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Pricing, Technology Choice, and Information in Health Care Markets

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ABSTRACT

This paper proposes a pricing model for health care markets wherein providers and patients play a Nash bargaining game. In this game, bargaining power is interpreted as a measure of market structure. Thus, marginal cost pricing (monopoly pricing) can be shown as the outcome of the absence of bargaining power among providers (patients). The model is then extended to explain how, in health care markets with imperfect information, discrete technology choices are made by providers and how such choices may drive observed pricing behavior such as price discrimination.

INTRODUCTION

The idea that health care providers charge noncompetitive prices has long been established, at least since Kessel (1958) noted the price-discriminating tendencies of physicians in the US. This arose from the observation that competitive conditions such as absence of barriers to entry and costless information hardly exist in health care markets, a belief further strengthened by evidence of significant profits from health care provision (for instance, Newhouse 1970 and Pauly and Satterthwaite 1981).

Should noncompetitive prices be a cause for concern? In so far as prices serve to signal good quality or to channel investment resources toward the provision of services whose benefits outweigh their costs, rents are not an issue. A

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problem arises, however, when deviations from the marginal cost mainly serve to redistribute resources from the patient to the health care provider. Any effort to identify the appropriate set of policy interventions to address noncompetitive pricing patterns in health care markets must begin with a positive analysis of price-setting behavior. How do hospitals and physicians set prices? How do they arrive at seemingly complex pricing structures? Why do they resort to such pricing practices?

Numerous hypotheses regarding pricing behavior have been advanced to date. Many of the pricing models that have generated these hypotheses assume that health care providers are active price setters while patients are mere price takers. A common approach is to proceed from standard pricing theory under monopolistic competition and then motivate departures from the standard results by invoking the unique features of the market.

This paper proposes an alternative approach to understanding pricing behavior of health care providers. It presents the idea that the observed price of a medical service can be viewed as the outcome of bargaining between a provider and a patient. As shown by Ellis and McGuire (1990, "EM" hereafter), the interaction between a physician and a patient can be modeled as a bargaining situation. Both players agree on a budget but, in general, a physician and a patient will differ in terms of their desired number of treatment units within a single visit. On the one hand, the physician might want a patient to undergo more diagnostic procedures to minimize the cost of malpractice suits. On the other hand, where medical care is inconvenient, time consuming, and painful, patients would want less of it. It is further assumed that both players know all possible treatment levels. If agents agree to resolve the disagreement through a Roth-Nash solution (1977), the bargaining outcome would simply be the weighted average of the physician's desired treatment level and the patient's desired treatment level with the weights reflecting the agents' bargaining powers. This paper proceeds in a similar fashion, modeling a bargaining game of the physician-patient interaction but assuming instead that the object of the disagreement is price. The bargaining outcome, if agents agree on a Nash (1950) solution, is the weighted average of the maximum price that the patient is willing to pay and the minimum price that the physician is willing to accept for a fixed treatment level.

Modeling pricing behavior as a bargaining game has several advantages. First, use of a pricing model allows one to be faithful to an institutional setting where prices are basically market-determined and where health care institutions are slowly moving toward the practice of bargaining in order to set prices. In the health insurance sector, for instance, insurers have increased their reliance on negotiating prices with health care providers as a means to control costs. With a widening membership base, insurers will be in a better position to bargain for reduced prices. Second, by re-interpreting "bargaining power" as a market structure parameter, the proposed bargaining model shows a one-to-one correspondence between market structure and pricing outcomes, thus facilitating analysis of the effects of market structure on prices. Third, using fairly simple functional forms, the outcome of the bargaining game can be captured in a sparse pricing equation that naturally extends to a hedonic price specification. This also facilitates an empirical analysis of price variations. Fourth, the proposed model, with appropriate extensions, can explain a host of pricing behaviors, including how providers can use medical technology as a mechanism for price discrimination. This particular extension of the model will be shown in this paper.

The rest of the paper is organized as follows. The second part presents the basic pricing model, beginning with assumptions on the nature of medical treatment and rules of the bargaining game. Using specific functional forms and a Roth-Nash solution to the bargaining game, a linear pricing rule is derived. The third part extends this basic pricing model by assuming the availability of alternative treatment protocols. With the additional assumption of imperfect information, this section concludes with the argument that technology choices can be used by price-discriminating providers as signals of patient willingness to pay. As such, no dominant technology choice is expected to prevail in health care markets.

