Physician-Induced Demand for Medical Care: Irish General Practitioners

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Abstract: In a cross-section study based on a national household sample survey, return visits with general practitioners (GPs) vary with the ratio of GPs to population. Thus, higher physician supply, which by itself would depress physician incomes, is compensated for by higher utilisation, in the form of increased return visits. Return visits also vary inversely with the regional ratio to population of low-income persons with free GP care. These results suggest that some demand for GP services is induced by the GPs themselves, for self-interested economic reasons. Similar studies have produced similar results in other countries with fee-for-service methods of remunerating physicians.

I INTRODUCTION

One difference between medical care and other private goods which are sold in markets is that in the market for medical care, supply and demand may not be independent. Much resource utilisation in medical care is physician-

induced. The possibility arises that physicians generate demand for their own services, at least in part, for self-interested economic motives. This paper presents some rather unique data from Ireland on physician-induced demand, and uses those data to examine some propositions bearing on various models of physician behaviour.

The present paper is part of a major study of utilisation in Ireland of a wide range of medical care services. Recent growth in medical care expenditures in Ireland has been explosive and unsustainable. The larger study focuses on the reasons for this growth and possible means of containing it, concentrating on the role of consumer and, especially, provider incentives. It is expected that the study as a whole will be published later by The Economic and Social Research Institute. Both the larger study and the present paper are based in considerable part on a national household survey of medical care utilisation, conducted by the author in 1981, using the facilities of the Survey Unit of The Economic and Social Research Institute. The survey is discussed later.

II PHYSICIAN-INDUCED DEMAND

Apart from the initial decision to contact a primary care physician, which is usually made by the patient (or a responsible member of the patient's household), many, and perhaps most, medical care decisions are made by, or strongly influenced by, the physician. The latter typically decides on the need for a return appointment or appointments; refers patients to other doctors, such as specialist; refers patient to non-doctor practitioners, such as nurses, dentists, or social workers; refers patients to hospital for x-rays, laboratory tests, or other out-patient services; prescribes medicines; suggests or orders over-the-counter non-prescription medicines; prescribes, orders, or suggests devices and appliances; and refers patients to hospital for admission. Where the patient is referred to a second physician, such as a specialist, that doctor is likely to make or to strongly influence further utilisation decisions. Many of these decisions affect the physician's own income and/or workload.

There are two principal models of physician behaviour: the "agency" model and the self-interest model.[1] The former is due to Feldstein (1974).

1. These two hardly exhaust the possibilities, however. Two other conceivable models are a "medical ethics model," in which the physician maximises the health of the patient at hand, regardless of cost, and in which the focus is on the individual patient, not on society; and the "resource rationing model," in which physicians act (often in a non-market system) to evaluate scarce medical resources (especially hospital bed time) at their true or economic values rather than at their (near-zero) prices.

The patient indicates his or her financial position, insurance coverage, and relevant preferences to the doctor, who then uses his or her own technical medical expertise to act for the patient ". . . as he would for himself if he had the appropriate expertise." If and to the extent that the physician acts in the sole interest of the patient, ". . . it would be difficult if not impossible to distinguish the agency relation from the traditional model of independent consumer behaviour on the basis of observed household consumption. . . . If the agency relationship is complete, it can essentially be ignored for the analysis of demand." Though Feldstein concedes that the relationship is not complete, he argues that "available evidence . . . does seem to support the notion of a generalized agency model of household demand for hospital services."[2]

There are a number of versions of the self-interest model. Two propositions, both having important policy implications, arise out of this literature:

1. Methods of remunerating physicians influence utilisation. Where doctors are paid on a fee-for-service basis, utilisation (including surgery) rates are higher than where capitation or salary methods are used, even where a similar or identical clientele are served.[3]

2. The agency model seems to lack a clear rationale, in terms of doctors' utility functions. The implied utility function, which is so empathetic that only patients' incomes and consumption levels appear, and from which physician self-interest is absent, is implausible, inconsistent with the traditions of economics, and at odds with our daily perceptions of physician incomes and workloads. "If the market is perfectly competitive, there is no reason for the physician not to act as a pure agent, while if the market is monopolistic, it appears to be inconsistent to assume that the physician is an income maximizer when he sets prices but not when he offers advice" Paul (1980).

3. However, it also appears that the same pattern of variability, albeit at different levels, exists in different countries for common surgical practices, irrespective of method of financing. Monsma (1970), Rutten (1978), and van der Gaag (1978), among others, find higher utilisation with fee-for-service remuneration methods in otherwise similar populations. In Monsma's study, there was a higher level of surgery in an American fee-for-service institutional arrangement than in an otherwise identical system under which the doctors were salaried; and evidence is produced suggesting that all appropriate surgery was, in fact, performed in the salaried case. Rutten and van der Gaag's studies were of the Netherlands health system. Abel-Smith (1979) notes that in the European Economic Community, the six countries with the highest pharmaceutical prescribing rates per person (with rates ranging from 9 to 21) remunerate primary care physicians on a fee basis. The three countries with the lowest prescribing rates, ranging from 4.5 to 6.9, all use a capitation method. Italy recently completed a major reform in its health care system, shifting (among other things) from a fee to a capitation system for remunerating primary care physicians. During the transition, it was found that "the number of consultations per patient under fee-for-service payment was on average greater than under capitation payment" (Abel-Smith and Maynard, 1978). McPherson, Wennberg, Hovind and Clifford (1982) examined surgery rates for tonsillectomy, hemorrhoidectomy, and five other common procedures in three New England states, Norway, and England, and found that while surgery rates were higher in the US (where a fee-for-service system obtains), patterns of variability were the same in the three countries, suggesting a less important role for method of finance. Health Maintenance Organisations (HMOs) are private organisations in the US where patients pre-pay for medical care on an annual fee basis, so that they in effect pay for all medical care and not merely GP services on a capitation basis. A large literature shows lower utilisation, especially hospitalisation, under HMO arrangements.

