The Journal of Risk and Insurance

© *The Journal of Risk and Insurance*, 2010, Vol. 77, No. 1, 129-144
DOI: 10.1111/j.1539-6975.2009.01335.x

Implications of the Interaction Between Insurance Choice and Medical Care Demand

Richard Dusansky
Çağatay Koç

Abstract

The gross price elasticity of demand for medical care is decomposed into two separate *observable* components: the medical care gross price elasticity of insurance choice and the cost-sharing elasticity of medical care. When consumers alter their choice of health-care plans, the price elasticity of medical care is no longer equivalent to the cost-sharing elasticity; using the latter as a proxy for the former may produce misleading results. We present conditions under which the medical care price elasticity is *positive*, the case of a quasi-Giffen good, and provide a theoretical foundation for extant empirical findings of a positive medical care price elasticity of *insurance* demand.

Introduction

Among the developed, higher-income countries, medical care expenditures have been rising at a pace that is distinctly above overall growth rates. In the United States, for example, total medical cost outlays have increased at an average rate of 8.9 percent since 1980, which is about 2.6 percentage points above the average for the aggregate economy, as measured by gross domestic product (GDP).[1] Similar patterns prevail when one examines medical expenditures in both per capita and budget share terms. As a share of the U.S. economy, medical care has nearly doubled over the 25-year period 1980 to 2005, rising from 9 percent of GDP in 1980 to 16 percent in 2005.[2] Medical care spending per capita has also increased dramatically during this period, increasing to \$6,697 from \$1,102.[3] Although the United States is by far the medical expenditure leader, similar trends exist in most developed countries.[4]

These observations prompt interest in the forces underlying medical care demand and in how individuals respond to its rising costs. In this article, we analyze consumer medical care demand response to a change in the gross price of medical care, paying special attention to the interaction between the consumer's demand for

Richard Dusansky is with the Department of Economics, University of Texas at Austin. Çağatay Koç is with the Department of Economics, University of Texas at Arlington. Dusansky can be contacted via e-mail: dusansky@eco.utexas.edu

[1] Centers for Medicare and Medicaid Services.
[2] Centers for Medicare and Medicaid Services.
[3] Centers for Medicare and Medicaid Services.
[4] Kaiser Family Foundation.

medical care and his demand for health insurance, and the ensuing implications for the measurement of demand elasticities.[5]

Private health insurance contracts provide for a price discount at the time the insured purchases medical care; therefore, the more generous an individual's insurance coverage is, the higher might be his demand for medical care. This effect of insurance on medical care demand is known as the moral hazard effect (Arrow, 1963; Pauly, 1968). It refers to the effect of insurance on the net price of medical care (i.e., percentage of cost sharing times the gross price) and to the consequent incentive effects on medical care consumption. In medical care, moral hazard combines with the interdependence between utilization and the insurance contract decision. The choice of type of insurance is influenced by expected utilization of medical care services, whereas utilization itself is affected by the consumer's insurance contract. This interaction complicates the analysis of the consumer's response to changes in medical care prices.[6] We present a principal–agent model of individual consumer medical care demand that highlights this interaction, so that the consumer is allowed to change both his demand for medical care and his selection of insurance contract in response to changes in medical care prices. A change in the gross price of medical care has two effects on demand: a direct effect, for fixed cost sharing, and an indirect effect through a moral hazard response that results from cost-sharing changes associated with price-induced changes in the choice of insurance plan. Much of the extant literature studies the demand for medical care by examining responses to changes in cost sharing, with the gross price held constant and the choice of health insurance contract remaining fixed. However, if one wants to compare medical care demand with the demand for other goods or categories of goods—or if one simply recognizes the fact that most insured consumers choose from among several insurance plans and can alter their intended choice—then the response to a change in gross price is important.

Our analysis reveals that the indirect demand effect through the moral hazard effect of insurance can have a major role in determining the consumer's medical care demand response to a price change. Indeed, it is possible for the own-demand curve for medical care to be upward sloping, even though medical care is a noninferior good.[7] For this possibility to occur, it turns out, the demand for health insurance must be increasing in the price of medical care. Although there is empirical support for this, it lacks a theoretical foundation. We provide one by developing a formal analytical condition, which embodies a dominant expenditure risk effect under which it holds. There has been some work done on the possibility that in response to an increase in the premium rate, consumers may choose to increase their insurance coverage, i.e.,

[5] This article concerns the case where individuals have some choice about the extent or generosity of their insurance coverage. It does not apply to systems where coverage is set exogenously, as in some national health insurance systems. However, even in the presence of national health insurance participation such as Medicare, what follows applies if the individual can privately supplement the mandated coverage.

