead to an increase in the use of GP services (summarised say by the number of visits to a GP). Assuming that the demand for visits is inelastic, the total amount spent on visits will fall and since there has been an increase in the number of GPs and a fall in total GP income, income per GP must fall. Via the agency relationship however (whereby for example repeat visits by patients are likely to be heavily influenced by the advice of the GP) GPs may be able to induce a rightward shift of the demand curve in an attempt to offset the decline in GP income.

Previous research on SID has tended to concentrate on the identification of SID in this context, i.e., examining the relationship between physician density and utilisation. Like Rossiter and Wilensky [2], Tussing [1,3] had the advantage of utilisation data that could distinguish between physician-initiated and patient-initiated visits. He asked patients attending GPs whether the present consultation was their own or the GP's idea and in addition, whether the visit led to a future return visit being arranged. He found that GP-initiated and return visits were correlated with GP density in the direction predicted by SID. He also found that such visits were lower in areas where there was a higher proportion of patients with free GP care. He concludes that since GP utilisation is higher amongst such patients there is less need for compensatory induced demand. Tussing's approach has been criticised (see Sørensen and Grytten [4]) on the basis that he did not control sufficiently for the underlying health of the population. Thus if there is a higher incidence of underlying health problems in those areas with the highest physician density then a positive correlation may be observed between density and utilisation, even though no inducement is taking place.[2] Despite numerous studies analysing SID in this context, evidence in favour of SID has been mixed. In a sequence of papers examining SID in the Norwegian health system, Carlsen and Grytten [5], Grytten *et al*. [6], Grytten *et al*. [7] and Grytten and Sørensen [8] found no significant effect of physician density on the utilisation of physician services, with the exception of some limited evidence regarding laboratory tests in the 1995 paper. However, Birch [9], Cromwell and Mitchell [10] and Rossiter and Wilensky [2] all find some evidence for SID in the context of dental visits in the UK, surgery rates in the US and physician-initiated medical expenditures in the US respectively.

The patient's degree of access to free medical services and the method by which physicians are reimbursed for the services they provide may also influence the degree to which physicians engage in self-interested behaviour. Rossiter and Wilensky [2] find that physician-initiated expenditures on both total, and ambulatory care, medical services in the US are significantly greater for patients with public (Medicaid or Medicare) and/or private medical insurance. While in this case, the method of reimbursement does not differ across patients or across areas, if demand inducement incurs a cost to the doctor in terms of the effort involved in convincing the patient that a return visit is warranted, the degree to which patients differ in their degree of coverage for free medical services also influences the financial incentives towards demand inducement. Grytten and Sørensen

[8] examine demand inducement in the context of the Norwegian system of GP care where the two groups of GPs differ in the incentives for inducement. Approximately 75 per cent of Norwegian GPs are contract GPs and receive a fixed fee-for-service payment from their local municipality for every visit and for any additional laboratory tests that they provide. The remaining 25 per cent of GPs receive a fixed salary. However, they find no significant difference in the mean number of laboratory tests between contract and salaried doctors or in the proportion of visits lasting longer than twenty minutes (for which contract doctors receive additional payments over an above their fixed fee).

While clear-cut evidence of SID as outlined above has been difficult to obtain there is nevertheless plenty of evidence that physicians in general (and not just GPs) do respond to financial incentives. Croxson *et al*. [11] show how GPs in the UK responded to the introduction of the GP fundholder scheme. The nature of the scheme gave GPs a financial incentive to increase hospital-based activity prior to entry to the scheme, which is precisely what Croxson *et al*. [11] found to be the case, even after allowing for selection into the fundholding scheme. Developing the same theme, Dusheiko *et al*. [12] show how GPs in the UK responded to the financial incentives offered by the abolition of the fundholding scheme; once again behaviour was in the direction indicated by the financial incentive.

Ireland provides a valuable test-case in this context, because a change in the basis on which GPs were reimbursed affecting only part of the population allows the impact of financial incentives on visiting to be investigated. Since 1989, GPs face differing reimbursement methods depending on whether their patients are eligible for free GP services or are paying for their own care. In Ireland, individuals below an income threshold, termed “medical cardholders”, are entitled to free GP consultations while the remainder of the population must pay the full cost of each consultation.[3] In 2001, 28 per cent of the adult population held a medical card (Central Statistics Office [14]). GPs in

Ireland are self-employed practitioners. Approximately two-thirds of GPs enter into contract with the State to provide services to medical cardholders. Individuals who are eligible for a medical card then choose a GP, and GPs must treat their medical card patients the same as their non-medical card patients in terms of access to surgery hours *etc*. Prior to 1989, GPs were reimbursed on a fee-per-service basis for both medical cardholder and non-medical cardholder patients, by the State and the patient respectively. In part in response to evidence in favour of demand inducement presented by Tussing [3], the reimbursement system for medical cardholder patients was changed from fee-for-service to capitation in 1989. As outlined in the simple model in Section 2, this exogenous change in reimbursement method in relation to medical cardholder patients led to a clear change in the financial incentives facing GPs, and provides a natural experiment whereby we can investigate the extent to which they responded to such a change.[4]

Using micro-data from large-scale household surveys from 1987, 1995 and 2000, a difference-in-differences approach is employed to analyse the extent to which the utilisation of GP services was influenced by the change in reimbursement in 1989. Section 2 outlines a simple model of GP behaviour illustrating how GPs might respond to the financial incentives implied by such a change in reimbursement regime. It also describes the difference-in-differences methodology, which we use to examine the effects of the change in reimbursement. In section 3 we discuss our data and variables, while in Section 4 the econometric approaches are briefly outlined. Section 5 presents empirical results and Section 6 summarises and concludes.

2. THEORETICAL MODEL

In empirical studies of the role of financial incentives in this context, the underlying structural model is most often implicit rather than spelt out. In this section we sketch out a model which brings out some of the core elements involved. It is necessarily simple and leaves out a range of potentially important factors – such as health insurance, differences in preferences between income groups, and rising expectations – some of which we incorporate into our subsequent econometric analysis. None the less, it is of interest in itself and helps to provide an illustrative framework within which that analysis can be seen.

Suppose that GPs face two types of patients, medical cardholder patients and non-medical cardholders patients. We assume that initially the reimbursement system is fee-for-service, but in the case of medical cardholder patients that this fee is paid by the state. We also assume that the patient initiates the initial visit to a GP; GPs can only influence (induce) subsequent visits. We assume a very simple utility function for GPs, which includes their gross revenue less the cost of effort (of carrying out a consultation). For convenience of exposition we separate utility from treating medical cardholder (public) patients and from treating non-medical cardholder (private) patients. Utility from treating medical cardholder patients is given by the revenue from visits initiated by the patient, $p\overline{Q}_{PUB}$, and revenue initiated by induced visits, pQ_{PUB}^{ind}. We assume that the number of visits initiated by the patient depends upon their underlying health, *H*, and a taste parameter, α. Thus we have:

$$U_{PUB} = p_{PUB}.\overline{Q}_{PUB}(H_{PUB}, \alpha_{PUB}) + p_{PUB}Q_{PUB}^{ind} - e(\overline{Q}_{PUB} + Q_{PUB}^{ind}) \qquad (1)$$

Utility from treating non-medical cardholder patients is likewise given by:

$$U_{PRIV} = p_{PRIV}.\overline{Q}_{PRIV}(H_{PRIV}, \alpha_{PRIV}) + p_{PRIV}Q_{PRIV}^{ind} - e(\overline{Q}_{PRIV} + Q_{PRIV}^{ind}) \qquad (2)$$

We make the crucial assumption that the marginal cost in terms of effort of inducing an extra visit from a non-medical cardholder patient is at least as great as it is from a medical cardholder patient i.e., $e'(Q_{PRIV}^{ind}) \geq e'(Q_{PUB}^{ind})$. This is because the medical cardholder patient will not have to meet the cost of the induced visit whereas the non-medical cardholder patient will. Thus either the GP will have to spend extra effort in trying to persuade the non-medical cardholder patient that a return visit is warranted, or the GP may have to charge a reduced fee. We also assume that the $e(.)$ function is convex i.e., $e'(.) \geq 0$. This is necessary in order to obtain an internal solution.