THE PRICING MODEL

Standard treatment protocols

In this stylized health sector, a consumer finds himself in any of $I+1$ states, where I are illness states and the last state referring to the absence of illness. To completely recover from illness i, a patient needs a specific package of medical services. This package consists of an array of services $[x_{i1},\ldots,x_{ir}]$ whose elements are measured in a single unit, say, time. The package can thus be represented by X_i, a scalar, where $X_i=\sum x_{ir}$. This combination of service characteristics is standard and nondivisible for each i.

The EM (1990) view that treatment levels are negotiable applies to a class of treatment types such as elective surgery. There are also instances, however, when treatment is standard and therefore, nonnegotiable. That is, a combination of services other than $[x_{i1},\ldots,x_{ir}]$ results in very low probabilities of recovery for the patient with illness i. Drug therapy and trauma care, for instance, fall under this category. Another example is anesthesia, which needs to be applied in precise amounts in order to be effective.

The assumption of "standard protocols" is not usually made and thus deserves further comment. One assurance that different providers will design identical protocols for a specific illness are institutions such as specialty societies, malpractice laws, the Hippocratic oath, and peer review, all of which act to restrain provider discretion. This assumption can also be motivated by viewing health care as a bundle of services, including diagnostic services, drugs, professional services, and hospital stay. Each illness will require different combinations of medical services and the unique bundle of services specified for a particular illness can be considered "standard" especially when payments by, say, insurance carriers are made for such bundles rather than for individual services (as with case payments).

The health care provider and consumer are assumed to have access to complete information. Both can identify illness states, thus, bargaining over is not necessary. Moreover, the set of standard treatment protocols, $\{X_i\}$, is known by all agents. For the rest of the paper, the subscript i is suppressed for notational convenience.

Bargaining agents

The market for consists of providers and $\bar{N}$ patients. While bargaining typically takes place between the patient and the health care provider, bargaining may also occur between third parties that agree to represent the patient and the provider. To simplify matters, it is assumed that all third-party agents have full information and act purely in pursuit of their client's interest.

Third-party agents are not precluded from representing more than one health care provider or patient. Let M and denote the number of providers and patients, respectively, that a particular third-party agent represents. If all patients have a single payer who negotiates with providers—say, a social insurance scheme— then . Similarly, if all hospitals belong to a single hospital association that represents all its member hospitals in price negotiations, then $M = \bar{M}$.

Alternatives

An individual who falls ill considers seeking treatment from a health care facility. All health care providers will prescribe a standard set of treatment protocols, X, which is known to the patient. Thus, when the agents are face-to-face, they know exactly what to buy or to sell but have no idea what the price is. The price, , is determined through a bargaining process.

Agents are assumed to undergo an implicit search process. Each patient attempts to bargain with all providers, but eventually transacts with the m^{th} provider from whom the most bargaining gains can be obtained.

In each encounter, agents face an "all-or-nothing" choice: either the bargain is consummated by a transaction or it is not. To the patient, the no-bargain option implies resorting to home care, denoted by X_0. To the provider, it means having to rely on other sources of income, say, interest earnings.

Agents' utility functions

The consumer derives utility from net consumption. He likewise derives utility from health care, but only indirectly. That is, health care is utility bearing to a sick person not for its intrinsic value but because it enhances the consumption of nonhealth goods.

In this stylized health sector, the two forms of health care— X_0 and X — are not perfectly substitutable. This is so because the health benefits derived from home care are assumed to be generally less than that from X. Home care, however, is cheaper than X. A sick individual therefore faces the following trade-off: results in full recovery but will cost $P > 0$ while home care costs less but is unable to completely restore one's health.[1]

The health care provider, on the other hand, derives utility from profits. His technology is assumed to exhibit constant returns to scale across patients: cost per patient is fixed regardless of case load.