[6] This interaction in the medical care industry has received recent attention. For example, Mougeot and Naegelen (2009) analyze the optimal outlier payment policy in a prospective payment system for hospitals under both adverse selection and moral hazard.

[7] Housing is another example of a noninferior good whose own demand can be upward sloping. See Dusansky and Koç (2007).

the demand for insurance may be upward sloping (Hoy and Robson, 1981; Briys, Dionne, and Eeckhoudt, 1989; Hau, 2008).[8] Our analysis complements this literature and suggests that health insurance, via its moral hazard effect, can make the demand for medical care upward sloping.

We also examine medical care's price elasticity of demand and demonstrate that the gross price elasticity can be decomposed into two separate and observable components, the medical care gross price elasticity of *insurance* choice and the cost-sharing elasticity of medical care. We show how the two can be combined in order to determine a measure of the gross price elasticity. When one allows for the contract choice response, the gross price elasticity of demand for medical care and the cost-sharing demand elasticity diverge. Consequently, using cost-sharing elasticities as a proxy for gross price elasticities would be unwise, if not misleading.

THE MODEL

We employ a principal–agent model in which the agent (consumer) first chooses an insurance plan, when there is uncertainty about his future health status, and then makes optimal choices of medical care and the standard consumer goods, after the health status uncertainty is resolved. The insurance contracts among which the consumer chooses can vary considerably across the basic health characteristics. For example, there can be differences in the annual deductible per person and/or per family, in the physician co-pays per physician type, in the percentage cost shares for hospital stays, for in-network versus out-of-network services, etc. We follow Feldstein (1971) in assuming that the characteristics of any insurance policy can be represented by a single metric. We designate this by σ, the percentage of cost sharing. An increase in the deductible or co-pay, for example, increases σ. For simplicity, we assume that our consumer faces a continuum of policies, arrayed by percentages of cost sharing, and for a given gross price of medical care chooses a policy with a particular percentage of cost sharing, say $\sigma = \sigma^*$. Here we acknowledge the reality that the majority of insured consumers choose from among several insurance policies. In 1995, 62 percent of insured U.S. workers were offered two or more health plans. For firms with 200 or more workers, this figure was 84 percent.[9]

The consumer's *ex post* budget constraint can be represented by

$$Y - R = c + \sigma p m, \tag{1}$$

[8] Hoy and Robson (1981) show that for the class of constant relative risk-aversion utility functions, the coefficient of relative risk aversion must be greater than 1 for insurance to be a Giffen good. Briys, Dionne, and Eeckhoudt (1989) demonstrate that insurance is not a Giffen good if and only if the variation of risk aversion is lower than a minimal bound, which is satisfied with increasing and constant absolute risk-aversion utility functions. Assuming that there are two states of the world (loss and no loss), they confirm Hoy and Robson's result by reversing their necessary and sufficient condition. Hau (2008) shows that the necessary condition for insurance to be a Giffen good can be made less restrictive than that proposed by the above studies by extending their result to the case with a continuum of states of the world and without the class of constant relative risk-aversion utility functions.

[9] See Jensen et al. (1997).

where Y is income, R is the cost to the consumer for participating in the health insurance plan (i.e., health insurance premium), c is a composite consumption good whose price is normalized to one without any loss of generality, and m is composite medical care services with gross price p. Since σ is the fraction of p that the consumer must pay out of pocket, σp is the net price for a unit of medical care service to the consumer.