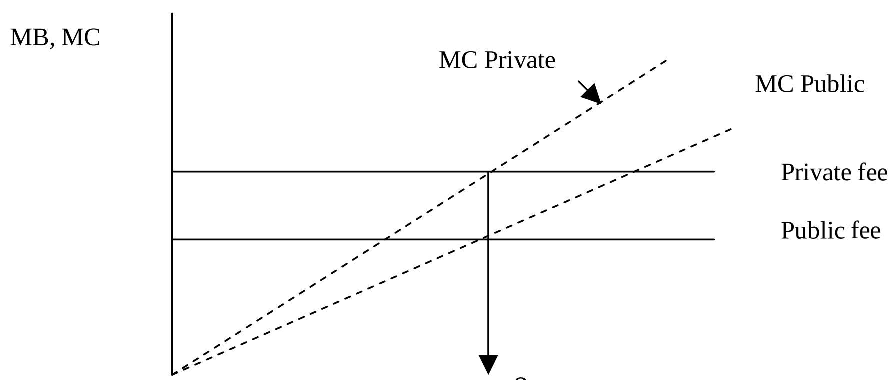
We also assume that the fee charged for a medical cardholder patient is less than that obtained for a non-medical cardholder patient i.e., $p_{PUB} < p_{PRIV}$. This is consistent with evidence presented in Tussing [1]. Assume also for the moment that the only choice variable open to the GP is the amount of induced visits. Thus the GP is assumed to have no influence upon patient-initiated visits nor upon the fee charged. (The assumption that GPs are price takers is certainly true for medical cardholder patients, but for patients paying out-of-pocket, an individual GP may not be able to raise the price of a visit much if others in locality do not, but GPs as a group may well be able to do so).

The first order conditions for the GP are then:

$$\frac{\partial U}{\partial Q_{MED}^{ind}} = p_{MED} - e'(Q_{MED}^{ind}) = 0 \qquad (3)$$

$$\frac{\partial U}{\partial Q_{PRIV}^{ind}} = p_{PRIV} - e'(Q_{PRIV}^{ind}) = 0 \qquad (4)$$

The first order conditions can be represented diagrammatically below:



Note that the marginal cost (o $Q_{PUB}^{ind} = Q_{PRIV}^{ind} = Q^{*}$. Induced visits pward sloping; this is a consequence of the convexity of the *e*(.) function. Since fees are fixed, the marginal benefit curves are straight horizontal lines. The GP induces visits for both sets of patients; we cannot determine the precise quantity of induced non-medical cardholder and medical cardholder visits as this will depend upon the positions of the relative curves. In the diagram here an equal number of non-medical cardholder and medical cardholder visits are induced i.e., $Q_{PUB}^{ind} = Q_{PRIV}^{ind} = Q^{*}$.

Now suppose that the reform introduced in Ireland in 1989 is incorporated into the model i.e., payments for medical cardholder patients switch from a fee-for-service arrangement to a capitation system. The weighted capitation payment that GPs receive for their medical cardholder patients depends upon demographic factors such as the age and gender of the patients on their list. Crucially however, the absence of a fee-for-service for these patients removes the financial incentives for GPs to induce return visits. The utility function for medical cardholder patients now changes to:

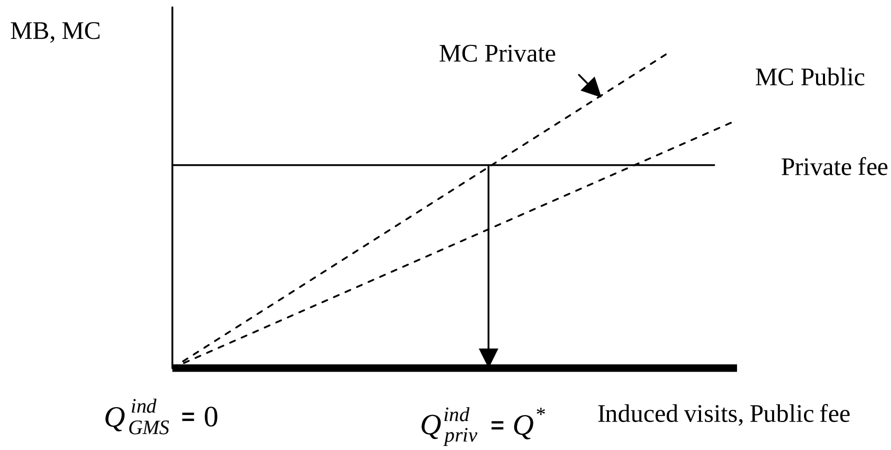
$$U_{PUB} = N_{PUB}(D_{PUB}) - e(\overline{Q}_{PUB} + Q_{PUB}^{ind}) \qquad (5)$$

where N_{PUB} refers to the number of medical cardholder patients on a GP's list and D_{PUB} refers to the underlying demographic factors influencing the weighted capitation payment.

The utility function for non-medical cardholder patients remains as before. The first order condition for medical cardholder patients now becomes:

$$\frac{\partial U}{\partial Q_{PUB}^{ind}} = -e'(Q_{PUB}^{ind}) < 0 \qquad (6)$$

This clearly indicates a corner solution and implies that GPs will induce zero visits from non-medical cardholder patients. The diagram changes to below:



The medical card fee schedule is now effectively the horizontal axis and hence the corner solution of $Q^{ind}_{PUB} = 0$ is obtained. It is possible that GPs will increase their private fees to offset this loss in income and in turn they may induce extra visits by non-medical cardholder patients. The effect on overall induced visits would then be ambiguous.

What will be the overall effect on total utilisation by medical cardholder and non-medical cardholder patients before and after the reform? Before the reform total utilisation by medical cardholder patients will be equal to induced and non-induced visits i.e. $Q_{0,PUB} = \overline{Q}_{0,PUB} + Q^{ind}_{0,PUB}$ where the "0" subscript refers to the period *before* the reform. Alternatively per capita utilisation can be expressed as $q_{0,PUB} = \overline{q}_{0,PUB} + q^{ind}_{0,PUB}$ where lower-case refers to utilisation per head. Similarly total per capita utilisation for non-medical cardholder patients will be $q_{0,PRIV} = \overline{q}_{0,PRIV} + q^{ind}_{0,PRIV}$. Following the reform we now have $q_{1,PUB} = \overline{q}_{1,PUB} + q^{ind}_{1,PUB}$ and $q_{1,PRIV} = \overline{q}_{1,PRIV} + q^{ind}_{1,PRIV}$.

For medical cardholders, the difference in total utilisation before and after the reform is $(q_{0,PUB} - q_{1,PUB})$. The difference for non-medical cardholders is $(q_{0,PUB} - q_{1,PUB})$. The difference in the differences can be expressed as:

$$(q_{0,PUB} - q_{1,PUB}) - (q_{0,PRIV} - q_{1,PRIV}) \tag{7}$$

$$= \overline{q}_{0,PUB} + q_{0,PUB}^{ind} - \overline{q}_{1,PUB} - q_{1,PUB}^{ind} - \overline{q}_{0,PRIV} - q_{0,PRIV}^{ind} + \overline{q}_{1,PRIV} + q_{1,PRIV}^{ind}$$

$$= (\overline{q}_{0,PUB} - \overline{q}_{1,PUB}) - (\overline{q}_{0,PRIV} - \overline{q}_{1,PRIV}) + (q_{0,PUB}^{ind} - q_{1,PUB}^{ind}) - (q_{0,PRIV}^{ind} - q_{1,PRIV}^{ind})$$

On the basis of the model outlined above, plus a number of reasonable assumptions, it should be possible to sign the above expression. Take the first two terms on the left-hand-side of the above equation, $(\overline{q}_{0,PUB} - \overline{q}_{1,PUB})$ and $(\overline{q}_{0,PRIV} - \overline{q}_{1,PRIV})$. These terms represent the change in GP visits before and after the reform initiated by the patients themselves. If we assume what is what is known as the "common macroeconomic effect" then there should be no difference in the growth rates for patient-initiated visits for medical cardholder and non-medical cardholder patients.[5] Thus overall these terms should be zero.

Turning now to the latter two terms, $(q_{0,PUB}^{ind} - q_{1,PUB}^{ind})$ and $(q_{1,PRIV}^{ind} - q_{0,PRIV}^{ind})$, our model outlined above predicts that the first of these terms will be unambiguously positive. The change in reimbursement will drive induced visits for medical cardholder patients to zero in period 1. The model is less clear-cut regarding what will happen the second term. However, as discussed above, the strong likelihood is that it will be non-negative i.e., induced visits for non-medical cardholder patients will not fall from period 0 to period 1 and may well increase.