Evaluating alternatives

The bargaining process begins with agents revealing simultaneously and truthfully their reservation prices. The patient declares the maximum price that he is willing to pay for X (call this $P^{\max}$) and the provider, the minimum price that he is willing to accept (call this $P^{\min}$). In the event that $P^{\max} \geq P^{\min}$, bargaining will take place.

In deciding whether or not to join a bargaining game, the patient compares the payoffs derived from buying X from the provider and from home care. The patient's reservation price is therefore that which makes him indifferent between being cared for by the provider and self-medication. This implies that $P^{\max}$ solves

$$U_0 = U$$

where U_0 is the patient's utility conditional on home care and U denotes the patient's utility function conditional on X.

On the other hand, the provider's decision to treat a patient or not will be based on an evaluation of payoffs from caring for that patient relative to that derived from other sources of income. He is indifferent to both alternatives if what he can charge this particular patient is that which equates payoffs from both alternatives. That is,

$$V_0 = V$$

[1] Alternatively, the trade-off can be defined as follows: while home care is cheaper than market-based care, the time involved to produce the same health effect (e.g., full recovery) is longer for home care than for market-based care.

where V_0 is the utility from alternative sources of income V and is the utility derived from treating the patient. The price that solves the above equation is defined as $P^{\min}$.

The bargaining outcome

Define bilateral welfare, W, as:

$$W = (U - U_0)^{\alpha}(V - V_0)^{1-\alpha} \qquad (1)$$

where $0 < \alpha < 1$. W is assumed to be continuous and twice differentiable with respect to P. Assuming that the agents agree on a bargaining outcome that can satisfy three axioms of Nash (1950), namely, Pareto optimality, independence of irrelevant alternatives, and independence of positive linear transformation, then any value of P that maximizes (1) is a solution to the bargaining problem.

Note that this is the asymmetric formulation of the Nash game (see Roth 1977 and Binmore 1992). The exponents of the Cobb-Douglas welfare function represent the bargaining power of the agents. That is, the parameters α and $1-\alpha$ reflect the elements of the bargaining environment that do not get included in the agent's utility functions but would nonetheless affect the bargaining outcome.

Interpreting α

Following Brooks et al. (1997), α can be re-interpreted as a market structure variable. Define α as a composite measure of market power:

$$\alpha = \frac{N'}{N' + M'}$$

where $M' = \frac{M}{\bar{M}}$ and $N' = \frac{N}{\bar{N}}$. M' is the proportion of all providers in the market that a particular agent represents. If all providers act as a single seller through a single third-party agent, then $M' = 1$. On the other hand, N' reflects a patient's bargaining position. If all patients are represented by a single agent, then $N' = 1$.

It can be noted that because

$$\alpha \rightarrow \begin{cases} 0 & as \quad N' \rightarrow 0 \\ 1 & as \quad M' \rightarrow 0 \\ 0.5 & as \quad N' \rightarrow M' \end{cases}$$

different market structures can be represented by varying values of α. When $\bar{M} \to \infty$ and $M << \bar{M}$, then $\alpha \to 1$. In this case, providers are infinitely many but only a few are represented in the bargaining game. On the other hand, if $\bar{N} \to \infty$ and $N << \bar{N}$, then $\alpha \to 0$. In this case, patients are infinitely many but only a finite number are represented in the bargaining process. Finally, when the proportion represented in the bargaining game is the same for both patients and providers, $\alpha = \frac{1}{2}$.

The presence of a third-party agent is a convenient way to illustrate the extent by which agents can be represented in a bargaining game. For example, with greater insurance coverage of consumers (say, through the social health insurance program), providers are forced to be accredited by the dominant insurance carrier and thus, be bound by its pricing schedules and payment rules. In this situation, the consumers' representation in the bargaining game is stronger.

A specific pricing rule

In this section, specific forms are assigned to U and V and then an optimal pricing rule is derived under the assumption that prices are determined in a Nash bargaining game.

