

**Supply and Demand for Medical Care:  
Or, Is the Health Care Market Perverse?**

**Professor Jeff Richardson**

Director, Health Economics Unit, Monash University

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The Co-ordinator  
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PO Box 477  
West Heidelberg Vic 3081, Australia  
**Telephone** + 61 3 9496 4433/4434      **Facsimile** + 61 3 9496 4424  
**E-mail** [CHPE@BusEco.monash.edu.au](mailto:CHPE@BusEco.monash.edu.au)  
**Web Address** <http://chpe.buseco.monash.edu.au/>

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## Abstract

This paper examines the structure of the health sector and summarises the reasons for believing that market behaviour is idiosyncratic. The pivotal relationship which largely permits this perversity is the influence of doctors over patients or, the so called theory of 'Supplier Induced Demand' (SID). Empirical evidence and theoretical arguments relating to the theory are summarised. Three analyses of Australian data are reported. These are (i) the correlational evidence from time series and cross sectional data; (ii) econometric analyses of cross sectional data; and (iii) evidence from the 'natural experiment' of public and private service use following hospital admission with a heart attack. It is concluded that, while the theory of SID is well supported and helps to explain the failure of simple competitive markets, it is not of decisive importance for the determination of future health sector reform which might, potentially, adopt either a competitive or cooperative model of health service delivery.

# Supply and Demand for Medical Care: Or, Is the Health Care Market Perverse?

## 1 Introduction

Virtually all economists who have analysed the health sector agree that it raises some unusual problems. As a minimum, orthodox economists generally agree that when patients are sheltered from the cost of health services by health insurance there will be an increase in demand—‘moral hazard’—and that the removal of demand side restraints will make the outcome of the otherwise competitive market problematical. The conclusion does not depend upon the assumption that health care and health insurance have a special role in the achievement of social justice—although this is almost certainly true. Unregulated competitive markets result in private health insurance and the effect upon moral hazard does not depend upon the reason for the health insurance. With either public or private insurance there will be a trade-off between objectives: more insurance reduces risk but increases demand and cost and, for this reason, most economists will countenance supply side controls as, at least, a possible way of ameliorating this problem.

Voluntary health insurance creates two further problems which are universally recognised; namely, cream skimming<sup>1</sup> and adverse selection<sup>2</sup>. Unlike moral hazard, however, these two outcomes are only a social problem if health insurance or health services are given special status. (The failure of a market to supply a normal product at a price that ensures that everyone buys the product is not a sign of market failure)<sup>3</sup>.

Other issues associated with the health sector are more contentious but a 1989 survey of primarily North American health economists found majority support for a number of propositions which would be regarded as surprising by most economists (Table 1). Some of the controversial results are supported by a more recent survey of 46 ‘leading health economists’ and 44 ‘leading theorists’ conducted by Victor Fuchs (1996) and reported in the *American Economic Review*. A larger percentage (81 percent) of the health economists believed that technological change was the primary reason for the health sector’s increasing share of the GDP than in the earlier survey.

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<sup>1</sup> Cream skimming occurs when private health insurers seek to attract members whose risks are significantly below premiums. For example, policies with generous benefits for sports medicine but with poor benefits for hip replacement or fractures would be attractive to the young but not to the elderly.

<sup>2</sup> Adverse selection refers to the possibility of a company attracting high risk members which will increase premiums and thereby deter low risk, low cost, people from purchasing the insurance. This, in turn, represents further adverse selection which will further increase premiums and drive out the remaining marginal patients. This process occurred with Australian private health insurance before the introduction of the 30 percent rebate and life time health insurance contracts (Industry Commission 1997).

<sup>3</sup> I have argued elsewhere that moral hazard is a problem only if health or health services are meritorious. A trade-off between risk and expected return (avoidance of moral hazard) is commonplace and the optimal portfolio of assets normally forgoes expected return in exchange for security (Richardson 1984).

Both groups in Fuch's survey agreed that moral hazard has had a significant and adverse effect (84 and 93 percent respectively) and that doctors have the power to 'shift the demand curve' (68 and 77 percent respectively). This latter result refers to the theory of Supplier Induced Demand (SID) or, with US terminology, Physician Induced Demand (PID) which is discussed at length in Sections 3 and 4 below. The theoretical basis of the theory is the existence of an asymmetry of information between doctors and patients or, as argued in Richardson (1999) an 'asymmetry' in the capacity of the patient and doctor to assess options in individual cases in the face of uncertainty.

**Table 1 Health Economists' Opinions**

Issue	Percent Responding			
	Feldman & Morrisey		Fuchs	
	(strongly) agree %	(strongly) disagree %	Health Economist %	Economist %
Physicians generate demand	81	17	68	77
Competition model cannot apply	46	16		
Hospitals shift costs	63	25		
Insurance causes a welfare loss	63	32	84	93
Technology is the culprit	46	50	80	37
	277		46	44

Source: Feldman & Morrisey (1990) p641.  
Fuchs (1996)

This asymmetry is one of the two elements of the medical market which, according to Canada's Bob Evans, permeates and dominates market behaviour and results in highly atypical behaviour. The second element is the structure of the power relationships which have evolved partly because of informational asymmetries and partly for historical reasons. As these latter factors are country specific, their effect also differs between countries. The framework developed by Evans and adopted by the OECD (1992) represents the most radical departure from the orthodox view of markets and is the basis for the discussion in Section 2.

Greatest attention is given here to the theory of Supplier Induced Demand. It has been the most contentious issue in the literature and, as discussed below, it is of pivotal importance in determining the significance of many of the possible relationships in the health sector and of the effectiveness of the alternative policies available for influencing cost and outcome.

## 2 Leaky Boundaries, Incomplete Vertical Integration and Market Behaviour

In his influential analysis of health markets Evans (1983) commences by noting that a description of the health sector must include at least four, not two, critical players<sup>4</sup>. These are the patient, the provider (doctors) the agency or agencies financing health services and the government/regulator. While normative analyses may speculate upon the effect of partly or

<sup>4</sup> The discussion here simplifies and 'Australianises' Evans, who, distinguishes first and second line providers, where the former may include pharmacists or primary health workers, etc.