Thus, overall our model predicts that the difference-in-differences should be positive. However, relaxing the assumption that GPs are price-takers then complicates the situation. If GPs increase the fees charged to non-medical cardholder patients in order to offset the fall in income brought about by the reform, then the overall effect will be ambiguous. This is because the second term on the left-hand side $(\bar{q}_{0,PRIV} - \bar{q}_{1,PRIV})$ may well turn out to be positive. However, if demand is price inelastic, it is likely that this effect will be dominated by the combined positive effect of the latter two terms.

As discussed in Section 3 below, our data allow us to clearly identify a treatment (medical cardholder) and a control (non-medical cardholder) group, as well as a treatment (pre-1989) and a control (post-1989) period. Following the discussion in Wooldridge [19] let *A* be the control group and *B* the treatment group. Thus the dummy variable *dB* equals one for those in the treatment group and it is zero otherwise. Similarly let *d2* be the dummy variable for the treatment period (i.e., before the policy change). Then the simplest equation for analysing the impact of the policy change is:

$$y = \beta_0 + \delta_0 d2 + \beta_1 dB + \delta_1 d2 \cdot dB + u \qquad (8)$$

where *y* is the outcome of interest. The dummy variable *d2* captures the aggregate factors that affect both the treatment and control groups over time. The variable *dB* captures differences between the control and treatment groups before the policy change. The coefficient δ_1 captures the effect of the interaction between the policy change and the treatment group as the term $d2 \cdot dB$ only takes a value of unity for those observations in the treatment group in the treatment period.

If we estimate the above relationship by OLS and let $\bar{y}_{A,1}$ denote the sample average of *y* for the control group for the control period and let $\bar{y}_{A,2}$ denote its value for the control group for the treatment period. Define $\bar{y}_{B,1}$ and $\bar{y}_{B,2}$ similarly. Then the OLS estimator $\hat{\delta}_1$ can be expressed as:

$$\hat{\delta}_1 = (\bar{y}_{B,2} - \bar{y}_{B,1}) - (\bar{y}_{A,2} - \bar{y}_{A,1}) \quad (9)$$

and is known as the difference-in-differences estimator. We can see how this is equivalent to expression (7), i.e., $(q_{0,PUB} - q_{1,PUB}) - (q_{0,PRIV} - q_{1,PRIV})$. The use of $\hat{\delta}_1$ means that both group-specific and time-specific factors are controlled for. One important assumption which must be maintained for $\hat{\delta}_1$ to be a valid estimator of the policy change is that other macroeconomic events (apart from the policy change), which might occur between the treatment and control groups, should affect both treatment and control groups equally. As pointed out by Wooldridge [19] it is customary to include other independent variables in the estimated equation (10). These allow for the fact that the random samples within a group may differ systematically over the two time periods. In this case the interpretation of $\hat{\delta}_1$ remains essentially unchanged. We propose to estimate the above model using four different econometric methodologies, both with and without additional independent variables.

3. DATA AND VARIABLES

Two data sources are employed in this paper. The first is the 1987 Survey of Income Distribution, Poverty and Usage of State Services, which was carried out by the Economic and Social Research Institute (ESRI) between October 1986 and September 1987. A more detailed description of the design and conduct of the survey as well as response rates and the representativeness of the survey are provided in Nolan [20] and Callan *et al*. [21]. Health information on medical card eligibility, insurance coverage, number of visits to GPs, number of nights in hospital *etc*. were obtained for all individuals in the household from the head of household (HOH) or the spouse of the HOH. In addition, each adult aged 15 years and over completed a personal questionnaire. This covered a wide range of information on labour force status, occupation, income, style of living, financial situation and attitudes. It also included some questions on health status, both physical and psychological. The latter represented a major advantage of these data over the earlier 1980 data set employed by Tussing [1,3].

The second source of data is the Living in Ireland (LII) Survey. The LII Survey was also carried out by the ESRI and constitute the Irish component of the European Community Household Panel (ECHP). The ECHP began in 1994 and ended in 2001. It involved an annual survey of a representative sample of private households and individuals aged 16 years and over in each EU member state, based on a standardised questionnaire. Where possible, the same households were followed through time. Similar questions to those asked in the 1987 Survey were included in the LII Surveys. However, while the HOH or spouse of the HOH provided information on each individual's use of GP services, medical card eligibility *etc*. in the 1987 Survey, each adult aged 16 years and over provided this information personally in the LII Survey. As with the 1987 Survey, this personal questionnaire also contains information on physical and psychological health status. In this paper, data from the second (1995) and seventh (2000) waves of the LII Survey are analysed.[6]

The samples include all adults aged 16 years and over, amounting to 9,421, 8,530 and 8,055 observations respectively. After deleting observations for which information on one or more variables of interest was missing[7], completed observations are available for 6,713 individuals in 1987, 7,096 individuals in 1995 and 6,657 individuals in 2000. When the data are pooled across the three years, this gives a complete sample of 20,466 individuals.

Table 1 presents variable definitions for the various dependent and independent variables employed in this study. As a number of different econometric methodologies are proposed to model the utilisation of GP services (see Section 4), two dependent variables are necessary: a binary variable indicating whether the individual visited a GP in the previous twelve months (GPPOS) and a count variable recording the number of visits to a GP in the previous twelve months (GPVISITS). As is evident from Table 2, the standard deviation of GPVISITS is consistently larger than the mean, a feature of the data which has consequences for the choice of the most appropriate econometric methodology. Schellhorn [22] discusses the problem of reporting error that may arise when individuals are asked to recall behaviour over a long period of time. An examination of the frequency of GP visits in Table 3 reveals that there are clusters at 6, 10 and 12 visits, which are consistent with individuals rounding up or down the number of visits or approximating "once a month" for example. However, the percentage of individuals with such frequencies is only a small fraction of the total and is consequently not considered a problem.

Summary statistics for the independent variables are presented in Table 4. The demographic/socio-economic characteristics of the individual are represented by variables describing the age, gender, household location, education level, employment status, marital status, household income and private insurance status of the individual. As the health status of the individual is consistently found to be the most significant factor explaining health services utilisation in previous studies, a number of indicators of physical and psychological health status are employed. Whether an individual gave birth during the previous twelve months is represented by a dummy variable. Individuals who report that they suffer from "*any chronic, physical or mental health problem, illness or disability*" (see Table 2 for the slightly different wording of this question in 1987) are subsequently asked for the nature of this illness or disability; we have constructed a categorical variable with eleven categories corresponding to various medical conditions with the base category indicating that the individual did not indicate that they suffered from any chronic, physical or mental health problem, illness or disability. Scores from the General Health Questionnaire (GHQ) are used to construct a variable indicating psychological health status. The GHQ contains twelve questions relating to psychological health status. For the six positive statements, a person scores one if they answer "less than usual" or "much less than usual" while for the six negative statements, a person scores one if they answer "more than usual" or "much more than usual". An example of a positive statement is "have you recently been able to concentrate on whatever you're doing?" while an example of a negative statement is "have you recently lost much sleep over worry?" These scores are added up and constitute an ordinal variable indicating the degree of psychological distress; anyone scoring above the conventional threshold of two is considered to be in psychological distress (see also Nolan [20]).[8]

We include a dummy variable with the value one indicating individuals who are eligible for a medical card, i.e., the treatment group. A dummy variable with the value one for individuals surveyed in 1987 indicates the period before the change in reimbursement, i.e., the treatment period. In line with the difference-in-differences approach outlined above we also include a variable called *med87*, the interaction term between medical card status and the fee-for-service regime for medical cardholders. The coefficient on this variable captures the effect of the policy of fee-for-service reimbursement for medical cardholders and the model outlined above predicts that this coefficient should be positive and significant. Finally because the post-regime period includes two cross-sections of the LII Survey, we include an additional dummy variable with the value one indicating observations surveyed in 1995.

Table 2 presents the average number of GP visits for medical cardholder and non-medical cardholder patients for each of the three years, 1987, 1995 and 2000 and for the pooled sample. As expected, medical cardholders have a higher number of annual visits to their GP than non-medical cardholders in all years, reflecting most importantly the difference in the relative price of a consultation between the two groups and also the distribution of age and health status across the two groups. For both groups of patient, the average number of GP visits fell from 1987 to 1995. However, while medical cardholder visits fell by a smaller percentage between 1987 and 1995 than those of non-medical cardholders, medical cardholders' visits recovered to much nearer their 1987 level than those of non-medical cardholders by 2000. As our model treats 1987 as the treatment group and 1995/2000 as the control group, the statistics in Table 2 indicate that the magnitude of the reduction in visits after the reform was greater for non-medical cardholder patients, contrary to the predictions from our model. It is the objective of the multivariate analysis undertaken in Section 5 to determine a) whether there is a significant difference between medical cardholders and non-medical cardholders in patterns of utilisation pre- and post-1989 and b) whether this difference, if any, persists when other demographic, socio-economic and health status variables are taken into account.