2. An increase in the quantity of physicians relative to population, in a cross-section sense, is associated with a compensating rise in utilisation (including surgery), or price, or both.[4] We call this compensatory demand stimulation.

The present paper concerns the latter hypothesis. It, and a similar proposition relating to hospitalisation,[5] have given rise to the notion of ". . . an advanced form of Parkinson's law" operating in the medical care area, according to which ". . . to whatever extent health care resources are expanded they will still all be used . . ." (UK Office of Health Economics, 1979). The notion of a medical Parkinson's law is an extremely important one, both in the conceptualisation of markets for medical care, and in the control of health care expenditures. If it is correct, then medical care costs might be restricted by *limiting* the quantities of resources employed — restricting entry into medical school, controlling hospital construction, etc. If it is incorrect, and medical care markets are conventional (including possible applicability of an agency model), then costs might be controlled by precisely the opposite policies — *increasing* the numbers of physicians, and building more hospitals. Governments in North America and Western Europe appear to be acting as if such a Parkinson's Law did apply.[6]

If doctors have the ability to shift patients' demand curves, and if they are profit-maximisers, they might be expected to shift demand as much as they are capable, irrespective of doctor-population ratios. Such behaviour would be inconsistent with compensatory demand stimulation, and would moreover be virtually impossible to detect empirically. In the literature, two main devices are relied upon to limit or constrain doctors' demand stimulation in self-interest models. One is an assumption that doctors engage in "satisficing" rather than in maximising behaviour (Evans, 1974; Evans, Parish and Sully, 1973; Fuchs, 1978; Fuchs and Kramer, 1972; Hixson, *et al.*, 1980; Newhouse, 1970; Sweeney, 1982). In particular, in this literature, it is hypothesised that doctors aim for exogenously determined *target incomes* (linked, e.g., to the incomes of other professionals in the community). If doctors' locational

4. See among others, Fuchs and Kramer (1972), Fuchs (1978), Evans (1974), Held and Manheim (1980), Mitchell, Cromwell and Dutton (1981), and Reinhardt (1973). Mitchell, Cromwell and Dutton contains an excellent overview and critique of the existing literature. See also the critique by Sloan and Feldman (1978); and for a critique of that critique, see Reinhardt (1978).

5. There is evidence that within the British NHS, despite rather large changes in the throughout capacity of the hospitals, the total waiting list has remained remarkably constant (Culyer, 1976).

6. The Netherlands, Denmark, France, Germany and Ireland are restricting the numbers of entering medical students on the basis of this theory. The United States and Canada are restricting physician immigration on the same basis. The USA and all members of the EEC restrict hospital construction and expansion in order to restrict utilisation. In France, this is the central cost-containment strategy.

decisions are also exogenously determined, target incomes can be achieved or approached by demand stimulation.

The second device, used in the context of a utility-maximising model, is to assume that doctors have a distaste for demand stimulation. Increases in demand stimulation ". . . imply the physician is giving poor medical advice or is prescribing unnecessary treatment. The physician receives disutility and is sensitive to these concerns because physician-initiated demand may not be associated with good medical practice and the physician may come under scrutiny by peer review procedures, insurers, or consumers," (Wilensky and Rossiter, 1980). Though physicians get disutility from demand stimulation, they also, of course, get utility from the income derived therefrom. This kind of model yields demand stimulation which is, among other things, in effect compensatory for physician density. Patients are more likely to resist demand stimulation when their out-of-pocket costs are high.

In the present paper, as will be seen below, a model is tested in which physician demand stimulation is a positive function of doctor density, and a negative function of patient resistance/doctor reluctance. Our data do not permit us to distinguish the target-income hypothesis from the utility-maximising model. However, this is a minor matter, as the central implications of the two models are the same.

III EMPIRICAL LITERATURE

No prior economic studies exist on either Irish medical care utilisation or physician behaviour. Empirical testing elsewhere for compensatory demand stimulation has in effect been along two lines. The first can be discussed by reference to Figure 1, which is due mainly to Reinhardt (1978).[7]

In Figure 1, the initial supply curve (S_o) and demand curve (D_o) provide the initial equilibrium price (P_o) and quantity (Q_o). Then an outward shift in supply (to S_1) is brought about by an increase in the number of doctors (all quantities are relative to population). If the market is competitive and supply and demand are effectively independent (including the possibility of doctors' acting as patients' agents, as above), price falls (to P_1) and output rises (to Q_1). An increase in the ratio of doctors to population results in an increase in the number of contacts (visits, etc.) per capita. Note that the positive relationship between physician supply and utilisation is not taken to be an indication of physician-induced demand. It might be called price-induced demand, and it represents an ordinary adjustment process, found in conventional markets. If doctors influence demand in this case, they do so