The health care consumer

Assuming that the consumer is risk neutral, U_0 can be defined as:

$$U_0 = \sigma_0 Y \tag{2}$$

where Y is income and σ_0 is a measure of the health benefits from self-medication, with $0 \leq \sigma_0 < 1$. By normalizing the price of home care to zero in (2), U_0 can be interpreted as a health-adjusted measure of income. In the extreme case where $\sigma_0 = 0$, self-care is completely ineffective and could lead to the patient's death. The patient is unable to derive utility from income; thus, $U_0 = 0$. On the other hand, if the patient decides to purchase X from a market-based provider, utility is given by:

$$U = \sigma(Y - P) \tag{3}$$

where $\sigma = 1$ since by definition, X completely restores the patient's stock of health prior to the illness. Note that the difference $1 - \sigma_0$ is a measure of the severity of illness i. For more severe illnesses, the disparity between the health effects of self-care and facility-based care is greater. Thus, if $\sigma_0{}^i > \sigma_0{}^{i'}$, illness i is less severe than illness i'.

The health care provider

The health care provider is likewise assumed to be risk neutral. The utility derived from attending to the patient is

$$V = P - C \tag{4}$$

where C is the cost of producing X. If the provider chooses not to admit the patient, he receives nonpractice income, which is normalized to zero:

$$V_0 = 0. \tag{5}$$

The bargaining outcome

Assuming that the patient and the health care provider agree on a Nash solution to the bargaining problem, the following can be derived:

Proposition 1.

The bargaining outcome is a weighted average of the agents' reservation prices, where the weights are measures of market power.

Proof.

By substituting Equations (2)-(5) in (1), the bargaining problem can be stated as:

$$\underset{\{P\}}{Max}\, W = ((1-\sigma_0)Y - P)^{\alpha}(P - C)^{1-\alpha}.$$

Moreover, using the following definition of the provider's and patient's reservation prices:

$$P^{\max} = (1-\sigma_0)Y$$

and

$$P^{\min} = C,$$

the maximization problem can be re-written as:

$$\underset{\{P\}}{Max}\, W = (P^{\max} - P)^{\alpha}(P - P^{\min})^{1-\alpha}. \tag{6}$$

The solution to (6) is given by:

$$P^{b} = \alpha P^{\min} + (1-\alpha)P^{\max} \tag{7}$$

As $\alpha \to 0$, the price approaches the patient's maximum willingness to pay. This is akin to the pure monopoly outcome. On the other hand, as $\alpha \to 1$, the price approximates marginal cost, an outcome expected in perfectly competitive markets. If $\alpha = \frac{1}{2}$, the price is a simple average of the agents' reservation prices, and bargaining gains in a bilateral monopoly are divided equally among the provider and the patient. This result constitutes a departure from standard textbook models where the pricing outcome under a bilateral monopoly is not clearly described. Prices are simply said to lie somewhere between $P^{\max}$ and $P^{\min}$ (see, for instance, Layard and Walters 1978).

Another deviation from conventional analysis of industrial organization is the result that the number of sellers in a market cannot sufficiently predict pricing outcomes. It can be noted, for instance, that the pure monopoly outcome where $\alpha \to 0$ can be supported by any value of $\bar{M}$. Whether providers are few or many, so long as patients are infinitely many yet only a finite number are represented in the bargaining game, prices are set such that the patient's surplus is completely extracted.

Market equilibrium

Bargaining is assumed to be costless and each patient bargains with all providers whose reservation prices satisfy the condition that $p^{\min} \le p^{\max}$. Let $N^* \cdot M^*$ be the total number of bargains made in the market. The patient is assumed to choose the provider that maximizes his bargaining gains. Thus, the solution to:

$$Max\,\{U_1 - U_0, U_2 - U_0, \ldots, U_{M^*} - U_0\}$$

defines the patient's optimal provider choice. Since U_m varies inversely with p, the patient's most preferred provider would be that with whom he obtains the lowest bargained price. Similarly, the m^{th} provider's most preferred patient will be given by the solution to:

$$Max\,\{V_1 - V_0, V_2 - V_0, \ldots, V_{N^*} - V_0\}.$$

That is, his most preferred patient would be that with whom he can bargain for the highest p^b.

Based on the aforementioned assumptions,

Definition. *A contract arises between the* m^{th} *provider and the* n^{th} *patient if*

(i) the provider's most preferred patient is the patient; and

(ii) the patient's most preferred provider is the provider.