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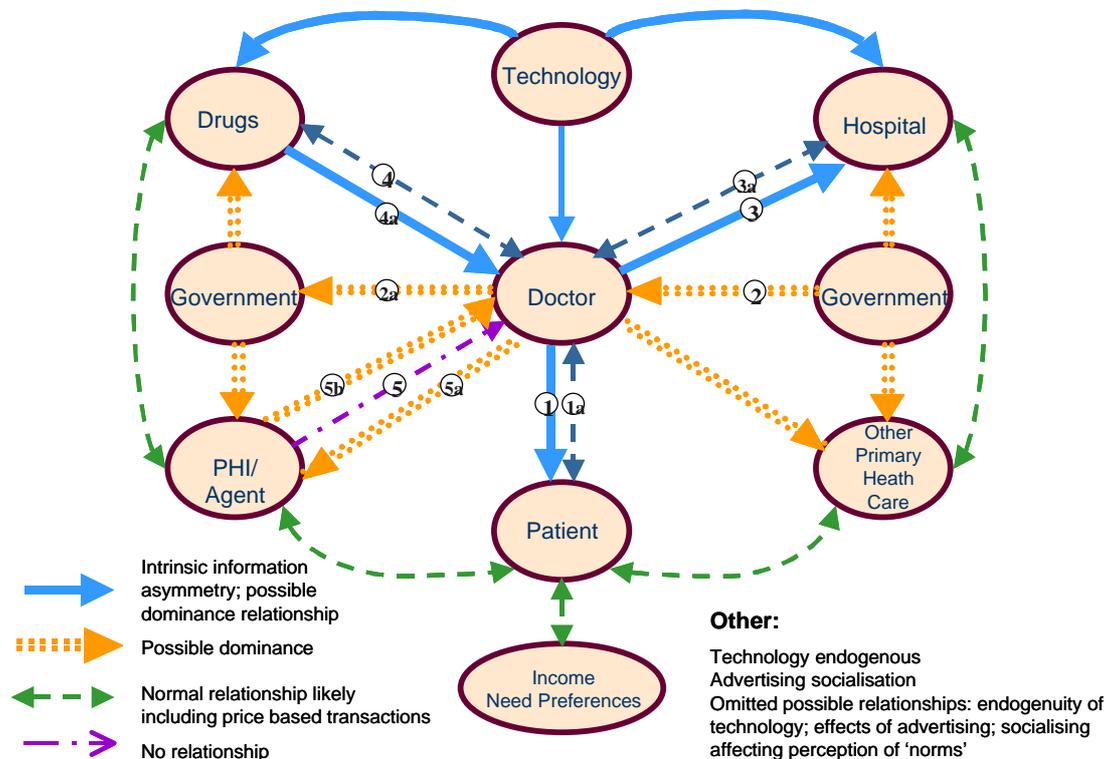
totally eliminating government, positive analyses cannot ignore the existence and influence of the body regulating most aspects of behaviour and providing the largest share of funds. Likewise every developed country operates with public or private insurance which fundamentally alters the relationship between patients and doctors/providers.

The relationship between these four bodies and between them and other parts of the health sector may vary and it is these relationships which are determined by informational asymmetries, unequal power and idiosyncratic institutional factors which may have evolved through time. Evans' key hypothesis is that because of these factors there is the possibility or likelihood of 'leaky boundaries': key players may forward integrate and take over or control some of the functions of other market players but do this without complete vertical integration. Market behaviour depends upon the pattern and extent of this incomplete vertical integration.

The possible behavioural patterns are illustrated in Figure 1. To simplify the figure the government is shown in two positions: government has a left wing and a right wing! Three sets of relationships are shown. First, thick lines depict cases where there is an inevitable information asymmetry: one body has greater technical knowledge or capacity to evaluate than another. Doubled dotted lines represent relationships where dominance may occur: where decision making by one body is directly influenced by the other. Finally, dashed lines represent normal relationships: disinterested referrals, exogenous determinants of behaviour or the normal influence of market prices.

First, and as noted above, the relationship between doctors and patients is characterised by an informational asymmetry (link 1). This does not preclude the existence of a price effect even if it is offset, in part or full, by doctors' direct influence. Secondly, governments regulate doctors to a greater or lesser extent (link 2). Minimally, this includes the registration of doctors and, in most countries, a determination of doctor numbers by a control of the medical schools. Various ad hoc interventions may also occur to influence the behaviour and location of doctors and, in the extreme case, doctors may be directly employed by government (as in the UK and Australia's public hospitals). However doctors may also 'forward integrate' and influence government. Regulatory boards are commonly dominated by doctors and there are plentiful examples of 'regulatory capture': prohibition of competitive behaviours, etc.

**Figure 1 Information, Power Relationships and Incomplete Vertical Integration in the Health Sector**



There are two possible relationships between doctors and hospitals (links 3, 3a). First, doctors may be conventional employees with behaviour determined contractually (link 3a). However even in such cases doctors normally have an atypical level of influence over hospital behaviour and both internal and external relationships may be determined, not by the objectives of management but very largely by the competing centres of medical power within the hospital. Secondly, in the case of private hospitals (such as those in Australia and the USA) economic survival depends upon the private patients brought to the hospital by private doctors. The hospitals' 'customers'—those purchasing services and generating profits—are doctors, not patients, and for this reason these hospitals may legitimately be described as 'doctors' workshops'<sup>5</sup>.

A similar two-way relationship exists between doctors and pharmaceutical companies. In principle, doctors, acting as patient agents, might prescribe drugs on the basis of their benefits but also their costs to the patient (link 4). However, doctors' knowledge of recent drugs and their efficacy is derived primarily from the sales representatives of different drug companies. The importance of this influence is illustrated by the fact that pharmaceutical companies employ a small army of sales representatives who target doctors individually.

<sup>5</sup> The phrase was introduced by Pauly (1980) in the title of his book 'Doctors and Their Workshops'.

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Last, and in recent years the focus of increasing attention, there are a multiplicity of possible relationships between health insurers/agents/purchasers of health services and service providers (links 2, 5, 5a, 5b). First, and as noted above, governments may employ doctors directly. Secondly, there may be no relationship. Health insurers may limit their role to insurance per se (as occurred until very recently in Australia). Thirdly (and as initially occurred in Australia) doctors may 'forward integrate' and control the boards of both medical and hospital insurance companies. This may then ensure that provider interests are fully serviced and preserved. Finally, insurers may also act as patient-agents and use their purchasing power to negotiate lower prices and/or services of a particular type and quality: precisely what doctors sort to prevent in the previous model. The 'no gap' contracts between Australia's private health funds and various hospitals represents the first example of this in Australia.

Various combinations of these possible linkages will result in different models of health care. Four of these combinations are shown in Table 2. First, if the intrinsic informational advantages are not used and possible dominance relationships not realised then a conventional competitive model might evolve. The fact that this has never occurred is consistent with the economist's belief in the importance of self interest. Secondly, and the default system when neither government nor the private sector exercises its potential power, there is, in Evans' (1983) terminology, the 'fully professional model'. Doctors effectively direct government policy and, where relevant, the behaviour of private health funds whose role is to underwrite doctor fees. Patients are disempowered; there is no independent source of information concerning the efficacy of medical options or even the price of alternative doctors' services. Hospitals are doctor workshops. Third, governments may 'forward integrate' and own, employ or finance all of the key elements and players in the health sector. This is the 'national health' or Beveridge model employed, until recently, in the UK and in Scandinavian countries. Fourthly, there is the 'universal public health insurance model' which is similar to a national health scheme as government provides the majority of funds and seeks to actively influence behaviour. In this model, however, doctors are independent agents reimbursed through health funds which may be public (Canada) or part public-part private (Australia). In this model there are two centres of power: the government and doctors, and behaviour would be commonly characterised by ongoing disputation over funding and, potentially, professional autonomy.

Finally, there is the model of Managed Competition or Managed Care. In this, the private (and possibly the public) sector creates agents which actively participate in the market negotiating the price and content of various medical packages or schemes. In the model of Managed Competition the agents are usually envisaged as being at 'arms length': they negotiate with independent providers of care and are, in turn, heavily regulated—managed—by government. With Managed Care, as it has evolved in the USA in the last decade, there is less regulation and a plurality of providers including fully integrated Health Maintenance Organisations, which commonly provide care directly using salaried doctors and scheme hospitals.