4. ECONOMETRIC METHODOLOGIES

The dependent variable (the number of visits to a GP in the previous twelve months) is a variable that can only take on non-negative integer values. In addition, the distribution of GP visits is highly skewed (a large proportion of observations are clustered at zero while only a small proportion of individuals record frequent visits (see Table 4)). This necessitates the use of count data econometric methodologies, which assume a skewed, discrete distribution and restrict predicted values to non-negative values. The most basic count data model is the Poisson model; however it is rarely used in applied work as an underlying assumption of the model is that the expected mean and variance of the dependent variable are equal. Table 2 indicates that this assumption is violated for our data. The alternative negative binomial model overcomes this problem. However, model selection tests (see below) favour the generalised negative binomial over the standard negative binomial model. The generalised negative binomial model allows α (the parameter estimated within the negative binomial model which represents unobserved population heterogeneity, a possible source of over-dispersion) to differ across observations by specifying it as a function of observed characteristics as follows:

$$\alpha_i = exp(z_i'\gamma) \qquad (10)$$

where z_i are the set of independent variables, which may be the same as x_i. The generalised negative binomial model therefore takes the form:

$$P\left(Y_i = y_i \mid \varepsilon_i\right) = \frac{exp\left(-\delta_i\right)\left(\delta_i\right)^{y_i}}{y_i\,!}, \quad y_i = 0,1,2,\ldots \tag{11}$$

where $\delta_i = exp\left(x_i{}'\beta\right) exp\left(\varepsilon_i\right)$ and ε_i has a gamma distribution with mean one and variance α_i.

The standard and generalised negative binomial models assume that all individuals have a positive probability of experiencing the event in question. A number of authors (Durkan *et al*. [32], Giuffrida [33] and Kelleher and McElroy [34]), question the validity of assuming that all zero observations are generated from the same underlying decision-making structure. It is important to ascertain whether zero observations relate to true non-participants (i.e., individuals that would never visit a GP) or to individuals who are potential participants (i.e., individuals who do visit their GP but who are not observed doing so during the survey period in question). The zero-inflated Poisson (ZIP) and zero-inflated negative binomial (ZINB) models allow us to distinguish between different sources of zero observations and in the process, overcome the problem whereby conventional count data methodologies may under-estimate the true extent of the zero observations. However, model selection tests (see below) favour both the two-step and generalised negative binomial models over the ZINB, suggesting that the distinction between actual and potential participants is not a useful one for our data (probably due to the relatively long length of the survey period).

A number of authors (Buchmueller *et al*. [35], Gerdtham [36], Hakkinen *et al*. [24], Hurd and McGarry [28], Nolan [20,39], Pohlmeier and Ulrich [37], Tussing [1] and Van Doorslaer *et al*. [38]) have argued that two-step approaches are more appropriate in accounting for the nature of the decision-making process underlying the decision to visit a GP. They argue that different variables may affect the decision to visit a GP (contact decision) and secondly, the decision about frequency of visits (frequency decision). In addition, the same variables may affect the two stages of the decision-making process in different ways. The most common interpretation of the two-step model is in terms of a principal-agent framework whereby the patient initiates the visit to their GP but the

GP decides on the frequency of treatment. The first stage is modelled using a binary choice model (logit or probit) while a variety of techniques are used for the second stage, including truncated OLS, Poisson and negative binomial methodologies. As the second stage variable is an integer count variable, we consider only truncated Poisson or negative binomial specifications for the second stage (see also Gerdtham [36], Grootendorst [40], Hakkinen *et al*. [24], Pohlmeier and Ulrich [37] and Van Doorslaer *et al*. [38]). Model selection tests (see below) favour the truncated negative binomial over the truncated Poisson specification for the second step. The two-step negative binomial model therefore consists of two stages which may be estimated separately:

- A binary model (e.g. probit), which estimates the probability that an individual visited a GP within the observation period, i.e.,

  $$P\left(y_i > 0\right) = F\left(x_i{}'\beta\right) \tag{12}$$

  where $F(.)$ is the logistic/standard normal cumulative distribution function and x_i are the set of independent variables.

- A truncated negative binomial model for positive observations, i.e.,

  $$P\left(y_i \mid y_i > 0\right) = \frac{exp\left(-\delta_i\right)\left(\delta_i\right)^{y_i}}{y_i\,!\left[1 - exp\left(-\delta_i\right)\right]}, \; for \; y_i > 0 \tag{13}$$

  where $\delta_i = exp\left(x_i{}'\beta\right)exp\left(\varepsilon_i\right)$ and ε_i has a gamma distribution with mean one and variance α .

Gerdtham [36], Jimenez-Martin *et al*. [25], Kelleher and McElroy [34], Santos-Silva and Windmeijer [41] and Vera-Hernandez [30] argue that the two-step methodology is only appropriate when the data refer to a single illness spell, an assumption that is often violated in surveys that record health services utilisation over relatively long periods of time such as a year. Indeed, Jimenez-Martin *et al*. [25] find that the two-step model is rejected in favour of the basic negative binomial model in their study of the determinants of GP visits in twelve European countries and argue that this is due to the restrictive assumptions about illness spells underlying the two-step model. In interpreting the results from this model, it is important to bear this limitation in mind.

However, as we are primarily interested in changes over time, once the distribution of illness spells over the survey period does not change between 1987 and 1995/2000 (and we have no reason to believe that it did), the results from this model are still useful. More sophisticated modelling alternatives such as GMM estimation of both processes developed by Santos Silva and Windmeijer [41] or finite mixture models applied by Gerdtham and Trivedi [42] are not considered here as we are primarily interested in the effect of the change in reimbursement rather than the specification of the most appropriate model for estimating GP services utilisation.

We therefore estimate, and present the results of, four models: negative binomial, generalised negative binomial, zero-inflated negative binomial and two-step negative binomial.[9] We base the discussion on the results from the generalised negative binomial model as it is preferred on the basis of model selection tests but make reference to the two-step model where differences arise. The set of independent variables is comparable across all three years (with the exception of the physical illness variable where the underlying question changed slightly between 1987 and 1995/2000; see Table 1 for further details). Each of the models is estimated using STATA8 and marginal effects and standard errors are presented in Tables 5 and 6. Marginal effects for the continuous independent variables are calculated at the mean of the independent variable of interest while marginal effects for discrete independent variables are calculated as the difference in the expected value of the dependent variable when the independent variable of interest takes the value zero and when it takes the value one. Standard errors are calculated using the delta method. Finally, all standard errors are adjusted to take into account the fact that observations are clustered by household.

5. EMPIRICAL RESULTS

Looking first at the results without additional independent variables (i.e., with just treatment group and period dummies and the interaction dummy between treatment period and treatment group) for the generalised negative binomial model, column (3) in Table 5 indicates that GP visits were significantly higher for medical cardholders across the period of our analysis; this is consistent with evidence presented in Tussing [1,3] and Nolan [20,39] that medical cardholders consume more GP services due to the zero monetary cost they face in visiting their GP. It is also possible that eligibility for a medical card distorts the relative prices of GP substitutes. While a GP visit is necessary to receive a referral to a specialist (except in emergencies), the fact that non-medical cardholders must pay the full cost of a GP consultation but receive heavily subsidised, or free (if privately insured) specialist care in hospital may also explain this result. In addition, as waiting lists for elective surgery are higher for public than for private patients, this may mean that medical cardholder patients use their GP more intensively due to accessibility.[10] On average, GP visits for both groups were significantly higher in 1987 and significantly lower in 1995 than in 2000. Most importantly however, the results indicate that, contrary to the predictions from a model highlighting supplier-induced demand, there is a negative and significant difference-in-differences effect. In other words, the difference between medical cardholders' visits in 1987 and 1995/2000 was significantly less than the difference between non-medical cardholders' visits in 1987 and 1995/2000. While both groups visited their GP less in 1995/2000 than in 1987, the regression results confirm that the reduction was actually larger for non-medical cardholders than for medical cardholders.

The results from the two-step model in Columns (4) and (5) in Table 5, while very similar to those for the generalised negative binomial, show one exception. The probability of a GP visit is significantly lower in 1987 than in 2000; this is consistent with the patterns in Table 2 where the proportion of the population visiting at least once increased from 1987 to 2000, even though the average number of visits for those visiting at least once declined.