The equilibrium in the bargaining model is therefore akin to that in implicit markets, where agents are matched according to their individual preferences. The total number of contracts is at most equal to $N^* \cdot M^*$.

PRICING, INFORMATION, AND TECHNOLOGY CHOICE

A number of patterns of technology use are distinctly characteristic of medical care markets. Unlike in most industries where a single technology—generally, the most cost-effective one—would tend to dominate, alternative technologies are observed to co-exist in medical care markets. These technologies usually pose a trade-off between cost and quality, higher quality care being more expensive. In this section, the bargaining model is extended in an attempt to explain these atypical patterns of technology choice.

The assumption of perfect information is relaxed to depict the more realistic scenario where health care providers are unable to observe patient incomes accurately. The bargaining model predicts that certain pricing rules require an investment in a wide range of so-called "half-way" technologies.

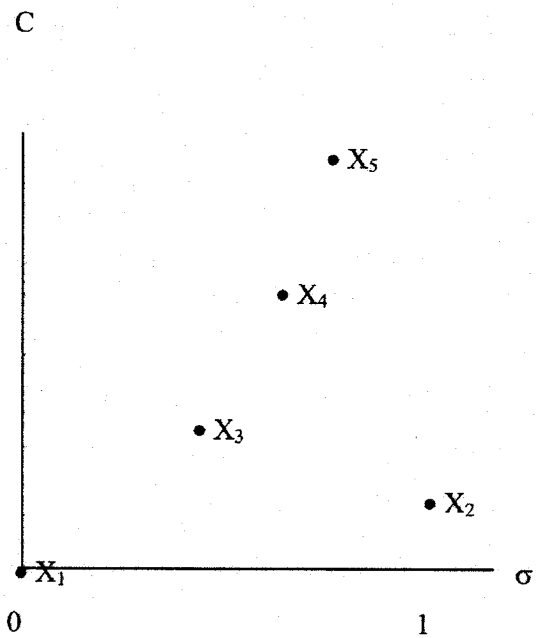
Thomas (1975) defined "half-way" technologies as those falling between two extreme categories: "nontechnologies" and "high technology." Nontechnologies are those that have no capacity to treat a patient but will entail minimal resources. An example is treatment of AIDS patients, which consists of confinement for whatever symptoms that may emerge and to ease the psychological pain of the prospect of death. On the other hand, high technologies are those that seek to prevent, rather than cure, disease. These are likewise the cheapest forms of medical care. Immunization is an example of a high technology. Half-way types are generally successful at extending life but are unable to bring patients to complete recovery. Many of these are expensive protocols, as exemplified by organ transplantation, coronary artery bypass surgery, and chemotherapy. There are also half-way technologies that are less costly but might entail inconveniences like pain and other adverse side-effects.

The Thomas typology is adopted in the model, which is re-cast in the following context. Suppose that for each illness i, there are alternative technologies, T of which are available in the market:

where X_0 denotes home care while $X_{t>0}$ are those technologies that can be bought in the market. Let C_t denote the cost of producing a medical technology X_t and σ_t, the health benefits derived from such technology. The parameter σ_t indicates how effective a particular technology is in treating a patient while the parameter σ_0 measures the health benefits from home care.

In Figure 1, X_1 represents a nontechnology: it has zero costs and does not provide health benefits. X_2 is a high technology: full health benefits are provided at a low cost. X_3, X_4, and X_5 are half-way types. These technologies are useful only in extending a sick person's life. Moreover, it is assumed that for this type of technology, greater health benefits can be obtained only at a higher cost.

Figure 1. Technology types



Equilibrium

Agents are assumed to have perfect information regarding the cost and effectiveness of all technological alternatives. Each patient bargains with all health care providers for each available technology. This series of bargaining games defines a vector of prices for each health care provider, $[P_t]^m$. Defining utility functions over $[P_t]^m$, each patient and health care provider chooses the technology that yields the highest utility. A transaction arises between the m^{th} provider and the n^{th} patient if their most preferred technologies are identical.