**Table 2 Health Sector Models: Price and Dominance Relationships**

Model Interactions	Market		Professional		NHS (UK)		MC	
	Price <sup>(1)</sup>	Other <sup>(2)</sup>	Price <sup>(1)</sup>	Other <sup>(2)</sup>	Price <sup>(1)</sup>	Other <sup>(2)</sup>	Price <sup>(1)</sup>	Other <sup>(2)</sup>
Doctor > Patient	Yes	No		Yes	?	Yes	Yes	No
Doctor > Patient DOC > PHI DOC < PHI (MC)	-	No No <sup>U</sup>		Yes(?)		?		Yes
Doctor - Gov DOC > Gov DOC < Gov		No No <sup>U</sup>		Yes (?)		Yes		?
Doctor < Drug Co		No <sup>U</sup>		?		No		No
Doctor Hospital DOC > Hosp DOC < Hosp	?	No <sup>U</sup>		Yes		Yes		Yes
Patient - Drug	Yes		Yes		?		Yes	No
Patient - Hosp	Yes							No

Key: ? Unimportant \* Regulation Only U Unexpected Option > dominates; forward integrated  
 (1) 'Price': price help to equilibrate supply and demand  
 (2) 'Other': some other factor influences the equilibration of supply and demand

Market behaviour clearly depends upon which of the stylised models best describes a country's health scheme. Of course it is also possible that different parts of a national scheme may resemble different models. Australia's public hospital system is similar to the UK NHS model but financing and delivery of private medical services are similar to the universal public health insurance or Canadian model.

There are a large number of other caveats. For example, governments are dominant in the NHS and public health insurance models. However this does not indicate the extent to which potential power will be explored. Australia has used its monopsony power to drive unit drug costs to perhaps the lowest in the world. Similar monopsony power has not been used in this way in either Canada or the UK. In general, identification of a model does not indicate the extent to which behaviours will follow the incentives generated within the model. Further complicating this complex description, behaviours may differ within sub-sectors of the health system. Thus, for example, the sub-system of 'doctors' comprises a large number of specialty groups and behaviours may differ between these. In particular, the extent of Supplier Induced Demand discussed below may vary with the complexity of the health problem, the uncertainty of the appropriate treatment and the extent of the informational asymmetries. SID might, therefore, be less likely in general practice than in oncology or neurosurgery.

Two main conclusions can be drawn from this discussion. First, there is no universal model which describes all health systems. Institutional and historical factors are major determinants of incentives and behaviours. Secondly, and following from this, the success of a health system in achieving social objectives will depend, in part, upon the type of model adopted but also upon the extent to which various incentives and possible dominance relationships have been used and exploited.

There is a final and critical conclusion to be drawn from Figure 1. This is that the relationship between doctors and patients and the extent of SID is of pivotal importance. Without SID, patients would select doctors and doctor services according to their own objectives and with

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sufficient information and power to ensure utility maximisation. Competitive doctors would have a powerful incentive to ensure that their relationship with each of the other key players in the health sector contributed to their capacity to satisfy empowered and discriminating patients. While this would not fully immunise the system against market failure it would increase confidence that the pursuit of patient wellbeing was not being thwarted by the self interest of other players. It is partly for this reason that SID has received such attention in the literature.

## **3 Supplier Induced Demand: Evidence**

### **3.1 Overseas Evidence**

Like many theories in the physical sciences Supplier Induced Demand was first suggested to explain observations which were not convincingly explained within the orthodox framework. The theory is commonly attributed to Evans (1974) who observed that across the province of British Columbia there was little variation in doctor incomes despite very significant variation in their supply. As doctors could not charge fees above the benefit (rebate) this implied service use in proportion to the doctor supply. This is, of course, consistent with orthodox economics if supply had adjusted to demand or if there had been a permanent excess demand. It is at this point of the argument—both with respect to Evans' data and the observations in many subsequent studies—that a difference of interpretation arises. Critics of SID have generally argued that as the observations are consistent with theory, then SID is 'unproven'. Evans and others appeal to judgement. Is it likely that variation in service use of 200 - 400 percent could be attributed to other causal factors? The effects of age, sex, income and medical status are independently known and cannot explain the discrepancy. Anecdotal evidence did not indicate significant queuing. SID was therefore proposed as an alternative explanation.

A more rigorous statistical analysis had, in fact, been published in 1972 by Fuchs and Kramer. In this, and in subsequent, similar, studies doctor supply is endogenised and explained, in large part, by doctors' propensity to work in congenial residential areas. Inserted in the demand equation the endogenised doctor supply has had significant explanatory power.

This latter approach has been criticised statistically as discussed briefly below and various other sources of evidence have been used to support SID. For example a number of studies report an otherwise inexplicable increase in services per person following the freezing of the fee schedule. Perhaps the most notable evidence is the result of a random control trial which 'converted' Charles Phelps, one of the most trenchant critics of SID (see Phelps 1997 p254). In this, doctors at a university hospital clinic were randomised to receive income by salary or a fee for service. Patients attending the clinic were randomly assigned to doctors. The result was that fee-for-service doctors scheduled almost 30 percent more return visits than those on salary. Most of the discrepancy was attributable to a 50 percent greater scheduling of (medically doubtful) well care visits (Phelps 1997).

### **3.2 Casual Australian Evidence<sup>6</sup>**

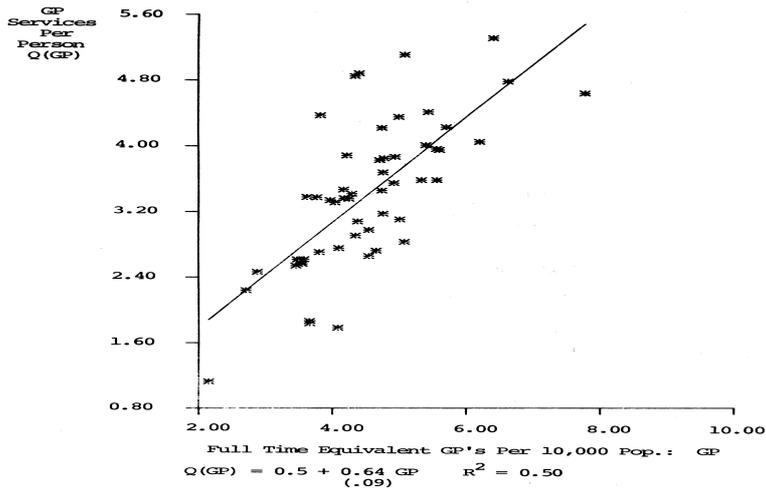
Figures 2 - 4 report casual correlational evidence from Australia. Figures 2 and 3 indicate that there has been and remains a very close relationship between the geographic availability of GPs and the use of their services. As there is very significant border crossing and especially between statistical subdivisions (the unit of analysis in Figure 2) the relationship is not a necessary one. In

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<sup>6</sup> This section draws upon Richardson (1999).