The consumer's utility function, which is assumed to be continuous and bounded,[10] is represented by

$$U = U(c, H(m,s)), \tag{2}$$

where $U_1 = \frac{\partial U}{\partial c} > 0, U_2 = \frac{\partial U}{\partial H} > 0$, $U_{11} = \frac{\partial^2 U}{\partial c^2} \leq 0$, and $U_{22} = \frac{\partial^2 U}{\partial H^2} \leq 0$. We assume that $U_{12} = \frac{\partial^2 U}{\partial c \partial H} \geq 0$; i.e., the consumer's marginal utility of consumption rises (technically does not fall) as health improves. This ensures that the second-order condition with respect to the *ex post* decision problem about purchases of medical care and other goods conditional on the *ex ante* choice of insurance plan is satisfied.[11] $H(.,.)$ is the health production function with $H_1 = \frac{\partial H}{\partial m} > 0$, $H_{11} = \frac{\partial^2 H}{\partial m^2} \leq 0$, and $H_2 = \frac{\partial H}{\partial s} > 0$, as in Dardanoni and Wagstaff (1990). It determines the amount of health produced measured as income equivalent with input m in state s.

The model is solved by backward induction. First, the consumer solves for the optimizing values of m and c conditional upon the choice of insurance policy σ for each possible realization of the unknown health state s. Second, the consumer formulates a prior probability measure F of the future health states denoted by $F(s)$. Next, substituting these optimal values of m and c into the utility function and integrating over s gives the indirect conditional expected utility associated with insurance policy σ. This indirect conditional expected utility function forms the basis of choice of insurance policy σ. Assuming a perfectly competitive health insurance market, the consumer maximizes this function over the set of *zero-profit* insurance policies, yielding the optimal insurance plan choice.

For any arbitrary health status, given a choice of insurance policy, our consumer chooses the level of medical care that maximizes

$$U(Y - R - \sigma pm, H(m,s)), \tag{3}$$

where we have used the budget constraint to rewrite the first argument of U. The first-order condition is

$$-U_1 \sigma p + U_2 H_1 = 0. \tag{4}$$

Rearranging the first-order condition gives the optimality condition for this second-stage problem:

[10] If the consumer's utility function is continuous and bounded, the expected utility of insurance is well defined.

[11] This assumption appears elsewhere in the literature. See, for example, Wagstaff (1986), Blomqvist (1997), and Jack (2002).

$$\frac{U_2}{U_1} = \frac{\sigma p}{H_1} = \pi, \tag{5}$$

where $\pi = \frac{\sigma p}{H_1}$, the shadow price of health, is the insurance adjusted (net) cost to the consumer of producing an extra unit of health. Since the price of the composite consumption good is normalized to one, the consumer's marginal rate of substitution between health and the composite consumption good, at the optimum, equals the shadow price.

The presence of uncertainty complicates planning. Although all prices and the current health state are known when the consumer chooses his insurance policy, the future health state s is unknown. Hence, the *consequences* of the *ex ante* action σ depend crucially on s, which is revealed in the second stage. When making his choice, the consumer must therefore forecast his *ex post* consumption stream according to the future health state s, given that he makes some insurance choice σ. The consumer is assumed to have a prior subjective probability distribution of the future health states denoted by $F(s)$.

In choosing a health insurance plan, the consumer is assumed to confront a perfectly competitive health insurance market. Given the utility-maximizing medical care schedule $m(\sigma, s)$ characterized by (4), the consumer's expected utility function for a particular insurance plan as represented by its cost sharing σ and premium R is

$$V(\sigma, R) = \int_S U(Y - R - \sigma p m(\sigma, s), H(m(\sigma, s), s))\, \mathrm{d}F(s). \tag{6}$$

The competitive equilibrium health insurance policy maximizes (6) subject to the zero-profit insurance policy constraint

$$R = \int_S (1 - \sigma) p m(\sigma, s) \mathrm{d}F(s). \tag{7}$$

Our model is similar to those presented in Zeckhauser (1970), Spence and Zeckhauser (1971), Feldstein and Friedman (1977), Baumgardner (1991), and Blomqvist (1997).[12] It is a principal–agent model where the agent (insured consumer) observes his future health status (s) and decides on the level of *composite* medical care services (i.e., his effort). Given a level of medical care chosen by the insured according to (4) and assuming a perfectly competitive health insurance market, the principal (the insurer) maximizes the expected utility of the insured subject to the zero-profit insurance policy constraint, which also incorporates the utility-maximizing medical care schedule. Since health insurance policies provide for a price discount at the time

[12] Zeckhauser (1970), Feldstein and Friedman (1977), and Baumgardner (1991) consider linear insurance schedules, i.e., a constant coinsurance parameter where health insurance pays the same fraction of the cost of the consumer's medical care services, regardless of the total amount spent. Spence and Zeckhauser (1971) and Blomqvist (1997) analyze the properties of nonlinear health insurance policies that depend on the amount of medical expenditures spent.

the insured purchases medical care, the insured has an incentive to select a supraoptimal amount of medical care no matter what his health status is. The insurer recognizes this *ex post* moral hazard problem and therefore (4) is imposed as a constraint in the consumer's expected utility maximization. This can be considered as a form of self-selection constraint which guarantees that an individual facing σ will, for a given s, voluntarily choose the combination $[\sigma, m(\sigma, s)]$ corresponding to the values in the optimal solution.