Turning to the analyses including additional independent variables hypothesised to influence GP visits, Column (3) in Table 7 indicates that once again, medical cardholders consume significantly more GP services than non-medical cardholders although the effect has declined in magnitude. GP visits are significantly higher in 1987 than in 2000 but there is no significant difference in the average number of GP visits between 1995 and 2000. The inclusion of additional variables now means that the difference-in-differences effect becomes insignificant. For the two-step model, Columns (4) and (5) indicate that the difference-in-differences estimate remains negative and significant: the difference between medical cardholders' visits in 1987 and 1995/2000 was significantly less than the difference between non-medical cardholders' visits in 1987 and 1995/2000.

These results, on the face of it, do not lend support to the notion that supplier-induced demand was a major contributor to the differential in visiting rates between medical cardholders and others prior to the change in reimbursement system, since that change did not narrow the differential. Visiting rates by medical cardholders did fall, however, which is in itself consistent with an impact of the switch to capitation for them: the differential did not fall because visiting rates fell (even more) for the rest of the population. This could reflect *inter alia* a response of non-medical cardholders to increases in the price of a GP visit. That obviously would not have affected medical cardholders, leaving some scope for the change in reimbursement to have been a contributory factor in falling visiting rates for them. We cannot test for the potential scale of such a price effect with just three observations over time, but it has to be kept in mind. So while the empirical results do not demonstrate a significant impact from the change in reimbursement system, they do not rule out the possibility that it had some independent effect in reducing visiting rates for those affected.

The remainder of the independent variables have effects that are largely consistent with expectations and with previous research analysing the utilisation of GP services at the cross-sectional level (see for example Tussing [1,3] and Nolan [20,39] for research using Irish data). The health status variables are all positive and highly significant, in common with results found in the above studies. The results from the two-step model suggest that some variables (such as marital status, household location, education, income and insurance status) have different effects on the two decisions (contact and frequency decision). The effect of having private medical insurance significantly increases the probability of visiting a GP but is negative and significant in determining the frequency of visits for those with at least one visit. While private medical insurance does not in general cover the cost of GP consultations (except where large deductibles are exceeded), the significance of insurance in determining the contact decision may reflect differences in attitudes towards health care between the two groups with those covered by private medical insurance possibly more risk averse than those without. It is also possible that the GP realises that the patient is not covered by insurance for GP visits but would be covered for an out-patient consultation in hospital and recommends this route instead of a follow-up consultation with the GP. As discussed in Section 1, many studies include urban/rural location to proxy physician density in an attempt to identify SID. Our results provide no such evidence, except in the case of the probit model where individuals resident in rural areas (with presumably lower physician densities) have a significantly lower probability of visiting their GP. However this is more likely to indicate a distance or travel time effect, with those resident in rural areas facing higher travel and time costs associated with a GP visit, rather than any absence of an incentive for demand inducement on the part of GPs in such areas.

6. SUMMARY AND CONCLUSION

This paper has used a difference-in-differences methodology to analyse whether Irish General Practitioners' behaviour changed following a change in the financial incentives facing them. Up to 1989, GPs were remunerated on a fee-for-service basis by the State for low-income patients, but the system was then changed to a capitation basis. The remainder of the population has continued to pay for GP visits out-of-pocket throughout. The purpose of this paper was to identify whether this change in reimbursement led to a change in visiting rates by low-income patients compared with other patients.

Unfortunately, our data do not distinguish between patient-initiated and GP-initiated visits and thus it is difficult to make direct inferences about GP behaviour from utilisation data. In addition, Rice and Labelle [43] argue that visits are not the primary means by which demand might be induced. Instead, a GP might induce demand by increasing the complexity of the consultation or ordering ancillary services (for which they may receive additional payments), behaviours that are that not picked up in utilisation data. None the less, the evidence presented here for Ireland shows clearly that the differential in visiting rates between low income groups and others did not narrow when the reimbursement system for the former was changed from fee for service to capitation, as might have been anticipated if supplier induced demand played a major role.

NOTES

[1] For an excellent and very readable introduction to this area see Tussing [1].
[2] This highlights the problems associated with obtaining definitive evidence of SID in this context. As Carlsen and Grytten [5] point out, a positive relationship between physician supply and utilisation could be due to any one of four factors: SID, the demand response by patients to lower prices, the demand response to increased availability of doctors (which lowers the time and transport costs associated with a consultation) or the supply response to area-wide variations in factors that positively influence utilisation such as health status.
[3] There is no set fee for non-medical cardholder patients but it is worth noting that in 2000, the average fee for a GP consultation was €33. The same study also noted that between 1990 and 2000 doctors' fees rose by an annual average of 7.1 per cent compared to the overall annual inflation rate of 2.7 per cent, indicating a relative rise in the price of consultations (see Competition Authority [13]).
[4] For a discussion of natural experiments and evaluation in general see Blundell and Costa Dias [15]. See also Chiappori [16], Cockx and Brasseur [17] and Van de Voorde *et al*. [18] for similar analyses of natural experiments of the effect of an increase in co-payments for certain groups on the demand for physician services in France and Belgium.
[5] In the subsequent econometric analysis the validity of this assumption can be strengthened by including in the analysis additional regressors which might affect the underlying demand for GP services by medical cardholder and non-medical cardholder patients. These would include demographic and socio-economic factors such as age, gender and employment status.
[6] Data from 1994 are not used as the number of GP visits is not separately identified from the number of visits to medical specialists, dentists and opticians in that year. The 2001 data are not utilised as all over 70s automatically became eligible for a medical card from July 2001; this would have meant that inferences across time would be more difficult due to the substantial change in the characteristics of the medical card population from 2001.
[7] In all years, the majority of the missing observations occur for the health status questions, particularly psychological health status; this is due to the fact that the individual questionnaire was completed by proxy rather than in person for these individuals (because the person was ill, never at home or refused to co-operate with the interviewer) and as such questions such as education level and inquiring about physical and psychological health were particularly difficult to answer using proxy responses. A simple probit regression of missing values on age, gender and marital status (variables which are always observed) indicates that missing observations are significantly more likely for those that are aged 16-24 years, male and single.
[8] Cameron *et al*. [23], Hakkinen *et al*. [24], Jimenez-Martin *et al*. [25] and Schellhorn [22] all discuss the problem of using current measures of health status to predict past health services utilisation. All suggest that lagged measures be used instead. We do not employ this method in our study as the 1987 survey was a single cross-section and the physical health status question was not asked in 1994. However, we will consider this issue in a future paper analysing the full Living in Ireland panel. In addition, it is important to control for health status in analysing the demand for GP services. If those that are ill are more likely to hold medical cards/be insured, the positive effect of medical card eligibility/insurance on GP utilisation may not be the result of the incentive structures inherent in these systems but rather the result of adverse selection of the ill into these categories of eligibility/insurance coverage. A number of studies therefore treat insurance as an endogenously determined variable (see Cameron *et al*. [23], Harmon and Nolan [26], Holly *et al*. [27], Hurd and McGarry [28], Jones *et al*. [29], Schellhorn [22], Vera-Hernandez [30] and Waters [31]). While Harmon and Nolan [26] and Hurd and McGarry [28] either find that those in better health are more likely to be insured (and therefore that the positive effect of insurance coverage on health services utilisation is under-stated if insurance is not treated as an endogenous variable) or no evidence for adverse selection, we do not consider this possibility in this paper and instead rely on extensive health status variables to control for differences in health status.
[9] The results of model selection tests (likelihood ratio tests for the nested models and Vuong tests for the non-nested models), which are available on request from the authors, indicate that the negative binomial model is preferred to the Poisson model, the truncated negative binomial model is preferred to the truncated Poisson model, the ZINB is preferred to the ZIP, the generalised negative binomial model is preferred to both the negative binomial and the ZINB and the two-step negative binomial model is preferred to both the negative binomial and the ZINB. However the Vuong test of the generalised negative binomial model against the two-step negative binomial model was inconclusive. On the basis of information criteria, the generalised negative binomial model is preferred.
[10] We thank an anonymous referee for this point.