A graphical solution to the extended bargaining model

The optimal technology choices of each agent are graphically represented in Figure 2. The patient is indifferent to all technologies lying on the curve with slope equal to:

$$\left(\frac{dC_t}{d\sigma_t}\right)^U = -\frac{\partial U_t / \partial \sigma_t}{\partial U_t / \partial C_t} = -\frac{Y - C_t}{\sigma_t} > 0 .$$

The patient's indifference curves are concave to the origin as indicated by:

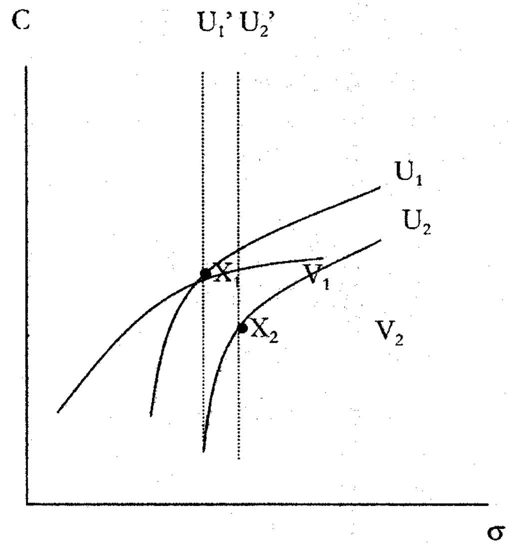
$$\frac{\partial}{\partial \sigma_t}\left(\frac{dC_t}{d\sigma_t}\right)^U = \frac{-Y - C_t}{\sigma_t^{\,2}} < 0 .$$

Indifference curves lying closer to the σ -axis and farther from the C -axis represent higher levels of utility since $\frac{\partial U}{\partial \sigma} > 0$ and $\frac{\partial U}{\partial C} < 0$. Similarly, the provider's indifference curve has a positive slope since:

$$\left(\frac{dC_t}{d\sigma_t}\right)^V = -\frac{\partial V_t / \partial \sigma_t}{\partial V_t / \partial C_t} = \left(\frac{\sigma_0}{\sigma_t^{\,2}}\right) Y > 0 .$$

Moreover, downward shifts in V represent higher utility levels since $\frac{\partial V}{\partial \sigma} > 0$ and $\frac{\partial V}{\partial C} < 0$. Note further that for sufficiently small values for σ_0, the provider's indifference curves are flatter compared to that of the consumer's.

Figure 2. Optimal technology choice (no trade-off between C and σ)



Each agent chooses the technology on the indifference curve representing the highest level of utility. A transaction arises between the m^{th} patient and the n^{th} provider if the solutions to their respective maximization problems are identical. In Figure 2, both patient and provider will choose X_2.

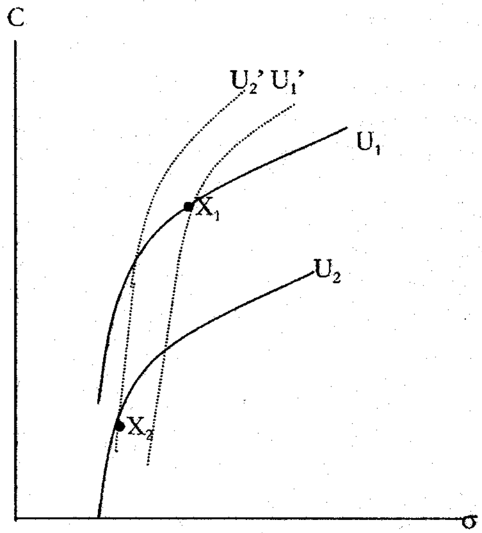
Proposition 2.

In a market with heterogeneous agents and where available technologies are half-way types, the optimal technology choice is not unique.

Proof.

Suppose that there are two available technologies. X_1 is costlier and has fewer health benefits compared to X_2. Figure 2 shows that regardless of preferences, both agents will choose X_2. That is, whether patient preferences are represented by U_1 and U_2 or by U_1' and U_2', X_2 is the optimal choice. Hypothetical indifference curves can also be drawn for the provider that are slightly flatter than U_1' and U_2'. Regardless of level curves, a transaction ensues between the m^{th} patient and the n^{th} provider and where X_2 is the chosen protocol. Suppose instead that the available technologies pose a trade-off between cost and effectiveness: X_1 is costlier but has greater health benefits compared to X_2. In this case, the slope of the indifference curves will matter in determining preference rankings. As shown in Figure 3, if the patient's preferences are represented by U_1 and U_2, X_2 is optimal. By contrast, if U_1' and U_2' indicate patient's preferences, then the patient's optimal choice is X_1.