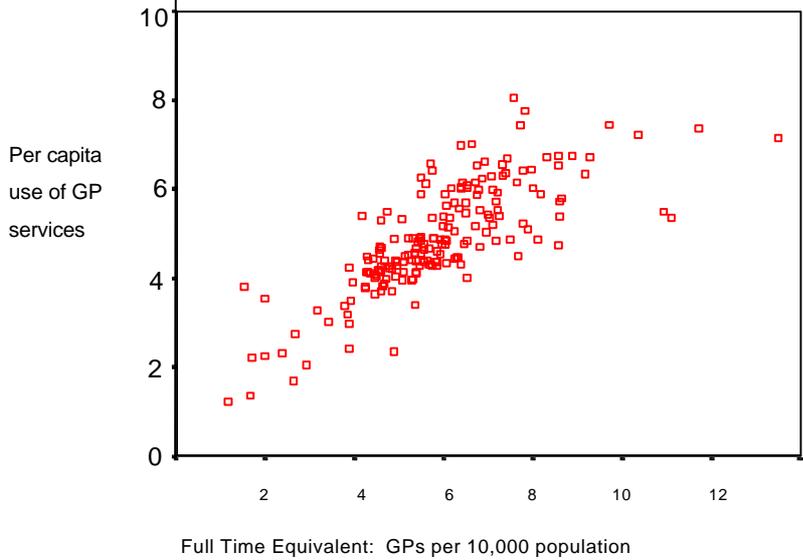
principle, local supply could be unrelated to local demand with border crossing and variable work loads accounting for the discrepancy. The two figures do not, of course, demonstrate a causal relationship between GP supply and the demand for their services for at least two reasons. First, increased border crossing would be associated with increased time costs. Consequently, poorly supplied regions would have lower demand because of these costs. Importantly, border crossing was not a significant determinant of demand in either Richardson's 1981 or 1999 study, summarised below.

**Figure 2 GP Supply vs Use by SD Australia**



Source: Richardson, J. & Deeble, J., Statistics of Private Medical Services in Australia 1976, Health Research Project, Technical Paper No 1, The National University, Canberra.

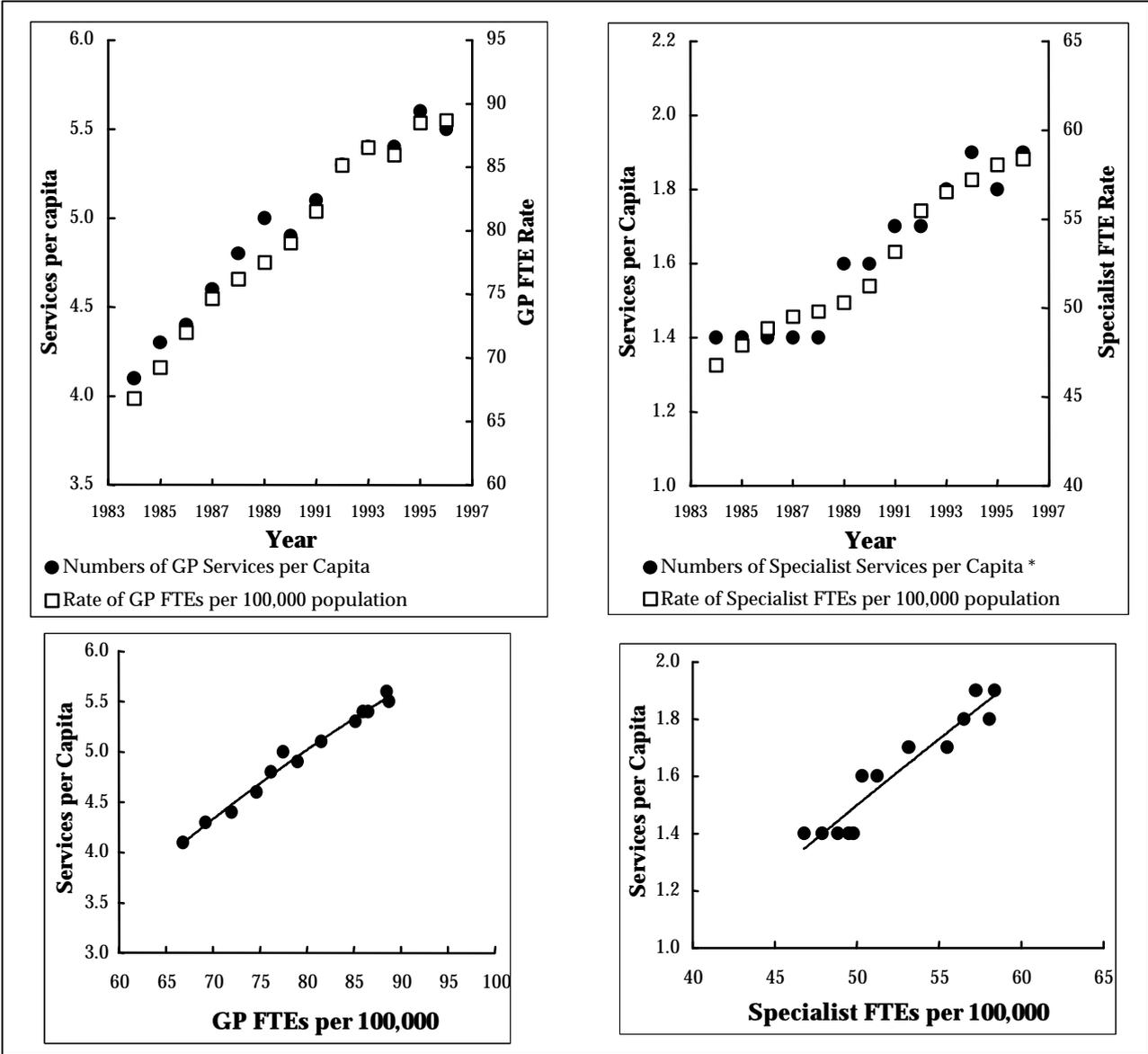
**Figure 3 GP Supply vs Use, by SSD, Australia, 1996/97**



Secondly, it is possible that GPs locate their practices in areas of high autonomous demand and it is for this reason that a cross sectional statistical analysis must attempt to take account of reverse causation and endogenise the GP supply. The importance of reverse causation could, however, be overstated. Age/sex standardisation does not reduce the variation in either the 1976 or 1996 data. Price, income and socio-economic variation are also insufficient to explain more than a very small part of the observed variation.

**Figure 4A GP Supply and Use 1983-1997**

**Figure 4B Specialist Supply and Use 1983-1987**



Source: Commonwealth Department of Health and Family Services  
 \* Excluding Pathology and Radiology

The more persuasive data are those presented in Figures 4a and 4b. They indicate that over time there has been an almost perfect correlation between the growth of general practitioners and the use of their services. Unless it is postulated that there has been a permanent excess demand for GP services, (and most believe the opposite to be true) then causation must run from supply to demand. In Australia, doctor supply has been determined autonomously and erratically by the

independent creation of capacity in medical schools and, more recently, by government policy. The apparent impact of supply upon demand is most strikingly illustrated following the cessation of the growth in the GP supply in 1995 and the corresponding cessation in the growth of service use<sup>7</sup>.