Table 1 Variable Definitions for Dependent and Independent Variables

VARIABLE	DEFINITION
GPPOS	=1 if visited a GP in the previous twelve months =0 otherwise
GPVISITS	Number of GP visits in the previous twelve months
Age 25-34	=1 if aged 25-34 years, =0 otherwise
Age 35-44	=1 if aged 35-44 years, =0 otherwise
Age 45-54	=1 if aged 45-54 years, =0 otherwise
Age 55-64	=1 if aged 55-64 years, =0 otherwise
Age 65+	=1 if aged 65+ years, =0 otherwise (Base Category = aged 16-24 years)
Female	=1 if female, =0 otherwise (Base Category = male)
Rural	=1 if lives in household located in open country or in a village with 200 - 1,499 inhabitants, =0 otherwise (Base Category = lives in a household located in a town with 1,500 – 10,000 or more inhabitants or in Waterford, Galway, Limerick and Cork cities or Dublin city and county)
Lower Secondary	=1 if highest level of education completed is lower secondary (i.e., intermediate/junior certificate), =0 otherwise
Upper Secondary	=1 if highest level of education completed is upper secondary (i.e., leaving certificate), =0 otherwise
Third Level	=1 if highest level of education completed is third level (i.e., diploma, primary degree or higher degree), =0 otherwise (Base Category = highest level of education completed is primary level)
Married	=1 if married, =0 otherwise
Separated/Divorced	=1 if separated or divorced, =0 otherwise
Widow	=1 if widowed, =0 otherwise (Base Category = never married)
Employed	=1 if employed, =0 otherwise
Unemployed	=1 if unemployed or seeking employment, =0 otherwise (Base Category = economically inactive (i.e., in education, engaged in home duties, retired, incapacitated for work *etc*.)
Income	Net Household Weekly Income in IR£[1] (adjusted for household size and divided by 100)
Medical Card	=1 if have a medical card or covered on another family member's card, =0 otherwise (Base Category = does not have a medical card and is not covered on another family member's card)
Insurance	=1 if insured either in own name or through another family member, =0 otherwise (Base Category = not insured in own name or through another family member)

Notes: (i) While the majority of individuals with medical cards do not have private medical insurance, there are a number who have both and a number who have neither (38.7, 28.5 and 26.3 per cent had neither in 1987, 1995 and 2000 respectively while 1.0, 1.6 per and 2.3 per cent had both in 1987, 1995 and 2000 respectively).
(ii) household income is equivalised using the following scale: 1 for the HOH, 0.66 for any other adults over the age of 14 years and 0.33 for any children under the age of 14 years.

[1] The euro was introduced in Ireland on 1 January 2002.

Table 1 continued

VARIABLE	DEFINITION
Birth	=1 if gave birth in previous twelve months, =0 otherwise (Base Category = did not give birth in previous twelve months)
GHQ	GHQ score (ranges from 0 to 12; for each of the six negative statements score one if answer “more than usual” or “much more than usual” and for each of the six positive statements score one if answer “less than usual” or “much less than usual”)
Disease	=1 if nature of illness or disability is an infectious or parasitic disease or neoplasm or a congenital abnormality, =0 otherwise
System	=1 if nature of illness or disability is an endocrine disorder, blood disorder, skin disorder or a genito-urinary problem, =0 otherwise
Mental	=1 if nature of illness or disability is a mental disorder, depression (defined in 2000 only) or a mental handicap (defined in 2000 only), =0 otherwise
Nerve	=1 if nature of illness or disability is a nervous complaint or bad nerves, =0 otherwise
Circ	=1 if nature of illness or disability is a circulatory problem, =0 otherwise
Resp	=1 if nature of illness or disability is a respiratory problem, =0 otherwise
Digest	=1 if nature of illness or disability is a digestive problem, =0 otherwise
Headache	=1 if nature of illness or disability is headaches, =0 otherwise
Musculo	=1 if nature of illness or disability is a musculo-skeletal disorder, bad back or a physical handicap (defined in 2000 only), =0 otherwise
Accident	=1 if nature of illness or disability is an accident, =0 otherwise
Other	=1 if nature of illness or disability is not specified or does not fall under the above classifications, =0 otherwise (Base Category = does not have any major illness, physical disability or infirmity that has troubled the individual for the past year and is likely to go on troubling the individual in the future (1987 definition) or does not have a chronic physical or mental health problem, illness or disability (1995 and 2000 definition))

Table 2 Average Number of GP Visits by Year and Medical Card Eligibility

	MEDICAL CARD					NO MEDICAL CARD					ALL				
	1987	**1995**	**2000**	**1995/ 2000**	**POOL**	**1987**	**1995**	**2000**	**1995/ 2000**	**POOL**	**1987**	**1995**	**2000**	**1995/ 2000**	**POOL**
Average number of visits	6.5 (9.8)	5.6 (8.1)	6.4 (7.8)	6.0 (8.0)	6.1 (8.7)	2.8 (5.7)	2.3 (4.3)	2.3 (4.1)	2.3 (4.2)	2.5 (4.7)	4.0 (7.6)	3.4 (6.0)	3.5 (5.8)	3.5 (5.9)	3.7 (6.5)
Percentage with at least one GP visit	70.9	80.9	85.6	83.1	78.8	52.9	64.2	66.9	65.5	61.5	59.1	69.6	72.5	71.0	67.1
Average number of visits for those with at least one visit	9.1 (10.5)	7.0 (8.5)	7.4 (8.0)	7.2 (8.3)	7.8 (9.1)	5.2 (7.0)	3.6 (4.9)	3.5 (4.6)	3.5 (4.7)	4.0 (5.5)	6.8 (8.8)	4.9 (6.7)	4.9 (6.3)	4.9 (6.5)	5.4 (5.4)

Note: (i) Standard deviations in parentheses.

Table 3 Frequency of GP Visits

	1987		1995		2000		POOL	
GP VISITS	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
0	2744	40.9	2156	30.4	1831	27.5	6,731	32.9
1	810	12.1	1220	17.2	1106	16.6	3,136	15.3
2	637	9.5	1097	15.5	1099	16.5	2,833	13.8
3	381	5.7	574	8.1	561	8.4	1,516	7.4
4	348	5.2	554	7.8	573	8.6	1,475	7.2
5	184	2.7	219	3.1	199	3.0	602	2.9
6	332	5.0	353	5.0	369	5.5	1,054	5.2
7	61	0.9	60	0.9	64	1.0	185	0.9
8	99	1.5	88	1.2	100	1.5	287	1.4
9	19	0.3	18	0.3	12	0.2	49	0.2
10	124	1.9	127	1.8	115	1.7	366	1.8
11	4	0.1	6	0.1	5	0.1	15	0.1
12	625	9.3	394	5.6	415	6.2	1,434	7.0
13+	345	5.1	230	3.2	208	3.1	783	3.8
Total	**6,713**	**100.0**	**7,096**	**100.0**	**6,657**	**100.0**	**20,466**	**100.0**

Table 4 Summary Statistics for Dependent and Independent Variables

VARIABLE	1987	1995	2000	POOL
GPVISITS	4.0	3.4	3.6	3.7
	(7.6)	(6.0)	(5.8)	(6.5)
GPPOS	0.59	0.70	0.73	0.67
Age 16-24	15.1	19.4	17.3	17.3
Age 25-34	18.9	17.1	14.4	16.8
Age 35-44	18.0	18.2	18.0	18.0
Age 45-54	17.3	16.9	17.9	17.3
Age 55-64	14.8	13.3	14.6	14.2
Age 65+	16.0	15.1	17.8	16.3
Female	52.6	52.5	53.7	52.9
Male	47.4	47.5	46.3	47.1
Married	65.5	59.2	58.2	61.0
Separated/Divorced	1.8	1.9	2.8	2.2
Widowed	6.5	6.3	6.9	6.6
Single	26.1	32.5	32.1	30.3
Employed	46.9	48.6	53.4	49.6
Unemployed	10.4	6.5	3.2	6.7
Inactive	42.7	44.9	43.5	43.7
Rural	47.5	50.9	52.0	50.2
Urban	52.5	49.1	48.0	49.8
Primary	51.6	34.3	30.5	38.8
Lower Secondary	20.5	24.2	23.0	22.6
Upper Secondary	18.5	28.8	29.5	25.7
Third Level	9.4	12.7	17.0	13.0
Income	1.08	1.66	2.15	1.63
	(0.78)	(1.10)	(1.32)	(1.17)
Medical Card	34.7	32.3	30.0	32.3
No Medical Card	65.3	67.7	70.0	67.7
Insurance	27.5	41.0	46.0	38.1
No Insurance	72.5	59.0	54.0	61.9
Birth	2.2	1.6	1.4	1.7
No Birth	97.8	98.4	98.6	98.3
GHQ	1.06	1.18	1.09	1.11
	(2.06)	(2.32)	(2.26)	(2.22)

Note: (i) For the continuous/ordinal variables (GPVISITS, equivalised household income and GHQ), the summary statistics are the mean and standard deviation (in parentheses) while for the remainder of the variables which are discrete, the summary statistics refer to the percentage of the sample in that particular category.