In the above principal–agent framework, moral hazard leads to a nonconvexity in the set of feasible contracts, which is a well-known problem with optimization under moral hazard. To see this, consider the contract space (σ, R), with R on the vertical axis and σ on the horizontal axis. The set of zero-profit insurance policies given by (7) is curved inward toward the axes; i.e., it is concave to the origin. This is because as σ falls, R increases more than proportionately (since as σ falls, not only does the insurer's portion of medical expenses increase, but also total expenditure increases due to the moral hazard problem (Phelps, 2003, p. 335)).[13] The feasible sets of contracts (i.e., those making a nonnegative profit), however, are those contracts to the left of this curve, including the curve. The set is clearly nonconvex. This problem affects the interpretation of our comparative statics analysis of the impact of medical care price on the choice of insurance contract. Since the implicit function theorem is based on the first-order conditions, which do not uniquely determine the optimum when there is a nonconvexity problem, the expression in (13) does not define the *global* impact. We assume that the first-order conditions of the health insurance demand decision do characterize the *local* impact.[14]

The first-order condition for the maximization of (6) subject to (7) is given by

$$-p\mathbf{E}\left[m-(1-\sigma)\frac{\partial m}{\partial \sigma}\right]\int_S -U_1\mathrm{d}F(s)-\int_S U_1 mp\mathrm{d}F(s)+\int_S[-U_1\sigma p+U_2H_1]\frac{\partial m}{\partial \sigma}\mathrm{d}F(s)$$
$$+p\mathbf{E}\left[m-(1-\sigma)\frac{\partial m}{\partial \sigma}\right]\int_S[-U_1\sigma p+U_2H_1]\frac{\partial m}{\partial Y'}\mathrm{d}F(s)=0, \tag{8}$$

where $Y' = Y - R$, $-p\mathbf{E}[m-(1-\sigma)\frac{\partial m}{\partial \sigma}] = \frac{\partial R}{\partial \sigma}$, and the $\mathbf{E}[]$ operator refers to the expectation across S. Using (4), the optimum condition for health insurance choice is

$$\int_S mpU_1\mathrm{d}F(s) = p\mathbf{E}\left[m-(1-\sigma)\frac{\partial m}{\partial \sigma}\right]\int_S U_1\mathrm{d}F(s), \tag{9}$$

[13] This also can be seen by analyzing the first and second derivatives of R with respect to σ:

$$\frac{\partial R}{\partial \sigma}=\left(-p\int_S m(\sigma,s)\mathrm{d}F(s)+(1-\sigma)p\int_S\frac{\partial m}{\partial \sigma}\mathrm{d}F(s)\right)<0.$$

$$\frac{\partial^2 R}{\partial \sigma^2}=-2p\int_S\frac{\partial m}{\partial \sigma}\mathrm{d}F(s)+(1-\sigma)p\int_S\frac{\partial^2 m}{\partial \sigma^2}\mathrm{d}F(s)$$

is positive if $\frac{\partial^2 m}{\partial \sigma^2} > 0$, i.e., if m increases at an increasing rate as σ falls.

[14] We thank a referee for helping us to understand this problem and for his guidance on how to deal with it.

where the right-hand side represents the cost of additional insurance in terms of expected marginal utility. This cost appears in the form of foregone consumption when the consumer uses some of his income to purchase more insurance. The left-hand side represents the benefit of additional insurance in terms of expected marginal utility. Since additional insurance reduces the cost of medical care, the value of the additional insurance appears as the benefit of extra medical care service.

Given the construction of the model and the backward induction solution process, expected utility maximization yields optimal solutions for σ, c, and m.