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7. The graph in effect consolidates two which appear in Reinhardt (1978) and one which appears in Auster and Oaxaca (1981). The discussion is due to these sources.
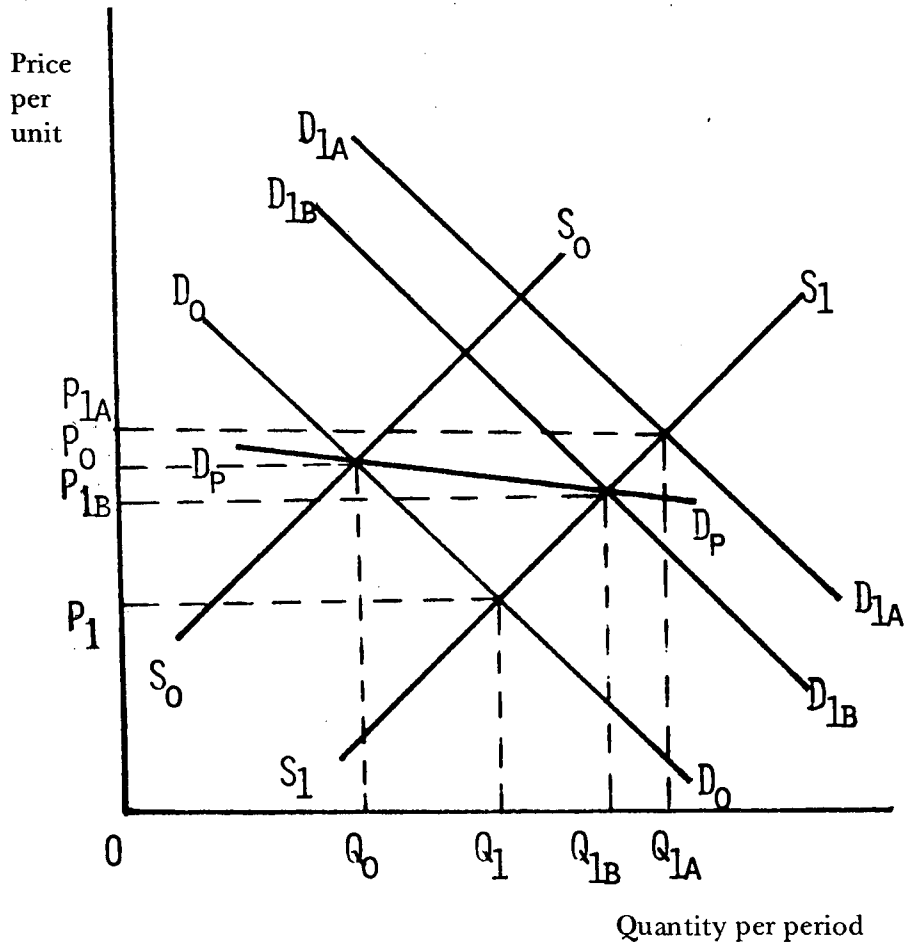
Figure 1: *Provider-Induced Demand vs. Price-Induced Demand*

Table 1: *Whose idea was most recent GP consultations? And was a return visit arranged at most recent GP consultation? Per cent distribution by Category of Health Services Entitlement*

Category of Entitlement	Most recent GP consultation was: (Per cent)					Per cent with a return visit arranged	Total number in sample
	Return visit	GP's Idea	Another Doctor's Idea	Household Member's Idea[a]	Other		
Category I	39.8	4.6	1.2	53.9	0.6	34.9	946
Category II	24.2	3.5	0.1	71.0	1.2	17.8	1101
Category III	15.8	3.7	0.2	79.1	1.2	13.3	426
All Persons	28.7	4.0	0.5	65.8	1.0	23.5	2472

a. Includes patient, parent, etc.

only within the context of an agency model. In this solution, the average doctor's workload falls (the number of doctors, indicated by the rightward shift in S, exceeds the rise in Q, from Q_o to Q_1). The unit price, P, also falls. Therefore, average physician income falls. Again, this is the result in a normally competitive market. In the satisficing model, income tends away from target. In the utility model, utility presumably falls.

Now let is be supposed that doctors are willing and able to induce a compensating increase in demand for their own services, and that the demand curve therefore shifts outward to D_{1A} or D_{1B}. Quantity rises (to Q_{1A} or Q_{1B}) but price can either rise (P_{1A}) or fall (P_{1B}) depending on the extent or degree of the compensating shift in demand (in conjunction with the elasticity of supply).

If we observe a positive association between doctor-population ratio and price or doctors' fees, as with the shift to P_{1A}, with other influences controlled for, we can conclude that we have a case of provider-induced demand. Controlling for other variables is important: if among regions we have differences in tastes, incomes, health status, etc., we certainly could observe differences in both physician-population ratios and prices without having to resort to supplier-induced demand for an explanation. It is also usually important to control for distance between patient and doctor as a type of time price. Otherwise, low physician density might imply 'i gher average distance to doctor's office, and higher time price to go along with the lower money price. High physician density areas would have lower time prices and higher money prices.

Though some studies (e.g., Evans, 1974; Held and Manheim, 1980)[8] have found positive associations among physician-population ratios, consulting rates, and fee levels, the situation depicted by D_{1B} and P_{1B} may be more common. In this case, though there is a compensatory demand shift, it is insufficient to raise or even maintain fee levels. There is no a priori way to determine whether fee levels will actually rise, in existing satisficing or utility-maximising models (Anderson, House and Ormiston, 1981). If demand shifts only to D_{1B}, we will not be able to identify the shift at all, as we will not be able to distinguish between it and the pseudo demand curve, D_p (Auster and Oaxaca, 1981).

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8. Held and Manheim (1980) find a positive net relationship between patient cost of hypertension treatment and physician to population ratio. The elasticity is described as low, 0.12. In addition, they find a low, positive relationship, elasticity = 0.08, between revisit rate and physician to population ratio. The latter is not significant at .05, though it is at .10. On the basis of these findings, Held and Manheim conclude that physician inducement may indeed be present, but that it is not important, because of the low elasticities. This appears to be a misreading of the authors' own results, as Figure 1 helps us understand: Low positive relationships can imply quite considerable physician inducement, offsetting the effects of supply.

Most of the studies cited have employed aggregated cross-section data, which regress, for example, mean consulting rates on doctor densities for metropolitan areas or whole American states. Individual data would reduce the identification problem.