Table 4 continued

Variable	1987	1995	2000	POOL
Disease	0.5	0.8	0.8	0.7
System	1.6	1.7	2.3	1.8
Mental	0.4	0.6	1.3	0.8
Nerve	1.0	1.4	0.9	1.1
Circ	4.3	3.4	4.0	3.9
Resp	1.7	2.6	2.4	2.3
Digest	0.8	0.8	0.8	0.8
Headache	0.1	0.2	0.2	0.2
Musculo	0.8	0.6	0.4	0.6
Accident	4.4	4.3	5.3	4.6
Other	1.5	0.7	0.9	1.1
No Health Condition	82.9	82.9	80.7	82.1
Year87	100.0	0.0	0.0	32.8
Year95	0.0	100.0	0.0	34.7
Year00	0.0	0.0	100.0	32.5
Med87	34.7	0.0	0.0	11.4

Note: (i) For the continuous/ordinal variables (GPVISITS, equivalised household income and GHQ), the summary statistics are the mean and standard deviation (in parentheses) while for the remainder of the variables which are discrete, the summary statistics refer to the percentage of the sample in that particular category.

Table 5 Marginal Effects (with no additional regressors)

	(1) NBREG	(2) ZINB	(3) GNBREG	(4) PROBIT	(5) TRNBIN
Medical Card	3.82	4.19	3.84	0.19	0.95
	(0.15)***	(0.17)***	(0.15)***	(0.01)***	(0.05)***
Year87	0.50	1.83	0.49	-0.14	0.54
	(0.14)***	(0.21)***	(0.15)***	(0.01)***	(0.06)***
Year95	-0.16	-0.18	-0.18	-0.04	-0.01
	(0.09)*	(0.10)*	(0.09)**	(0.01)***	(0.04)
Med87	**-0.30**	**-3.51**	**-0.31**	**-0.03**	**-0.25**
	(0.17)*	**(0.20)*****	**(0.17)***	**(0.02)***	**(0.06)*****
Number of Observations	20,466	20,466	20,466	20,466	13,735
Log-Likelihood	-47,093.99	-46,824.94	-46,749.26	-12,471.47	-34,284.02
AIC	94,195.974	93,665.746	93,514.520	24,950.942	68,576.049
BIC	94,227.680	93,729.158	93,577.932	24,982.648	68,606.159
AIC				93,526.991	
BIC				93,590.403	

Notes: (i) Standard errors, which are adjusted for the clustering of observations by household, are reported in parentheses.
(ii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table 6 Marginal Effects (with additional regressors)

	(1) NBREG	(2) ZINB	(3) GNBREG	(4) PROBIT	(5) TRNBIN
Medical Card	1.40 (0.12)***	1.36 (0.14)***	1.41 (0.11)***	0.14 (0.01)***	0.38 (0.04)***
Year87	0.27 (0.11)***	1.12 (0.16)***	0.28 (0.11)**	-0.11 (0.01)***	0.40 (0.05)***
Year95	-0.12 (0.07)*	-0.10 (0.08)	-0.09 (0.06)	-0.02 (0.01)*	-0.03 (0.03)
Med87	**0.01** **(0.14)**	**-0.30** **(0.15)***	**0.07** **(0.13)**	**-0.04** **(0.02)****	**-0.11** **(0.05)****
Age 25-34	0.36 (0.14)**	0.39 (0.18)**	0.49 (0.14)***	0.01 (0.01)	0.14 (0.06)**
Age 35-44	0.27 (0.15)*	0.38 (0.19)**	0.40 (0.15)***	-0.02 (0.01)	0.16 (0.06)**
Age 45-54	0.12 (0.156)	0.22 (0.19)	0.25 (0.15)*	-0.02 (0.02)	0.08 (0.06)
Age 55-64	0.62 (0.186)***	0.67 (0.21)***	0.70 (0.17)***	0.01 (0.02)	0.22 (0.06)***
Age 65+	1.04 (0.19)***	0.92 (0.22)***	0.90 (0.17)***	0.11 (0.02)***	0.25 (0.06)***
Female	0.62 (0.06)***	0.53 (0.08)***	0.53 (0.06)***	0.08 (0.01)***	0.14 (0.03)***
Married	0.45 (0.10)***	0.18 (0.12)	0.35 (0.09)***	0.08 (0.01)***	0.03 (0.04)
Separated/Divorced	0.39 (0.22)*	0.22 (0.25)	0.45 (0.23)**	0.08 (0.02)***	0.03 (0.08)
Widowed	0.58 (0.16)***	0.25 (0.17)	0.33 (0.14)**	0.11 (0.02)***	0.06 (0.05)
Employed	-0.35 (0.08)***	-0.49 (0.10)***	-0.42 (0.08)***	-0.004 (0.01)	-0.15 (0.03)***
Unemployed	-0.49 (0.14)***	-0.29 (0.19)	-0.47 (0.14)***	-0.07 (0.02)***	-0.09 (0.07)
Rural	-0.13 (0.06)**	-0.03 (0.07)	-0.07 (0.06)	-0.03 (0.01)***	0.01 (0.03)
Lower Secondary	-0.32 (0.08)***	-0.47 (0.10)***	-0.35 (0.08)***	-0.01 (0.01)	-0.15 (0.04)***
Upper Secondary	-0.44 (0.09)***	-0.58 (0.11)***	-0.41 (0.09)***	-0.01 (0.01)	-0.19 (0.04)***
Third Level	-0.46 (0.10)***	-0.67 (0.12)***	-0.42 (0.10)***	-0.01 (0.01)	-0.25 (0.05)***

Notes: (i) Standard errors, which are adjusted for the clustering of observations by household, are reported in parentheses.
(ii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table 6 continued

	(1) NBREG	(2) ZINB	(3) GNBREG	(4) PROBIT	(5) TRNBIN
Income	0.09	0.05	0.07	0.02	0.004
	(0.03)***	(0.04)	(0.03)**	(0.004)***	(0.01)
Insurance	0.01	-0.21	-0.04	0.04	-0.09
	(0.09)	(0.10)**	(0.08)	(0.01)***	(0.04)**
Birth	5.48	5.22	5.29	0.23	0.98
	(0.42)***	(0.45)***	(0.43)***	(0.01)***	(0.06)***
Disease	5.05	5.10	4.58	0.21	0.95
	(0.739)***	(0.77)***	(0.67)***	(0.03)***	(0.10)***
System	4.51	4.18	4.05	0.24	0.82
	(0.406)***	(0.40)***	(0.36)***	(0.01)***	(0.06)***
Nervous	4.43	4.06	3.85	0.24	0.79
	(0.56)***	(0.57)***	(0.48)***	(0.02)***	(0.09)***
Mental	3.67	3.69	3.54	0.19	0.76
	(0.63)***	(0.67)***	(0.58)***	(0.03)***	(0.11)***
Circulatory	4.67	4.45	4.17	0.25	0.85
	(0.30)***	(0.29)***	(0.25)***	(0.01)***	(0.05)***
Respiratory	5.89	5.42	5.18	0.24	1.00
	(0.47)***	(0.47)***	(0.42)***	(0.01)***	(0.06)***
Digestive	5.30	4.81	4.58	0.23	0.91
	(0.87)***	(0.83)***	(0.69)***	(0.02)***	(0.11)***
Headache	3.22	2.63	2.67	0.07	0.77
	(0.97)***	(0.94)***	(0.92)***	(0.09)	(0.15)***
Musculo-Skeletal	4.10	3.86	3.55	0.22	0.80
	(0.28)***	(0.29)***	(0.24)***	(0.01)***	(0.05)***
Accident	8.73	8.81	7.95	0.18	1.33
	(1.34)***	(1.29)***	(1.17)***	(0.03)***	(0.12)***
Other	3.25	2.91	2.93	0.16	0.67
	(0.54)***	(0.59)***	(0.55)***	(0.02)***	(0.11)***
GHQ	0.29	0.30	0.30	0.03	0.09
	(0.03)***	(0.04)***	(0.03)***	(0.01)***	(0.01)***
GHQ^2	-0.10	-0.01	-0.01	-0.001	-0.003
	(0.003)***	(0.004)**	(0.003)***	(0.001)*	(0.001)**
Number of Observations	20,466	20,466	20,466	20,466	13,735
Log-Likelihood	-44,857.32	-44,234.01	-44,111.96	-11,306.43	-32,838.51
AIC	89,784.640	88,608.02	88,363.920	22,682.860	65,747.020
BIC	90,062.068	89,162.88	88,918.776	22,960.288	66,010.490
AIC				88,429.880	
BIC				88,984.736	

Notes: (i) Standard errors, which are adjusted for the clustering of observations by household, are reported in parentheses.
(ii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

BIBLIOGRAPHY

[1] Tussing, A. (1985). *Irish Medical Care Resources: An Economic Analysis*. General Research Series Paper No. 126. Dublin: Economic and Social Research Institute.