During the time period shown in Figure 4a and 4b and the 6 year time period studied by Richardson (1991) neither the change in net prices nor the increase in per capita income can explain these correlations. The remaining demand side variable, time costs, may have contributed to the correlation. But reliance upon an unobserved variable, for which there is not even good anecdotal evidence, is not particularly persuasive.

### 3.3 Modelling Demand with Endogenised Supply

The model analysed by Richardson (1981) and summarised in Figure 5 below has been re-estimated using average data from statistical subdivisions across Australia. The full results are reported in Richardson (1999) and the model has been further re-estimated in Richardson and Peacock (2001).

**Figure 5 Supply and Demand for Medical Care with SID**

$$Q_D = f\left(\hat{P}_G, \text{INCOME}, \text{SES}, \hat{D}OC\right) + e_1$$

$$Q_S = DOC \cdot (Q / DOC)$$

$$DOC = f^2\left(\hat{P}_N, \text{Res}\right) + e_2$$

$$Q_S = Q_D$$

**Key**

$Q_D, Q_S$  = Services demanded; supplied  
 $P_G, P_N$  = Gross Price and Net Price after rebate  
 $SES$  = Socio economic indicators  
 $Res$  = Indicators of a desirable residential location  
 $\hat{\phantom{x}}$  = Endogenised variable

Source: Richardson (1981)

In this study, 'doctors' were defined as full time equivalent doctors providing services from within each SSD. Thus, if a doctor practiced in two or more locations, their supply would be apportioned pro rata between these two or more locations. Secondly, (and in contrast) utilisation data were derived from patient files and sorted according to the patient's residence. There were, therefore, no data problems associated with border crossing. A further qualification is that, reflecting Australia's health system, the data are a comprehensive record of private services provided in or

<sup>7</sup> Paterson (1996), amongst others, has argued that bulk billing will result in virtually unlimited demand. The unsupported assertion is unconvincing. Bulk billing does not reduce time costs. More importantly, the results of the Rand Health Insurance Experiment (a random control trial of health insurance) reveals that bulk billing had relatively small effects. For a discussion see Richardson (1991).

out of hospital. They omit services provided to public patients and for this reason it is important that the model includes hospital capacity, (a complementary product for specialist) and outpatient capacity (a substitute for private out-of-hospital practice).

Econometric results are presented in Table 3 and the implications of the key coefficients summarised in Tables 4 and 5.

**Table 3 GP Supply and Demand: Regression Results<sup>1</sup>**

Equation	Supply	Demand			
Dependent Variable	OLS GP/10,000	OLS Q(GP)/Capita	TSLs Q(GP)/Capita	OLS Q(GP)/Capita	e
	1	2	3	4	5
Net price		-0.28 (.00)	-0.42 (-00)	-0.34 (-0.00)	
Gross price	0.16 (02)				
GP/10,000		0.39 (0.0)	0.40 (00)		0.28 (0.00)
Pop density	6.82 (0.00)				
Hosp/10,000	-0.31 (.00)				
Urban dummy	1.12 (.00)				
ACT	-1.52 (00)				
NT	-2.53 (00)				
VIC	-0.46 (00)				
WA	-0.99 (00)				
% ABOR		-4.29 (00)	-4.01 (00)	-8.45	
Constant	1.95	3.57	3.86	6.22	-1.7
R <sup>2</sup>	0.69	0.83		0.59	0.43

<sup>1</sup> Regression Coefficient (significance level).

Results are striking. Coefficients have the expected signs, the significance level of each of the explanatory variables is extremely high and the overall goodness of fit statistics are (by comparison with Richardson (1981)) almost suspiciously large. Despite vigorous attempts it was not possible to find a reason for attributing these good results to artifactual errors. Rather, it appears that the extension of the unit of analysis from the statistical division (Richardson 1981) to the statistical subdivision has resulted in a far greater range of observations which are successfully explained by the postulated variables. From the supply equation (Equation 1) there is an increase in the GP supply with higher prices, with the absence of (substitute) hospital facilities and with areas which provide a congenial residential environment (higher population density and urban areas). Consistent with theory demand falls with net price (Equations 2 and 3) but, in this study, was uninfluenced by either income or other socio-economic variables. The inclusion of the GP supply significantly increased the explanatory power of the regression.

As elasticities are difficult to interpret when variables are close to zero Table 5 reports the effect upon demand of an increase in the price level from zero to the average net price (\$2.71). The implied effect upon demand is similar to the results in Richardson (1981) and empirical estimates overseas. Double log equations implied a price elasticity of demand of -0.17.

As reported in equations 2 and 3 GP supply was highly significant in both the OLS and TSLS models and increased the explanatory power ( $R^2$ ) of the equations by about 0.24. The impact of a 50 percent increase in the GP supply was somewhat greater than the impact of prices shown in Table 4. However the explanatory power of the variable is significantly larger reflecting the greater range of values for the GP supply. In the double log equation the GP supply elasticity of demand was 0.43, again similar to the results in Richardson (1991).

**Table 4 Summary Variables and Results**

GP/10,000	6.00
Q(GP)/capita	4.97
Fee (net)	\$2.70
d(Q)/d(Fee)	-0.28 (OLS) -0.42 (TSLS)
d(Q)/d(DOC)	0.39 (OLS) 0.40 (TSLS)

**Table 5 Magnitude of Effects**

			$\Delta$ Quantity	$\Delta Q/DP$
<b>Price</b>				d(Q)/d(P)
OLS	\$ 0 → \$2.709	OLS	0.76	0.15
TSLS		TSLS	1.13	0.23
<b>GP Supply</b>				d(Q)/d(GP)
OLS	GP → GP + 50%	OLS	1.17	0.24
TSLS	6 → 9	TSLS	1.2	0.24

Two additional equations are reported in Table 3. They were estimated to investigate the assertion that inclusion of GPs in the demand equation could result in specification bias and the attribution of price effects to the doctor supply. The first, equation (Equation 4), re-estimates demand with the GP supply omitted. This ensures that the full explanatory power of the remaining variables will not be wrongly attributed to the GP supply, although the converse may occur, viz, the effect of the GP supply may be attributed to one of the remaining variables. The error term,  $e_1$ , from this equation was then used as the dependent variable in equation 5 with the GP supply as the only independent variable. As price effects have been fully deleted from the dependent variable, its relationship to the doctor supply cannot now be attributed to the relationship between the GP supply and net price. Results of equation 5 suggest that the GP supply independently adds to the explanation of GP use. The impact is less than in equation 2. But this is because the significance of the variable ABOR, (a proxy for the socio economic status of a region) increases due to its correlation with the GP supply (0.58). Interestingly, results from equations 4 and 5 indicate a specification error. Clearly the omission of the doctor supply from

the demand equation does not result in a white noise error term as it correlates with the omitted variable: that is, the omission—not inclusion—of the doctor supply results in misspecification.