Mitchell, Cromwell and Dutton (1981), using individual patient data, find evidence of compensatory demand inducement amongst US surgeons, affecting surgery rates and, especially, fees. However, they find no inducement in rural areas and considerable inducement in densely populated urban areas. Pauly, in an important book (1980), and Pauly and Satterthwaite (1980), emphasise the significance of information in individual patient-based empirical models. Patients with adequate information on price and quality of medical care — taken to be persons with much education, or persons who live in rural areas — do not show significant compensatory demand-inducing effects in Pauly's test of the target-income model. Only less-educated urban residents, whose access to information is most limited, are subject to significant inducement as measured by utilisation levels. Pauly and Satterthwaite advance the theory that physicians' monopoly power increases as the number of physicians in a market (as measured by the ratio of physicians to *area*) increases, because the increase in numbers is associated with a fall in the amount and quality of consumer information, especially as regards alternative providers. They find physician-to-population ratios strongly correlated with physician-to-area ratios, and speculate that the former may be a proxy for the latter in many demand-inducement models. However, Mitchell, Cromwell, and Dutton, with a larger and more varied data set, in which the correlation between the two ratios is lower, find that the inclusion of the physician-to-area variable actually increases the significance of the physician-to-population variable, in explaining utilisation levels.

The main reason we have usually had to try to infer the existence of physician-induced demand from utilisation levels is that we have ordinarily had no direct observation of physician behaviour. An important exception is Wilensky and Rossiter (1981), whose unique data set from the USA includes ". . . a direct measure, from the patient's perspective, or the perspective of a member of the patient's household, of who initiated the demand for each visit . . ." the doctor or the patient. They also have extensive data on physicians, linked to the household sample. They found 39 per cent of American doctor consultations to be physician-initiated. Their empirical work uses the probability that a visit is physician-initiated, rather than utilisation itself, as the dependent variable. Wilenksy and Rossiter found a strong relationship between physician initiation and local physician density.

IV THE IRISH MEDICAL CARE SYSTEM

In order to follow the argument of this paper, one needs to understand only three things about the Irish medical care system.

First, with certain traditional exceptions (e.g., paediatricians, opthalmo-logists), primary care is given in Ireland only by general practitioners (GPs). With the same exceptions, patients can see specialists only on referral from a GP. GPs do not have access to patients in hospital, do not perform significant amounts of surgery, do not have x-ray or pathology facilities as parts of their practices, and do not work in partnership with specialists or non-physician professionals. Hence, if Irish GPs stimulate demand for their own services, it must be almost entirely by generating return visits, or, more rarely, by some-how stimulating an initial visit.

Second, the Irish system of entitlement to free (state-financed) or state-subsidised health care services is a complex one, but for our purposes the main outlines are sufficient. The lowest 35 per cent or so in the income dis-tribution are entitled to all services free of charge. These people are said to have "Category I eligibility." The next 50 per cent or so have "Category II eligibility," and have most services free or subsidised. They must, however, pay their GPs themselves. The top 15 per cent have "Category III eligibility," which entitles them to the fewest free services. Like those in Category II, they must pay their own GPs.[9]

Third, the same GPs who treat public (Category I) patients also treat pri-vate (Category II and III) patients. Doctors are paid on a fee basis by the state for public patients and by the patient for private patients.[10] The aver-age fee for private patients is about 1.6 times that paid by the state for pub-lic patients.[11]

9. Many of those in Category II and most of those in Category III are covered under Voluntary Health Insurance (VHI). Though VHI provides mainly for hospitalisation, it does cover such out-patient care as GP consultations after a large deductible is reached. Statistical work produced no evidence of an effect of VHI cover on GP consulting rates or on revisit rates. See note 19.

10. For historical reasons, approximately 5 per cent of Irish GPs are paid on a salary basis for their services to public patients, and another 15 per cent are paid on a fee basis subject to a minimum income. Because our survey is household or patient based, we could not distinguish these physicians, or their patients, from the rest, and treat all GP remuneration as fee-for-service. This presumably worsens our results — lowers t and F statistics, R^2s, etc.

11. The ratio is based on the survey discussed in Section V. However, the statement requires some qualification. GPs are paid for public patients on the basis of an elaborate schedule for home visits (about 20 per cent of consultations in Ireland) according to distance, and for after-hours consulta-tions (whether home or office) according to time. Most GPs have only two fee levels for private patients: office visits and home visits. The ratio compares actual fees paid and may be biased by dif-ferences in home consulting rates and distances as between public and private patients.

This writer's analysis of Irish medical care expenditures, to be published elsewhere, indicates that GP fees account for only about 5 per cent of total medical care expenditures, public and private. It is not on account of their direct use of resources, then, that GPs are economically important. Rather, it is in their role as gatekeepers, or decision makers with respect to further utilisation, that GPs are most important. This writer's analysis indicates that GPs are responsible, directly and indirectly, for approximately two-thirds of all expenditures. Of estimated public and private expenditures in 1980 of approximately £740m, GPs were responsible for over £490m. Pauly (1980) compares the role the physician plays within the medical care sector to the role played by profits in industry. "Just as the incentive provided by the relatively small fraction of total spending that is profits determines the form and use of all inputs and outputs in conventional markets, similarly the relatively small amount that goes to physicians provides the financial incentive which determines the bulk of resource use, output quantities and characteristics, and total costs in the health sector."

Return visits to GPs, which are the subject of this paper, are particularly strongly associated with other further utilisation — x-rays, prescription medicines, laboratory tests, etc.

V THE SURVEY

In January, 1981, the author conducted a nationwide sample survey of households in the Republic of Ireland. Data were collected from 1,069 households on medical care utilisation and expenditures. Information was collected on each household member, so there are 4,522 observations. In the present paper, we include only those persons who reported consultations (either home or office/surgery visits) with GPs in 1980. Thus, the maximum number of observations is reduced to 2,874.[12]

The survey included two direct measures of self-referral by physicians, one the same as, and one similar to, that employed in the USA by Wilensky and Rossiter. Respondants were asked, with respect to each person's most recent GP consultation, whether it was a return visit, and whose idea it was. Return visits are deemed to have been the physician's idea. They were also asked, again with respect to each person's most recent GP consultation, whether a subsequent return visit was arranged at that visit.