[2] Rossiter, L. and Wilensky, G. (1984). Identification of Physician-Induced Demand. *Journal of Human Resources*, 19 (2), 231-244.

[3] Tussing, A. (1983). Physician-Induced Demand for Medical Care: Irish General Practitioners. *The Economic and Social Review*, 14 (3), 225-247.

[4] Sørensen, R. and Grytten, J. (1999). Competition and Supplier-Induced Demand in a Health Care System with Fixed Fees. *Health Economics*, 8 (6), 497-508.

[5] Carlsen, F. and Grytten, J. (1998). More Physicians: Improved Availability of Induced Demand? *Health Economics*, 7 (6), 495-508.

[6] Grytten, J., Carlsen, F. and Sørensen, R. (1995). Supplier Inducement in a Public Health Care System. *Journal of Health Economics*, 14 (2), 123-262.

[7] Grytten, J., Carlsen, F. and Skau, I. (2001). The Income Effect and Supplier-Induced Demand: Evidence from Primary Physicians in Norway. *Applied Economics*, 33 (11), 1455-1467.

[8] Grytten, J. and Sørensen, R. (2001). Type of Contract and Supplier-Induced Demand for Primary Physicians in Norway. Journal of Health Economics, 20 (3), 301-460.

[9] Birch, S. (1988). The Identification of Supplier-Induced Demand in a Fixed Price System of Health Care System. *Journal of Health Economics*, 7 (2), 129-150.

[10] Cromwell, J. and Mitchell, J. (1986). Physician-Induced Demand for Surgery. *Health Economics*, 5 (4), 293-313.

[11] Croxson, B., Propper, C. and Perkins, A. (2001). Do Doctors Respond to Financial Incentives? UK Family Doctors and the Fundholding Scheme. *Journal of Public Economics*, 79 (2), 375-398.

[12] Dusheiko, M., Gravelle, H., Jacobs, R. and Smith, P. (2003). *The Effect of Budgets on Doctor Behaviour: Evidence from a Natural Experiment.* Discussion Paper in Economics No. 2003/04, University of York.

[13] Competition Authority (2003). *Professions Study*. Available from: www.tca.ie/professions.html

[14] Central Statistics Office (2002). *Quarterly National Household Survey: Health*. Dublin: Central Statistics Office.

[15] Blundell, R. and Costas Dias, M. (2000). Evaluation Methods for Non-Experimental Data. *Fiscal Studies*, 21 (4), 427-468.

[16] Chiappori, P., Durand, F. and Geoffard, P. (1998). Moral Hazard and the Demand for Physician Services: First Lessons from a French Natural Experiment. *European Economic Review*, 42 (3-5), 499-511.

[17] Cockx, B. and Brasseur, C. (2003). The Demand for Physician Services: Evidence from a Natural Experiment. *Journal of Health Economics,* 22 (6), 881-914.

[18] Van de Voorde, C., Van Doorslaer, E. and Schokkaert, E. (2001). Effects of Cost Sharing on Physician Utilisation under Favourable Conditions for Supplier-Induced Demand. Health *Economics*, 10 (5), 457-471.

[19] Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

[20] Nolan, B. (1991). *The Utilisation and Financing of Health Services in Ireland*. General Research Series Paper No. 155. Dublin: Economic and Social Research Institute.

[21] Callan, T., Nolan, B., Whelan, B., Hannan, D., Creighton, S. (1989). *Poverty, Income and Welfare in Ireland*. General Research Series Paper No. 146. Dublin: Economic and Social Research Institute.

[22] Schellhorn, M. (2001). The Effect of Variable Health Insurance Deductibles on the Demand for Physician Visits. *Health Economics*, 10 (5), 441-456.

[23] Cameron, A., Milne, F., Trivedi, P. and Piggott, J. (1988). A Microeconometric Model of the Demand for Health Care and Health Insurance in Australia. *The Review of Economic Studies*, 55 (1), 85-106.

[24] Hakkinen, U., Rosenqvist, G. and Aro, S. (1996). Economic Depression and the Use of Physician Services in Finland. *Health Economics*, 5 (5), 421-434.

[25] Jimenez-Martin, S., Labeaga, J. and Martinez-Granado, M. (2002). Latent Class Versus Two-Part Models in the Demand for Physician Services Across the European Union. *Health Economics,* 11 (4), 301-322.

[26] Harmon, C. and Nolan, B. (2001). Health Insurance and Health Services Utilisation in Ireland. *Health Economics*, 10 (2), 135-145.

[27] Holly, A., Gardiol, L., Domenghetti, G. and Bisig, B. (1998). An Econometric Model of Health Care Utilisation and Health Insurance in Switzerland. *European Economic Review*, 42 (3-5), 513-522.

[28] Hurd, M. and McGarry, K. (1997). Medical Insurance and the Use of Health Care Services by the Elderly. *Journal of Health Economics*, 16 (2), 129-154.

[29] Jones, A., Koolman, X. and van Doorslaer, E. (2002). *The Impact of Private Health Insurance on Specialist Visits: Analysis of the European Community Household Panel (ECHP)*. Working Paper No. 9. Rotterdam: Erasmus University, ECuity II Project.

[30] Vera-Hernandez, A. (1999). Duplicate Coverage and the Demand for Health Care. The Case of Catalonia. *Health Economics*, 8 (7), 579-598.

[31] Waters, H. (1999). Measuring the Impact of Health Insurance with a Correction for Selection Bias: A Case Study of Ecuador. *Health Economics*, 8 (5), 473-483.

[32] Durkan, J., Harmon, C. and Hughes, J. (1996). *Health Services Utilisation in the UK: An Empirical Analysis using Microdata.* Working Paper N65/07/96, Department of Economics, National University of Ireland, Maynooth.

[33] Giuffrida, A. (2000). *Night Visits in General Practice: Practice Organisation and Patient Demand.* Technical Paper Series 16, Centre for Health Economics, University of York.

[34] Kelleher, R. and McElroy, B. (2002). *A Comparison of Alternative Models to Assess the General Practitioner Weighted Capitation System in Ireland.* Paper presented to the 17th Annual Irish Economics Association Conference 2002.

[35] Buchmueller, T., Couffinhal, A., Grignon, M. and Perronnin, M. (2002). *Access to Physician Services: Does Supplemental Insurance Matter? Evidence from France.* Working Paper No. 9238, National Bureau of Economic Research, Washington.

[36] Gerdtham, U. (1997). Equity in Health Care Utilisation: Further Tests Based on Hurdle Models and Swedish Micro Data. *Health Economics*, 6 (3), 303-319.

[37] Pohlmeier, W. and Ulrich, V. (1995). An Econometric Model of the Two-Part Decision Process in the Demand for Health. *The Journal of Human Resources*, 30 (2), 339-361.

[38] Van Doorslaer, E., Koolman, X. and Puffer, F. (2001). *Equity in the Use of GP and Specialist Care in OECD Countries: Has Equal Treatment for Equal Need been Achieved*. Working Paper No. 3, ECuity II Project, Erasmus University, Rotterdam.

[39] Nolan, B. (1993). Economic Incentives, Health Status and Health Services Utilisation. *Journal of Health Economics*, 12, 151-169.

[40] Grootendorst, P. (1995). A Comparison of Alternative Models of Prescription Drug Utilisation. *Health Economics*, 4 (3), 183-198.

[41] Santos Silva, J. and Windmeijer, F. (1999). *Two-Part Multiple Spell Models for Health Care Demand*. Working Paper 99/2, Institute for Fiscal Studies, London.

[42] Gerdtham, U. and Trivedi, P. (2000). Equity in Swedish Health Care Reconsidered: New Results based on the Finite Mixture Model. *Health Economics*, 10 (6), 565-572.

[43] Rice, T. and Labelle, R. (1989). Do Physicians Induce Demand for Medical Services? Journal of Health Politics, Policy and Law, 14 (3), 587-600.