## 4 A Natural Experiment

Australia provides an interesting and unique laboratory for the examination of the relative importance of price and SID effects on patient demand. The perverse and idiosyncratic financing of health services results in a public sector in which hospital patients are treated without cost and a private sector in which, in return for the purchase of private health insurance, the patient is left with significant out of pocket expenses. In a simple market equilibrium public demand per capita would be expected to exceed private demand per capita. However, incentives facing doctors also differ. In the public hospital there is no financial benefit from the treatment of additional patients. In the private sector a full fee is earned. There is therefore no incentive for doctors to increase demand in the public sector and a strong incentive to increase it in the private sector.

In a recent study Robertson and Richardson (2000) examined the treatment of patients after an emergency admission with a heart attack (acute myocardial infarction (AMI)). Various treatments are possible for AMI. The most expensive and recent of these include the diagnostic test, Angiography, and Coronary Artery Revascularisation Procedures (CARP), viz, coronary artery bypass graft surgery (CABG), angioplasty or stenting. Each of these four procedures attracts a significant fee.

Differences in the rates of angiography and revascularisation for the Victorian population are shown in Table 6. Each of the entries represents the index number obtained by dividing the percent of patients receiving a procedure in a particular category by the percent receiving the procedure after admission as a public patient in a public hospital. The table reveals that private patients admitted to public hospitals and private patients admitted to private hospitals were 43 percent and 117 percent more likely to receive angiography than public patients (Column 1). Likewise, private patients admitted to private hospitals were 205 percent more likely to receive angioplasty or a stent and 95 percent more likely to undergo bypass surgery (CABG).

**Table 6 Ratio of Rates of Angiography and Coronary Artery Revascularisation Procedures in Private Versus Public Hospitals**

	Rate ratio (95% confidence interval) <sup>+</sup>			
	Angiography	Angioplasty/Stent	CABG	Any CARP
Public patients in public hospitals	1.00	1.00	1.00	1.00
Private patient in public hospitals	1.43	1.09	0.90	1.00
Private hospital patients	2.17	3.05	1.95	2.87

\* Rates are for all Victorian residents aged 15-85 years admitted to Victorian acute care hospitals with acute myocardial infarction, July 1995 - December 1997, adjusted for age group, sex and half-year of initial admission.

<sup>+</sup> Rate ratios are calculated using the Cox proportional hazards model.

CABG = Coronary artery bypass grafting. CARP = Coronary artery revascularisation procedure.

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Three important caveats must be made. First, patients who do not received revascularisation often receive thrombolytic drug therapy and the relative effectiveness of the different therapies is unknown. Secondly, data do not indicate whether private or public practice is closer to best practice medicine. Thirdly, data refer to the first eight weeks after AMI. State hospital records were linked for a 12 month period to test the hypothesis—asserted as fact by cardiologists shown the results—that public patients would eventually receive the same level of services and that the 8 week data only reflected the rapidity with which procedures are undertaken in the private sector. Data contradicted this hypothesis and differences in procedure rates did not converge. As queuing data did not indicate a ‘problem’ in the relevant area (cardiology) it appears that public patients are not queued: they receive other, cheaper services. It is, therefore, an unavoidable conclusion that there is a difference in the pattern of treatment in the two systems. At the time of admission patients included in this study would have had, within minutes to hours, a heart attack or would still be suffering from a heart attack. It is highly unlikely therefore, that they would have a clear view of the appropriate time or pattern of treatment, and these patterns must therefore be driven by physicians. Patient driven patterns determined by the usual economic variables would result in greater early service use in the ‘free’ public system or in significant queuing, and neither of these are observed following AMI.

## 5 The Theoretical Bases of Supplier Induced Demand

A fully satisfactory theory of SID must provide an answer to at least two questions: (i) why do patients allow their preferences to be manipulated; and (ii) what motivates doctors and, in particular, why do doctors fail to maximise demand shift and leave unexploited an opportunity to increase income or leisure?

Most economists now accept that patient abdication of decision making may be satisfactorily explained by the asymmetry in the information available to the doctor and to the patient and the resulting dominance of the doctor in decision making. Williams nicely encapsulates the consequences of this.

‘...a system ... ostensibly works on the principle that the doctor’s role is to give the patient all the information the patient needs in order to enable the patient to make a decision, and the doctor should then implement that decision once the patient has made it. I am sure the reader would find the above statement closer to his or her experience if the postulated roles of the patient and doctor were interchanged so that the sentence would then read: ‘the patient’s role is to give the doctor all the information the doctor needs in order to enable the doctor to make a decision, and the patient should then implement that decision once the doctor has made it’ (emphasis added). Williams 1988), p176

There are more compelling reasons, however, for believing that patients cannot be sufficiently well informed to evaluate alternative medical options. Some of that evidence is reported in Figure 6. This is a box plot of the ratio of observed to predicted 2 year procedure rates (rescaled so that 100 indicates that the observed equals the expected procedure rate). The figure reveals a variation in use in excess, in some cases of 1,000 percent—magnitudes greater than can be attributed to price, income or medical need. Some of the variation is, of course, attributable to random error. To investigate this the expected variation was calculated on the assumption that individual risk of a condition needing these procedures followed a Poisson distribution with risk set equal to the State average for each cohort. The second column of Figure 6 reports the ratio of variance to expected variance. This varies from 70 percent (exploratory laparotomy) to a staggering 3,530 percent (colonoscopy). Similar variations have been observed in virtually all studies, both between small areas and between countries. In part, the variation may be

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attributable to SID but even this fails to explain observations and, by default, it is generally accepted that the variations arise because of professional uncertainty concerning best practice and the enormous scope for 'legitimate' service delivery; that is, the variations are explained very largely by idiosyncratic factors. This is summarised by Wennberg:

'The evidence from small area analysis, from the critical appraisal of the strengths and weaknesses of the scientific basis of medicine and the failure of expert panels to reach consensus on appropriate practice build a consistent and strong case against the rational agency hypothesis and the associated assumptions about the nature of demand and the medical market. Professional uncertainty rather than consensus about the scientific basis of clinical practise is emerging as the dominating reality.'

Wennberg (1988) p100.

Wennberg's assertions are supported by estimates from the OECD and US office of technology assessment that only 20 - 25 percent of procedures have been satisfactorily evaluated clinically (and of course, even less have been subject to economic evaluation).

With such a state of medical uncertainty it is clearly impossible for patients to evaluate what doctors cannot do, and the abdication of consumer sovereignty represents a rational response to this.