12. The sample was selected using the RANSAM system as described in Whelan (1979). The response rate was 82 per cent. Respondents were asked in January, 1981, a battery of questions regarding medical care utilisation and expenditures for the calendar year 1980. As the questions are retrospective, they may be affected by errors of recall. We implicitly assume such errors to have a mean of zero. The questions included many on utilisation, referral, expenditures, etc., which served both as aids to memory and as cross-checks on responses.

VI THE MODEL

Self-referral occurs when a physician orders, suggests, or arranges for a patient to consult with the same physician himself or herself. Usually, this occurs on return visits. Return visits occur for medical reasons, but they have implications for physician income. We distinguish, then, between self-referral, which is a broad category including all cases of doctor-inspired or suggested consultations, and demand stimulation, which is directed to the doctor's own self-interest.

The income of the ith doctor, Y_i, depends on the number of consultations in the same time period with his public patients, C_{pi}, and with his private patients, C_{mi}, and the fee levels for public and private patients respectively, F_p and F_m.

$$Y_i = Y (C_{pi}, C_{mi}, F_p, F_{mi}) \qquad (1)$$

We will assume that fee levels are exogenously determined;[13] F_p is set centrally by the state, and is the same for all doctors. F_m does vary, and was mainly in the range £3.00-£4.50 during the period to which the sample refers.

$$F_p = F_{po} \qquad (2a)$$

$$F_{mi} = F_{mio} \qquad (2b)$$

The average regional public consulting rate, i.e., total number of public patient consultations (C_p) divided by the number of doctors (D), is the product of public patients (N_p) per doctor in the region, and consultations per patient; the same is true for private patients. If the ith doctor has the average consulting rates, we have:

$$C_{pi} = \frac{C_p}{D} = \frac{N_p}{D} \times \frac{C_p}{N_p} \qquad (3a)$$

$$C_{mi} = \frac{C_m}{D} = \frac{N_m}{D} \times \frac{C_m}{N_m} \qquad (3b)$$

Public patients per doctor depends on the size of the region's population, Q, number of doctors in the area, D; average health status of the local population, H; other background variables influencing demand such as income, social class, or occupation, Z; and the fraction of the local population with

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13. This seems unrealistic on a priori grounds, but we were unable to find statistically significant determinants of fee levels on a regional basis.

entitlement to free GP consultations, π:

$$\frac{N_p}{D} = N_p \ (Q, D, H, Z, \pi) \tag{4a}$$

Similar variables influence private patients per doctor in the region:

$$\frac{N_m}{D} = N_m \ (Q, D, H, Z, 1\text{-}\pi) \tag{4b}$$

Assume the jth patient's consultations equal the regional average. Consultations by the jth patient, if a public patient, depend on his or her health status, H_j; other background variables for medical care, Z_j; time-price of consultations, T_j; and demand stimulation by the doctor, S_j.

$$\frac{C_p}{N_p} = C_{pj} = C_p \ (H_j, Z_j, T_j, S_j) \tag{5a}$$

For private patients the variables are the same but include, in addition, the fee charged that patient, F_{mj}. If the jth patient were a private patient we would have:

$$\frac{C_m}{N_m} = C_{mj} = C_m \ (H_j, Z_j, T_j, F_{mj}, S_j) \tag{5b}$$

So, substituting (2a) and (2b) through (5a) and (5b) into (1):

$$Y_i = Y(H, Z, F_p, F_{mj}, T, Q, D, \pi, S_i) \tag{6}$$

where H, Z, and T are average values for the area.

Without the effect of S_i, the ith doctor's (unstimulated) income is

$$Y_{ai} = Y_a (H, Z, F_p, F_{mi}, T, Q, D, \pi) \tag{7}$$

where $\frac{\partial Y_a}{\partial Q} > 0$, $\frac{\partial Y_a}{\partial D} < 0$, and the sign of $\frac{\partial Y_a}{\partial \pi}$ is not obvious. It should be clear that $\frac{\partial Y_a}{\partial (D/Q)} < 0$. But the sign of $\frac{\partial Y_a}{\partial \pi}$ depends on the relative sizes of C_p and C_m and on F_p and F_m. While private fees are higher than public fees, it is also true that public consulting rates are, on average, very much higher than private consulting rates, and the effect on a doctor's income, net of demand stimulation, of π is problematical.

If a doctor has a target income, then his or her efforts at demand stimulation, S, will be influenced by the difference between that target and Y_a. Simplifying, we can argue that S is an inverse function of Y_a. A similar hypo-

thesis can be derived from utility-maximising models. The doctor's demand stimulation efforts may be limited or inhibited by a distaste for additional workload, by resistance from patients, and by a feeling of guilt by the doctor for stimulating demand unnecessarily. We combine these inhibiting factors, without concerning ourselves with their relative strengths, in B_p and B_m, for public and private patients, respectively. Presumably, $B_p < B_m$: resistance by patients will vary, cet. par., according to whether they must pay fees, and doctor's guilt should be expected to vary in the same way. B_p and B_m should also be expected to vary positively with time-price, T. Our expression for demand stimulation is:

$$S_i = S_i (Y_{ai}, B_{pi}, B_{mi})$$
(8)

or

$$S_i = S_i (H, Z, F_{mi}, T, \frac{D}{Q}, \bar{\pi})$$
(9)

where $\dfrac{\partial S_i}{\partial (D/Q)} > 0$

so that doctors stimulate more consultations per patient to offset a high ratio of doctors to population; and

where $\dfrac{\partial S_i}{\partial \pi} > 0$

as doctors face less resistance/guilt in stimulating public as opposed to private consultations.