COMPARATIVE STATICS IMPLICATIONS FOR EMPIRICAL WORK

In this section, we analyze how the insured consumer reacts to a change in the gross price of medical care p. One example of a change in p would be a change in nonnegotiated supply prices that are applicable to a percentage cost share rule. Such a change in p changes the net price, for given σ. One should note here that it would be inappropriate to consider an exogenous change in σ because σ is not an exogenous parameter in the consumer choice model. The choice of health insurance plan (i.e., σ) is endogenous; once chosen, σ is set for the period (i.e., deductible, co-pays, expenditure caps, etc. become fixed). However, σ can change if the consumer changes the intended choice of insurance plan *in response to a* change in the gross price p. In this case, the net price changes twice, first exogenously when p changes and second endogenously when σ changes. *Our theoretical model captures this reality and allows for the insurance policy choice response and its subsequent impact on net price and medical care demand*. We now turn to the comparative statics analysis of a change in p and examine its implications for demand behavior and measurement of demand elasticities.[15]

The change in individual medical care demand caused by an alteration in the gross price comprises two separate behavioral responses. The first is the standard neoclassical demand response, depicted by $\frac{\partial m}{\partial p}$; for a given cost sharing, a change in gross price directly impacts demand. Totally differentiating the first-order condition in (4) with respect to p, we get

$$\frac{\partial m}{\partial p} = \frac{U_1\sigma + U_{12}H_1\sigma m - U_{11}\sigma^2 pm}{\Theta}, \tag{10}$$

where $\Theta = U_{11}\sigma^2 p^2 - 2U_{12}H_1\sigma p + U_2H_{11} + U_{22}(H_1)^2 < 0$ is the second-order condition. Since $U_{12} \geq 0$, the second-order condition is satisfied; thus, $\frac{\partial m}{\partial p} < 0$ if medical care is noninferior.

The second response is indirect. A change in the price of medical care can lead to a change in the intended choice of health insurance. The consumer may now choose to

[15] There are two extreme values for σ. If $\sigma = 1$, the deductible has not been reached, and the net price of medical care is the same as the gross price. If $\sigma = 0$, then the consumer expenditure cap has been reached and the net price is 0. For analytical convenience, we will assume $0 < \sigma < 1$. This is the most common case in reality and allows us to emphasize the situation of a positive net price of medical care that differs from the gross price.

purchase a policy characterized by a lower degree of overall cost sharing (i.e., a lower σ). This lower σ can induce an increase in medical care demand. This second response is represented by $\frac{\partial m}{\partial \sigma}\frac{\partial \sigma}{\partial p}$, where $\frac{\partial \sigma}{\partial p}$ captures the impact of a changing medical care price on the choice of insurance contract (i.e., the insurance contract choice effect) and $\frac{\partial m}{\partial \sigma}$ captures the medical care response to a change in the degree of overall cost sharing (i.e., the moral hazard effect). From comparative statics of the optimality condition in (4) with respect to σ, we have

$$\frac{\partial m}{\partial \sigma} = \frac{U_1 p + U_{12} H_1 pm - U_{11} p^2 \sigma m}{\Theta}. \tag{11}$$

Rewriting the optimality condition in Equation (9) as

$$\Psi = -\frac{\partial R}{\partial \sigma}\int_S U_1\, \mathrm{d}F(s) - \int_S U_1 mp\, \mathrm{d}F(s) = 0 \tag{12}$$

and differentiating it with respect to p, we have

$$\begin{aligned}\frac{\partial \Psi}{\partial p} = &-\int_S m[1-\epsilon_{m,p}]\,(U_1 - U_{11}\sigma mp)\,\mathrm{d}F(s)\\ &+\frac{\partial R}{\partial \sigma}\int_S U_{11}\sigma m[1-\epsilon_{m,p}]\mathrm{d}F(s) - \frac{\partial^2 R}{\partial \sigma \partial p}\int_S U_1 \mathrm{d}F(s)\\ &+\frac{\partial R}{\partial p}\left(\frac{\partial R}{\partial \sigma}\int_S U_{11}\mathrm{d}F(s) + \int_S U_{11} mp\mathrm{d}F(s)\right)\\ &-\int_S U_{12}H_1\frac{\partial m}{\partial p} mp\mathrm{d}F(s) - \frac{\partial R}{\partial \sigma}\int_S U_{12}H_1\frac{\partial m}{\partial p}\mathrm{d}F(s),\end{aligned} \tag{13}$$