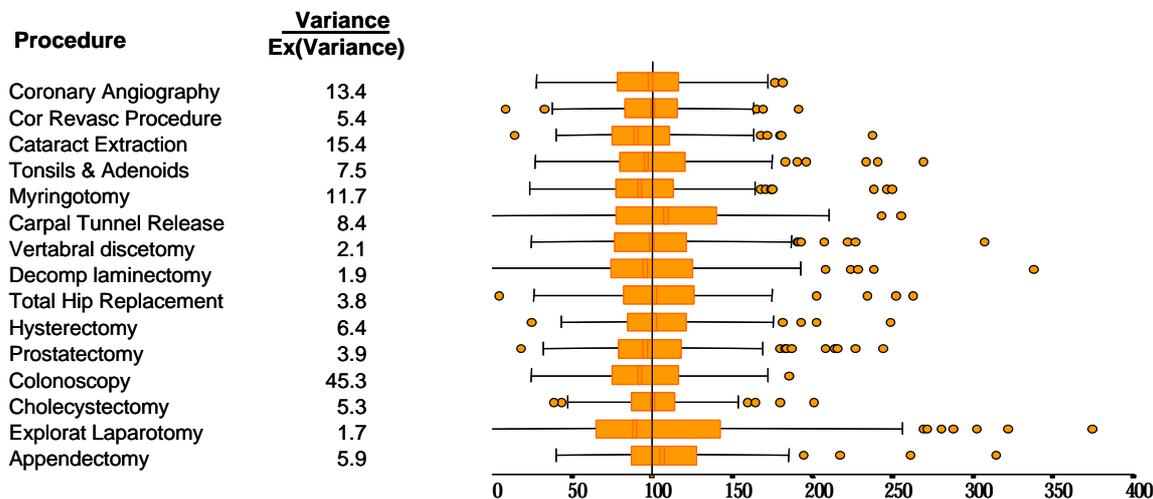
As a theoretical footnote the evidence concerning medical uncertainty in Figure 6 suggests that the asymmetry of information *per sé* is probably of lesser importance than the asymmetry in the capacity to make a medical *judgement* based upon imperfect medical knowledge and the possibly unique set of symptoms presented by an *individual* patient.

The more contentious theoretical issue concerns the motivation of doctors. Theorists, primarily in North America appear to have agreed that the doctor's utility function includes both income and the act of inducement *per sé*. The latter variable is assumed to have a negative impact upon utility as inducement is regarded as inherently unpleasant because it involves illegitimate advice motivated by self, not patient, interests. The assumption is unsurprising given the definition of SID that is adopted by most North American economists. For example, McGuire (2000) writes that: '*...physician induced demand (PID) exists when the physician influences a patient's demand for care against the physician's interpretation of the best interest of the patient.*' McGuire (2000) p504.

The 'unethical doctor hypothesis' serves at least one purpose. It demonstrates the theoretical possibility of SID within a conventional economics framework. For reasons explored in Richardson (1981, 1999) the theory is unsatisfactory. It implies that virtually all doctors are behaving unethically as Supplier Induced Demand, through time, must have been very significant if it is to explain the observed change in service use. A more plausible theory is readily available which draws upon the professional uncertainty which, as discussed, characterises medical practice. This is that doctors have both income and professional objectives. By training doctors believe that more intensive and careful treatment represents better quality care. An increase in the doctor supply which reduced patient numbers per doctor will, *ceteris paribus*, leave doctors with surplus capacity—a gap between actual and target working hours. This permits doctors to increase the quality of the care they provide. That is, surplus capacity leads to a change in practice style which involves a greater input of doctor time, which is professionally satisfying and which is within the very broad boundaries of legitimate medical practice set by medical science.

With this interpretation SID equates with the provision of better quality care by professionally motivated and ethical doctors. It is constrained by the length of the working week.

**Figure 6 Standardised Rate Ratios for Various Operations in the Statistical Local Areas in Victoria, Compared to the Rate Ratios for All Victoria**



### Standardised Rate Ratio

Median, range, 25th & 75th centiles for Statistical Local Areas, standardised to Victorian State Ratio = 100. Extreme values greater than 3 times 50th-75th and 25th-50th centile intervals are recorded as separate points.

Source: Richardson (1998).

This latter explanation does not explain why doctors fail to maximise SID and then control excess demand by raising fees (and income). This is discussed in Richardson (1999). It is shown that this latter behaviour will not occur if there is a small relaxation in the implied assumption that doctors either have perfect knowledge about market conditions and price elasticities or that they devote immense effort to experimentation. Without these assumptions there are a number of possible behaviours. An experimental increase in fees by an individual doctor may, as in perfect competition, lead to such a decrease in demand that further experimentation is inhibited. By contrast, when patient numbers fall owing to an increase in the doctor supply SID may restore the practice to the initial equilibrium.

The conclusion from this brief review is that a fully satisfactory theory has not been developed and supported with empirical evidence. However, there are theoretically satisfactory theories of maximising behaviour consistent with SID and it is probably for this reason that many economists have recently become more receptive to the theory.

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## 6 Discussion

While most economists now accept SID, to a greater or lesser extent, the theory was fiercely resisted. Both of the theoretical issues discussed here were contested. Empirical results were likewise challenged and quite surprising arguments were widely and uncritically accepted. For example, Auster and Oaxaca (1981) correctly argued that the (equilibrium) supply of services could not be inserted in the demand equation. This was widely and wrongly interpreted as implying an identification problem with cross sectional studies in general, and this argument has been reproduced in text books. However several cross sectional studies including those discussed here did not include services supplied in the demand function but, rather, the doctor supply which, in turn was a stochastic variable. Identification is, in these circumstances, no more or less complex than the identification of supply and demand curves from cross sectional data. As a second example, Hay and Leahy (1982) found that doctors and their families used medical services as much as others and often more so. Their widely cited conclusion was that there could be no SID or else doctors, capable of evaluating the need for medical care, would choose fewer services for themselves and their families. The counter-hypothesis, discussed above, is that doctors have confidence in their profession and equate 'more' with 'better' care. As a final example, Phelps (1986) (pre-conversion) argued that there is always the possibility of an unobserved variable explaining the apparent impact of doctors and, therefore, SID could never be demonstrated. Such a conclusion would, of course, apply to virtually all empirical studies.

More generally, the hurdles which SID has been required to jump contrast sharply with the rapid endorsement of a competitive explanation of the demand for health services, namely Grossman's adaptation of the theory of human capital (for a review see Grossman (2000)). The theory is widely accepted as being insightful and a valuable extension of economic theory. This is despite the extreme unreality of the assumptions and of the almost total absence of empirically supported and new prediction. For example, individuals are assumed to have a good knowledge of the determinants of present and future health despite the absence of such information by the medical profession. It is concluded that people plan the date of their own death and this will be affected by the interest rate! The model predicts that better educated people will be healthier and that older people will be less healthy. These are not new predictions.

There are at least two explanations for the resistance to SID. First, and as noted earlier, SID arose as a pragmatic answer to an empirical question and the theory was not immediately consistent with theoretical orthodoxy. Its subsequent history may be explained by the greater appeal of methodological 'rationalism' and adherence to orthodox behavioural assumptions than methodological 'empiricism' and its eclectic use of theory and assumptions.

The second possible explanation is that the implications of SID may be unpalatable. First, and most importantly, SID implies that simple markets will be relatively unconstrained by consumer demand and will, therefore be inflationary. (Of course it was the observation of this which led to the theory!) Secondly, and related to this, revealed preferences will lose much of their normative importance. The observation of service use no longer implies that there are benefits commensurate with the price paid and, in a competitive market, the opportunity cost of production. Of course a similar conclusion may be reached because of moral hazard but the problem is exacerbated by SID. Thirdly, the demand side management which is commonly favoured by economists in the health sector becomes problematical. The argument, repeated through time and in each country seeking to control medical costs, is that co-payments will encourage patients to examine the value of services and reduce service use when the benefits are small. Demand is certainly price elastic but SID implies that the services given up may not be

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the least valuable. This is, in fact, the conclusion reached by Lohr et al (1986) in the definitive Rand Health Insurance Experiment. Nevertheless it is for many an unwelcome conclusion.