However, when we look at the situation from the standpoint of the individual patient, whether public or private, rather than from that of the doctor, the sign changes: $\dfrac{\partial S_{ij}}{\partial \pi} < 0$

so that the tendency of a doctor to stimulate demand of the jth patient is negatively related to the fraction of the population in the area eligible for free consultations as public patients. The higher is $\bar{\pi}$, the greater will be the doctor's aggregate demand-stimulating opportunities, and the less will be the need to stimulate demand for any *given* patient.

While we have no opportunity to observe demand stimulation directly, our survey does give us two measures of doctors' self-referral. Self-referral can arise either out of the agency model or the self-interest model. In the agency model, if there is no demand stimulation, self-referral is a function of the patient's health status, H_j; background variables, Z_j; entitlement under

the health services, E_j; time-price, T_j; and the doctor's fee, F_m, though not F_p (which the patient does not pay). Demand stimulation in a self-interest model also depends on E_j and F_m. As F_p does not vary among patients, it does not appear in a cross-section model. In addition, demand stimulation depends on $\frac{D}{Q}$, the ratio of doctors in the population, and π, the fraction of the population eligible for free GP consultations. Thus, the model to be fitted is:

$$R_j = R\,(H_j, Z_j, E_j, T_j, F_m, \frac{D}{Q}, \pi) \qquad (10)$$

where R_j is the rate of self-referral by his or her physician of the jth patient.

As noted, we have two measures of self-referral. Respondents were asked, with respect to their most recent GP consultation in 1980, whose idea it was, or who first suggested that they see the doctor. Those not seeing a GP in 1980 are omitted, and those who responded that it was a return visit, or who stated that it was the general practitioner's idea, are coded 1 in the construction of a dummy dependent variable, called Whose Idea. Table 1, below indicates that 28.7 per cent of most recent visits were return visits, and another 4.0 per cent were reported as the GP's idea, for a total of 32.7 per cent physician self-referrals. However, those with free GP consultations (Category I) had a higher self-referral rate of 44.4 per cent (39.8 per cent return visits, and 4.6 per cent GP's idea). In addition, respondents were asked with respect to the most recent time each was seen by a GP in 1980, what the medical outcomes were, in terms of further medical care utilisation — whether pharmaceutical medicines were prescribed, the patient referred to hospital for admission, etc. Table 1 also indicates that 23.5 per cent of all visits with GPs led to a return visit being arranged. However, among those with free GP consultations, 34.9 per cent had return visits arranged. The dummy dependent variable Return Visit has a value of 1 where a return visit was arranged. Again, those without GP visits in 1980 were excluded. It is to be emphasised that self-referrals are not necessarily evidence in themselves of demand stimulation, as they can certainly reflect agency or other models of physician behaviour.

The expected signs of the agency partials are as follows:

$$\frac{\partial R_j}{\partial H_j} > 0,\ \frac{\partial R_j}{\partial Z_j} > 0,\ \frac{\partial R_j}{\partial E_j} > 0,\ \frac{\partial R_j}{\partial T_j} < 0$$

where H is interpreted as ill health or its proxies, and Z_j is interpreted as background characteristics associated with a taste for medical care. E_j appears in the model both to explain self-referral from an agency standpoint, and to explain demand stimulation. Both predict higher values of the depen-

dent variable if the patient has free GP consultations (as in Category I). If the doctor follows an agency model, and takes into account patient time-price, we would expect a lower rate of self-referral as patient's distance from the GP's surgery (office) increases.

For private patients, F_m appears in both the agency portion, where it has a negative sign, and in the demand stimulation portion, where it has a positive sign. However, as variability in F_m is not great, and as more demand stimulation is expected among public than private patients, little importance is attached to this variable. Our main tests of the demand-stimulation hypothesis lie first, as in the literature, in the doctor-population ratio, and second, in π, the fraction of the population eligible for free GP care. For reasons already noted, the sign of the former is hypothesised to be positive, and of the latter negative:

$$\frac{\partial R_j}{\partial F_m} > 0, \quad \frac{\partial R_j}{\partial (D/Q)} > 0, \frac{\partial R_j}{\partial \pi} < 0$$

VII ESTIMATION

Because our dependent variables are dummies, they are interpreted as probabilities. The right-hand-side variables' contribution to the probability that the present consultation was the GP's idea (in the case of Whose Idea), or that the consultation led to a future return visit being arranged (in the case of Return Visit), is measured by their coefficients. The model was estimated by the LOGIST procedure in SAS, a logistic multiple regression model. In addition, ordinary least squares (OLS) results are reported.[14]

For each patient, the following are used as independent variables:

Sex (female = 1). No health data are available, and sex is used as a proxy. Though women live longer, they traditionally have higher morbidity, and higher medical care utilisation rates. In addition, they are significantly less likely to be employed outside the home, and hence their opportunity costs of GP consultations (time-prices) may be lower.

Age and age-squared. Age serves as another proxy for health status. Aged people in particular frequently have chronic conditions, entailing return visits to physicians.

Category of health services entitlement. There are, as noted earlier, three categories of entitlement to free or subsidised health services: Category I, where all services, including GP consultations, are free to the user; Category II,

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14. OLS suffers from heteroscedasticity in the error term in the case of a dummy dependent variable. Even with weighted least squares, there is no guarantee that the predicted values of dependent variables will lie within the 0, 1 interval.

where most services, but excluding GP consultations, are free; and Category III, where the fewest services are free, and GP consultations are not. Unfortunately, the coefficients of these variables are difficult to interpret. They measure price, as they indicate whether the patient must pay for GP care. They may measure Z, as entitlement category is based on income. And they may measure health, as that is known to vary (inversely) with income. Separate dummy variables are included for Category I and III (Category II being included in the constant term). The sign of Category I is predicted to be positive, and, from the price standpoint at least, no significant difference is predicted between II and III, that is, the coefficient of Category III is predicted to be insignificant.