where $\epsilon_{m,p} = -\frac{\partial m}{\partial p}\frac{p}{m}$ is the standard neoclassical price elasticity of demand for medical care. From Equation (11), we learn that medical care demand is decreasing in the degree of overall cost sharing (i.e., $\frac{\partial m}{\partial \sigma} < 0$), since medical care is noninferior. Equation (13) is key to evaluating the sign of $\frac{\partial \sigma}{\partial p}$, the effect of a gross price change on insurance choice. From the implicit function theorem, we know that $\frac{\partial \sigma}{\partial p} = -\frac{\partial \Psi/\partial p}{\partial \Psi/\partial \sigma}$. Since the sign of the insurance contract choice effect is the same as the sign of $\frac{\partial \Psi}{\partial p}$ and since the latter is ambiguous, the effect of a change in the gross price of medical care on insurance choice is also ambiguous.[16]

The two behavioral responses are captured in the expression for the change in medical care demand with respect to a change in its price that is generated by a perturbation of the optimum conditions and can be expressed in elasticity form by multiplying by $\frac{p}{m}$ and by making use of the comparative statics result $\frac{\partial m}{\partial p} = \frac{\sigma}{p}\frac{\partial m}{\partial \sigma}$.[17] Adding the

[16] Later we present conditions under which this ambiguity is resolved.

[17] A change in p also has two income effects associated with a change in policy premium R on medical care demand. The first income effect is induced by p's direct effect on R, given by

two responses together provides an expression for the total gross price elasticity of demand for medical care:

$$\epsilon_{m,p}^{\mathrm{T}} = \epsilon_{m,\sigma}(1 + \epsilon_{\sigma,p}). \tag{14}$$

Equation (14) shows that the gross price elasticity of demand for medical care consists of two observable components: the cost-sharing elasticity of medical care ($\epsilon_{m,\sigma}$) *and* the medical care gross price elasticity of demand for health insurance ($\epsilon_{\sigma,p}$). Many studies that analyze the price elasticity of medical care explicitly take the medical care gross price elasticity of demand for health insurance to be 0.[18] As a result, the term in parentheses is unity and the cost-sharing elasticity of medical care demand $\epsilon_{m,\sigma}$ is tantamount to the gross price elasticity $\epsilon_{m,p}$. However, if one acknowledges the insurance contract choice effect, then $\epsilon_{\sigma,p}$ is not 0, the term in parentheses is not unity and $\epsilon_{m,\sigma}$ would not be the same as the gross price elasticity of demand for medical care.

It is not the case that the role of health insurance has been ignored. Quite the contrary is true. The importance of insurance in medical care demand is widely recognized. There is the pioneering RAND study, in which insurance plans are randomly assigned and plan change is precluded, and other studies both theoretical and empirical. Examples of these are Phelps (1976), Cameron et al. (1988), Strombom, Buchmueller, and Feldstein (2002), and Ahking, Giaccotto, and Santerre (2009). Phelps presents a theoretical model of insurance demand response to a change in the price of medical care (the response is ambiguous). Cameron et al. allow for a theoretical interaction between insurance choice and utilization decisions and then estimate an insurance demand equation, subsequently using the estimated insurance variable as an input to a medical care demand equation. Strombom, Buchmueller, and Feldstein estimate health plan choice as a function of premiums, health plan characteristics, and consumer characteristics. Ahking, Giaccotto, and Santerre estimate the aggregate demand for private health insurance coverage in the United States for the period 1966 through 1999.[19] However, no study takes account of the effect of a change in the price of medical care on the demand for health insurance *and* the resulting moral hazard effect of this change in intended insurance coverage on the demand for medical care.[20] The health insurance contract choice effect can play an important role in determining the

---

$\frac{\partial m}{\partial Y'}\frac{\partial Y'}{\partial R}\frac{\partial R}{\partial p}$. The second effect is induced by p's effect on σ and its subsequent effect on R, given by $\frac{\partial m}{\partial Y'}\frac{\partial Y'}{\partial R}\frac{\partial R}{\partial \sigma}\frac{\partial \sigma}{\partial p}$. We follow others in eschewing the income effects associated with a change in premium, which is generally considered to be negligible. For examples, see Pauly (1968), Feldstein (1973), Feldman and Dowd (1991), and Manning and Marquis (1996).