Figure 3. Optimal technology choice among half-way technologies



Thus, as illustrated in Figures 2 and 3, with the absence of a trade-off between cost and effectiveness, all agents will prefer the most cost-effective technology. On the other hand, when available technologies are half-way types, preference rankings are determined by the shape and position of agents' indifference curves. These in turn depend on Y and C. Thus, in a market composed of patients with varying and health care providers with different levels of C, preference rankings will also vary. Consequently, no unique technology choice will emerge.

Lemma. *Under perfect information, the bargaining model predicts that when available technologies are half-way types, richer patients tend to prefer costlier and superior technologies.*

Proof.
Patients with higher incomes have steeper indifference curves:

$$\frac{\partial}{\partial Y}\frac{dC_t}{d\sigma_t} = \frac{1}{\sigma_t} > 0$$

Moreover, increases in income can cause sufficiently large increases in the slope of the patient's indifference curves such that the optimal choice shifts from the cheaper and less effective technology to the costlier and more effective technology (see Figure 3).

Proposition 3.
When price-discriminating health care providers have sufficiently large market power but are unable to observe patient incomes, they invest in alternative half-way technologies.

Proof.
A health care provider can exercise price discrimination under three conditions, namely: (i) the market is composed of patients with varying incomes; (ii) the health care provider has market power (α is less than one); and (iii) the health care provider observes income differences (see, for example, Phlips 1988). By Lemma 1, when condition (iii) is not met, the health care provider can resort to inferring patient's income from his choice of technology. More expensive and more effective medical technologies will be preferred by richer patients. Conversely, cheaper technologies with less health benefits will be chosen by poorer patients. Thus, the health care provider who is unable to observe patient incomes will find it beneficial to invest in a range of half-way technologies to facilitate market segmentation.

Explaining evidence on price discrimination via bargaining
If technology choices are indeed driven by pricing behavior under imperfect information, then the incentive to invest in cost-effective technology could be weak in a market with heterogeneous patients whose incomes are sufficiently large. While this hypothesis has yet to be subjected to rigorous empirical testing, some observations on physician behavior in the Philippines at least do not contradict this hypothesis. For example, while Directly Observed Treatment Short Course is the most cost-effective treatment for tuberculosis patients, less than one-third of private physicians use this protocol (Kraft et al. 2005). Moreover, there is evidence that health care providers in both public and private sectors engage in price discrimination (De la Paz Kraft 1997; Gertler and Solon 1998). Regression results presented by Gertler and Solon (1998) could be interpreted as indirect support for price discrimination via technology choices. From their results, it can be noted that the implicit price of surgical procedures is about five times greater in private hospitals than in public hospitals. This implies that patients who choose to seek care in private hospitals, which are presumably more technologically advanced, tend to pay more for a surgical procedure than users of public hospitals, where cheaper and traditional treatment protocols are the dominant technology types. The same pattern can be seen for radiological examinations and physician visits. In other words, if facility choices can be viewed in a broad sense as technology choices, then patients who prefer private hospitals over public hospitals tend to be richer and thus, face higher charges.

CONCLUSION

This paper proposes that pricing behavior can be explained via a bargaining model. If providers and patients agree on a Nash (1950) solution, the price can be shown to be the weighted average of the maximum price that the patient is willing to pay and the minimum price that the physician is willing to accept for a fixed treatment level, where the weights reflect the level of competitiveness in the market.

This simple bargaining model is then extended to show that the observed utilization patterns of medical technology are the result of imperfect information and imperfect market structures. Why do alternative technologies exist? The results of the model indicate that health care providers invest in a wide range of substitutable technologies to facilitate price discrimination when patient incomes are not observable. For this menu of technologies to be an effective filter of patient incomes, the technologies must pose a trade-off between quality and cost. Given this supply of half-way technologies, the model predicts that no single technology will dominate.

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