Distance from patient's home to GP. This is a measure of time-price. It is important to include this variable in the equation so that doctor-to-population ratio, below, does not indirectly measure time-price as well as the position of the supply curve. In addition, patient resistance to demand stimulation by the physician is expected to vary with time-price.

Doctor's fee (F_m). The variable is usual GP fee for an office or surgery consultation. Demand theory suggests the demand for return visits should be an inverse function of fee. Moreover, stimulation by physicians of more consultations may also be an inverse function of fee, as the two represent alternative avenues to a given target income.

In addition, three variables were included based on regional rather than patient data. The Republic of Ireland is divided into eight regional Health Board areas, and though each is fairly large (i.e., includes more than one county), each of them is also fairly homogeneous with respect to socioeconomic characteristics. Thus, within-region variation in these variables is assumed to be small, relative to between-region variation, though we have no data on the former. The variables are the *ratio of general-practitioners to population* (D/Q); *the ratio of persons with Category I eligibility to population* (π); and an *index of per capita personal income.*[15] The last of these is included as a control variable. Areas with high per capita incomes may have higher demand for medical care, higher utilisation of GP services, and consequent higher physician density. If higher utilisation takes the form of relatively larger numbers of return visits, a positive association would be observed between physician density and our two dependent variables. A weakness in our study may be the lack of further variables which might control for medical factors influencing both physician density and return visits, such as the regional prevalence of chronic conditions.

VIII THE RESULTS

The results are shown in Table 2. Sex of patient does not seem to affect self-referrals by GPs.[16] Age does: in every equation, either age, or age-squared, or both, are significant and, as hypothesised, positive. The coefficient of Category I is highly significant and, as hypothesised, positive, a result consistent with both the agency and the self-interest models. As noted, this result is consistent with several interpretations, as Category I reflects both price and income, as well as such correlates of income as morbidity.[17] Category III is negative, and either nearly significant (OLS models) or significant (LOGIST model) for Whose Idea, and negative but insignificant for Return Visit. Distance is among the most significant variables in explaining self-referral; its sign, as hypothesised, is negative. GP fee, as hypothesised, is usually (but not always) negative, but the F-statistics are so low that we should treat the coefficient as zero.[18]

The results point strongly in the direction of demand stimulation in a self-interest model. Physician density, or the doctor-population ratio, is positive and significant in both LOGIST models. In explaining Return Visits, it has the highest Chi-square of any variable in the LOGIST model, and its absolute contribution to determining the value of the dependent variable dwarfs that of any other variable. Thus, the more doctors there are per person in the population, i.e., the further to the right is the supply curve in Figure 1, the more doctors appear to compensate by arranging for return visits for their patients. As noted above, however, more medical variables which controlled for factors explaining both physician density and return visits would have increased our confidence in this interpretation of the result. The Public Patient ratio, or ratio of persons eligible for free GP consultations to population, is negative and significant throughout. Thus, the larger the region's ratio of persons with Category I eligibility, who both have higher utilisation rates and who are arguably more easily induced to return for further visits, the less likely the individual is to be affected by physician self-referral.

Contrary to hypothesis, per capita income has a significant and negative influence on self-referral, except in the LOGIST model of Return Visit, where the coefficient is barely insignificant (significant at the 10 per cent level). Evidently, if a person lives in a region with low per capita income, he

16. In results not reported here, sex has a very strong influence on GP consulting rates, however.

17. It appears not to reflect social class or education, however, even though these are likely to be correlates of category of eligibility. In results not reported here, controlling for occupation and education level of head of household did not materially alter the result reported here. See note 19.

18. This is also true, in results not reported here, where observations are limited to persons with Category II or III eligibility only. See note 19.

Table 2: *Regressions of Physician Induced Demand on Selected Variables, Ireland, 1980*

	Whose idea? (OLS unwtd.)	Whose idea? (OLS wtd.)	Whose idea? (LOGIST unwtd.)	Return visit (OLS unwtd.)	Return visit (OLS wtd.)	Return visit (LOGIST unwtd.)
Female	0.02735 (2.794)	0.02697 (2.318)	0.140063 (2.65)	0.02704 (3.247)	−0.02276 (1.981)	0.15186 (2.53)
Age	0.00208 (2.619)	0.00280 (4.340)*	0.01743 (6.16)*	0.00434 (13.608)**	0.00353 (8.312)**	0.04060 (25.68)**
Age-squared	0.00004 (5.976)*	0.00003 (2.994)	0.00009 (1.14)	−0.00000[a] (0.034)	0.00000[a] (0.025)	−0.00021 (4.58)*
Category I	0.06846 (8.584)**	0.07382 (7.508)**	0.32273 (7.22)**	0.11764 (30.145)**	0.12576 (26.160)**	0.65303 (24.90)**
Category III	−0.04462 (3.537)	−0.04748 (3.522)	−0.27697 (4.16)*	−0.03269 (2.259)	−0.03307 (2.051)	−0.25556 (2.65)
Distance	−0.01808 (12.196)**	−0.01573 (8.156)**	−0.08785 (9.89)**	−0.02937 (38.256)**	−0.02868 (32.530)**	−0.16050 (25.26)**
GP fee	−0.00156 (0.075)	−0.00160 (0.060)	−0.00888 (0.09)	−0.00774 (2.202)	−0.00684 (1.328)	0.04101 (1.66)
Public Patient ratio	−0.75636 (29.703)**	−0.70987 (22.639)**	−4.29669 (31.65)**	−0.30289 (5.666)*	−0.28707 (4.445)*	−4.57684 (27.12)**
Physician density	−0.00491 (0.100)	−0.01187 (0.486)	3.11552 (3.58)*	0.03942 (7.653)**	0.04001 (6.629)*	13.29396 (52.14)**
Per capita income	−0.61823 (29.421)**	−0.00641 (27.975)**	−0.02961 (26.78)**	−0.00218 (4.338)*	−0.00247 (4.990)*	−0.01199 (3.54)
Constant term	1.06071	1.06492	1.42713	0.37466	0.41946	−5.76760
$\bar{R}^2$ or D	.111	.118	.104	.103	.103	.112
N	2874	2482	2874	2874	2482	2874

Figures in parentheses below coefficients are F-statistics for OLS, Chi-square for LOGIST. Significance levels are * .05 and ** .01

or she is more likely to have GP consultations based on self-referral by the physician. This finding also appears to support the self-interest model, though admittedly it was not included among our self-interest hypotheses. If, *cet. par.*, persons with high incomes have a higher demand for medical care (including GP consultation), doctors in lower-income regions will have a greater need to stimulate return visits in order to maintain their incomes.