Finally and most generally SID implies that all of the linkages discussed in Figure 1 may need to be the subject of explicit regulation. As patients are disempowered the incentives for efficiency in the health system are weak. Doctors have no incentive to provide or recommend optimal care. There is no mechanism for equating workforce supply and demand and explicit workforce planning must be undertaken. In sum, it may be necessary for governments to interfere in precisely the way in which economists generally eschew. As interventionism is associated with the left wing of politics there has also, for this latter reason, been a politicising of the issue with the theory being associated with the left wing of politics.

If SID is responsible for medically unnecessary services, as assumed but not demonstrated by North American economists, then evidence based medicine could result in the widespread unemployment of doctors. If, however, there is great variation, not simply in what is medically possible, but what is medically useful then evidence based medicine may simply increase the efficiency with which better quality medicine is achieved with the existing resources.

Despite these conclusions the major policy challenges in the health sector do not arise because of SID. The fragmented program structure and the immense variability of access and service provision require reforms to achieve allocative efficiency and the use of evidence based medicine. In principle, reforms may be achieved within the framework of a public, private or mixed system and, in the latter cases, the system might be either competitive or cooperative. The models of Managed Care and Managed Competition have attractive theoretical properties and there is some evidence from the USA that Managed Care can achieve favourable objectives. Such a model in the Australian context would, inevitably, be subject to careful regulation to achieve equity objectives and this regulation would convert Managed Care into Australian style Managed Competition. These policy options are not, however, contingent upon the magnitude of SID.

## 7 Conclusions

Supplier Induced Demand should be treated as a 'scientific hypothesis' to be supported or rejected by the available evidence. In contrast, the approach reflected in the literature has been to 'defend the paradigm at all cost'. In particular, the response reflects the common preference for 'methodological rationalism': reasons must be given to explain *why* the theory must be true and these reasons must be consistent with orthodox theory. By contrast, SID evolved to explain empirical observations and the most compelling reasons for its acceptance are empirical. SID has sought to explain *what* happens rather than *why* this must occur. The majority view with respect to this second question is not, at present, fully satisfactory although there are a number of plausible hypotheses still to be explored. Using the empirical criterion SID must be regarded as the 'best tentative hypothesis' to explain the stylised facts and, in empirical science, this is the purpose of theory.

SID implies that the simple competitive market will not generate efficiency. Price competition if it exists will be muted and there will be little if any incentive for doctors to use their influence to obtain low cost, best practice, services and inputs from elsewhere in the health system. This exacerbates the problem of incomplete vertical integration by other players in the system and the consequences of this have not been well researched in Australia. SID does, however, imply that governments should be doing many of the things they presently do in order to control costs.

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Within the present framework (Medicare) the policy challenge at present is to determine ways of delivering more *cost effective* services while simultaneously achieving equity objectives. Feasible options employ competition to a greater or lesser extent but these options do not depend upon the existence or quantitative importance of Supplier Induced Demand.

## References

- Auster R and Oaxaca R 1981, 'Identification of supplier induced demand in health care sector', *Journal of Health Resource*, vol 16, no 3; pp327-342.
- Evans R 1974, 'Supplier induced demand: Some empirical evidence and implications', in Pearlman M (ed), *The Economics of Health and Medical Care*, McMillan, London, pp162-173.
- Evans R 1983, 'Incomplete vertical integration in the health care industry: Pseudos markets and pseudos policies', *Annals, AAPSS*, 468, July, 60-87. Reprinted in Culyer AJ 1991, *The Economics of Health*, Volume II, Elgar.
- Feldman R and Morrisey M 1990, 'Health economics: a report on the field', *Journal of Health Politics, Policy and Law*, vol 15, no 3, pp627-646.
- Fuchs VR 1996, 'Economics and health care reform', *The American Economic Review*, vol 86, no 1, pp1-24.
- Fuchs VR and Kramer M 1972, 'Determinants of expenditures for physician services in the United States, 1948-1968', National Bureau of Economic Research, National Center for Health Services Research and Development, DHEW Publication (HSM), 13 December, pp17-30.
- Grossman M 2000, 'The human capital model', in A Culyer and JP Newhouse (eds), *Handbook of Health Economics*, Volume 1A, Elsevier, North Holland.
- Hay J and Leahy M 1982, Physician induced demand: An empirical analysis of the consumer information gap, *Journal of Health Economics*, vol 1, pp231-44.
- Industry Commission 1997, Private Health Insurance, Report No 57, AGPS, Canberra.
- Lohr K 1986, 'Use of medical care in the Rand health insurance experiment: diagnosis and services specific analysis in a random control trial', *Medical Care*, 24 (Supplement: S1-87).
- McGuire T 2000, 'Physician agency', in A Culyer and JP Newhouse (eds), *Handbook of Health Economics*, Volume 1A, Elsevier, North Holland.
- OECD 1992, The Reform of Health Care: A Comparative Analysis of 7 OECD Countries, Health Policy Studies No 2, OECD, Paris.
- Paterson J 1996, 'National Health Care Reform: The Last Picture Show', Government of Victoria, Melbourne.
- Pauly MV 1980, *Doctors and their Workshops: Economic Models of Physician Behaviour*, The University of Chicago Press, Chicago.
- Phelps C 1986, 'Induced demand—can we ever know its extent?', *Journal of Health Economics*, vol 5, pp355-365.
- Phelps C 1997, *Health Economics*, Second Edition, Addison-Wesley.
- Richardson J 1981, 'The inducement hypothesis: that doctors generate demand for their own services', in Van Der Gaag J and Pearlman M (eds) *Health, Economics and Health*

- 
- Economics*, North Holland, Amsterdam, Reprinted in Butler J and Doesell D, 1989, *Health Economics: Australian Readings*, Australian Professional Publications, Sydney.
- Richardson J 1984, 'Are consumer payments necessary in an efficient health care system?', *Economic Analysis and Policy*, vol 14, no 21, pp128-146.
- Richardson J 1991, 'The effects of consumer copayments in medical care', National Health Strategy Background Paper No 5, Treble Press.
- Richardson J (1998) 'The healthcare financing debate' in *Economics and Australian Health Policy*, (eds) G Mooney & RB Scotton, Allen & Unwin, Sydney.
- Richardson J 1999, 'Supplier induced demand reconsidered', in *Economics and Health: 1998*, Proceedings of the Twentieth Australian Conference of Health Economists, (ed) J Baldry, School of Health Services Management, University of New South Wales, Sydney.
- Richardson J & Peacock S 2001, 'Supplier Induced demand reconsidered and re-evaluated', Working Paper, Health Economics Unit, Monash University, forthcoming.
- Robertson I & Richardson J 2000, 'The effect of funding upon hospital treatment: the case of coronary angiography and coronary artery revascularisation procedures following acute myocardial infarction', *Medical Journal of Australia*, vol 173, pp291-295.
- Wennberg J 1988, 'SID/Medical evidence', *Health Affairs*, pp99-107.
- Williams A 1988, 'Priority setting in public and private health care', *Journal of Health Economics*, vol 7, no 2, pp173-183.