The results are robust and are essentially unaffected by partitioning the population, or by adding further variables reflecting education, social group, VHI cover, consultant density, and other influences.[19] It will be noted that $\bar{R}^2$ (R-square adjusted for degrees of freedom), and D, its equivalent in LOGIST models,[20] have low values, as is frequently the case with microdata. Our equations explain only about 10 per cent of the variability in the probability that a given visit is self-referred by the doctor, or that it leads to a self-referred return visit. This is neither surprising nor, from the point of view of the author, discouraging. Results obtained by others suggest that R^2s and Ds could be increased marginally had we more information such as household income, doctor income, doctor age, or the like. But it would be too much to expect such a basically medical variable as self-referrals by physicians to be dominated by essentially economic as opposed to medical explanatory variables. Our results show the economic variables to have an influence which is statistically quite significant and in strength far from trivial.

IX SUMMARY AND CONCLUSIONS

Our household survey of 1980 medical care utilisation in the Republic of Ireland yielded two measures of return visits to general practitioners: whether the most recent visit was a return visit, arranged at a previous visit; and whether a further return visit was arranged at the most recent visit. The present study focuses on explaining statistically what determines whether a given visit was a return visit or produced a return visit.

19. In a study to be published elsewhere, separate equations are estimated for (1) the whole population; (2) all persons except females aged 20-40 (to eliminate obstetrical consultations); (3) males; (4) females; (5) Category I only; and (6) Categories II-III only. In addition, the model adds the following independent variables: VHI cover; the ratio of consultant specialists to population; social group (head of household occupation group); other help (e.g., employer) with medical bills; household GP use; and age head of household completed full-time education. None of these changes significantly affected the results. These results are available from the author.

20. According to the SAS manual, "The D statistic is R-square in the normal setting. It is the value such that

$$D \cdot (n\text{-}p) \ (1\text{-}D) = \text{model chi-square}$$

where p is the number of variables in the model including the intercept and n is the number of observations."

The main results are as follows:

1. Return visits rise and fall with GP density, i.e., the ratio of GPs to population, holding constant the influence of other model variables. This is the main result of our study, and it is statistically very strong. It suggests that where GP density is high, so that GPs incomes would otherwise be depressed, GPs stimulate extra demand for their own services by arranging more return visits from patients.

2. Return visits rise as the ratio of persons with Category I eligibility (i.e., free GP care) falls, and vice versa, also holding constant other influences. This result also points in the direction of self-interested, compensatory demand stimulation by GPs. GP utilisation is higher, and return visits are also higher, among persons in Category I. Hence where the ratio of persons in Category I to the population is high, there will be less need to stimulate demand; where it is low, there will be more.

3. Persons in Category I, who have free GP services, low incomes, and possibly higher morbidity, have significantly more return visits than the rest of the population. This result is consistent with physician-induced demand, as this part of the population is less likely to resist demand stimulation; but it is also consistent with many other explanations, and cannot be taken as decisive evidence in favour of the self-interest hypothesis. Persons with Category III eligibility, who are like persons in Category II in that they must pay for GP care, but who are unlike them in having higher incomes, are less likely to have return visits, though the difference is (barely) insignificant at the 5 per cent level.

4. We also find that return visits rise with age; are inversely related to area per capita income; and are inversely related to distance from patient's home to GP. And we find that return visits are not significantly influenced by sex of patient or GP fee.

In terms of public and private fees paid to GPs, GP services are relatively inexpensive to Ireland, and demand stimulation by GPs would therefore appear to be a relatively unimportant source of inefficiency in the system. But as GPs are gatekeepers to the system, and as their decisions directly or indirectly influence an estimated two-thirds of all Irish medical care expenditures, the economic significance of demand stimulation is greater than would appear on the basis of direct cost. It also presumably has important medical implications.

It is to be emphasised that no wrong-doing among Irish general practitioners is necessarily to be inferred from these results. Medicine is an inexact science, and physicians vary in their methods according to their training, backgrounds, and experience; and a wide variety of return visit patterns is consistent with the same symptoms and diagnosis. Where a physician arranges a further return visit, in order to maintain a level of consultations consistent with a tar-

get income, it is unlikely that that visit is in any absolute sense "unnecessary". Shadings of judgement are involved, and those judgements are affected by, among other things, market conditions, and the physician's own economic self-interest. These findings do not point to any characteristic unique to Ireland. Similar studies have yielded similar findings in other countries where doctors are paid on a fee-per-item-of-service basis.

In Ireland, the fee-for-service system of remuneration obtains where a large fraction of the population are eligible for GP services without charge. Our results suggest that this is a questionable combination, and that it might be worthwhile to consider other remuneration schemes, such as salaries, capitation, or some arrangement such as in health maintenance organisations (HMOs), at least for Category I patients. These other methods have their own faults,[21] and cannot be adopted without serious consideration, but their faults are likely to be fewer than are found in the present arrangement.

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21. Where primary care physicians are paid on a capitation basis, referrals to specialists and hospital may be greater, and consultation times may be lower. Fee-for-service schemes can be usefully manipulated to induce desired behaviour, such as preventative care.

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