[18] A selection of papers include Rosett and Huang (1973), Newhouse et al. (1980), Wedig (1988), and Hughes and McGuire (1995). For a complete list of these papers see Cutler and Zeckhauser (2000) and Zweifel and Manning (2000).

[19] There is also an empirical literature that deals with the econometric problems arising from the endogeneity of contract choice. See, for example, Lee (1983), Hosek, Marquis, and Wells (1990), Dowd et al. (1991), Vera-Hernandez (1999), and Deb et al. (2006).

[20] The objective of the RAND study was to analyze the impacts of alternative cost-sharing regimes on medical care demand. Therefore, individuals were randomly assigned to insurance plans and were not permitted to change plans in order to avoid the endogenous contract selection. If the objective of the RAND study were to estimate the gross price elasticity of

consumer's observable demand response to a change in the gross price of medical care. The medical care demand curve could be upward sloping. Econometric studies of the price elasticity of medical care that ignore it—which is typically the case in the literature—would produce estimates that are erroneous. We now turn our attention to analyzing the implications of the contract choice effect for the slope of the medical care demand curve and for the price elasticity of medical care.

MEDICAL CARE AS A QUASI-GIFFEN GOOD

If the contract choice effect is positive (i.e., $\frac{\partial \sigma}{\partial p} < 0$), the consumer switches to a more generous health insurance plan. As a result, the moral hazard effect of this change in insurance coverage on the demand for medical care is positive (i.e., $\frac{\partial m}{\partial \sigma}\frac{\partial \sigma}{\partial p} > 0$), in opposition to the neoclassical response path (i.e., $\frac{\partial m}{\partial p}$). And if the standard neoclassical response path is dominated by the moral hazard induced effect of the change in insurance coverage on medical care demand, then $\epsilon^{\mathrm{T}}_{m,p} > 0$. The qualitative properties of the medical care demand curve are now distinctly different from those of the traditional response. Even though medical care is noninferior, an increase in the gross price of medical care causes an *increase* in medical care demand. Once health insurance choice is endogenized, it is possible that the demand for medical care is upward sloping.

The key to understanding this outcome is to note that the consumer responds to the net price, given by σp. Suppose that p rises. For a fixed σ, the net price increases. However, because of the contract choice effect, σ falls. If the decline in σ more than offsets the rise in p, the final outcome is a decline in the net price. Therefore, the demand for medical care can be upward sloping with regard to the gross price whereas at the same time be downward sloping with regard to its net price. We can characterize the condition under which an upward sloping medical care demand occurs. From (14), we know that the overall price effect is positive if and only if

$$\left(1 + \epsilon_{\sigma,p}\right) < 0. \tag{15}$$

Consequently, the demand for medical care is upward sloping if and only if $-\epsilon_{\sigma,p} > 1$, that is, if and only if the demand for health insurance is medical care price elastic.

Feldstein's (1973) empirical work on health insurance demand in response to changes in the price of medical care is relevant here. Using a variable akin to our σ, he found that an increase in the price of hospital care had a positive and statistically significant effect on insurance demand. This points to the viability of the contract choice effect. Feldstein also reported an elasticity of 1.2, which satisfies the condition in (15).[21] This suggests that, in some times and places, there may be some categories of medical services for which own-price demand elasticity is positive.

---

medical care demand, another randomized experiment could have been carried out to ascertain the medical care gross price elasticity of demand for health insurance and one could have calculated the gross price elasticity of medical care demand by combining estimates from two sets of randomized experiments.

[21] Note that if the contract choice effect is positive, $\frac{\partial \sigma}{\partial p} < 0$ according to our model setup, so that $\epsilon_{\sigma,p}$ should be taken as -1.2.

PRICE ELASTICITY OF THE DEMAND FOR MEDICAL CARE

Much of the existing econometric literature has focused on the impact of changes in cost sharing (e.g., changes in co-pays or deductible), with the gross price of medical care held constant and the choice of health plan remaining fixed. The estimated cost-sharing elasticities have been used as perfect proxies for price elasticities, since for a *given* insurance policy, the medical care demand elasticity with respect to cost sharing equals the elasticity with respect to gross price of medical care.[22] Relatively little attention has been devoted to changes in the gross price and to how these changes influence insurance choice and its ensuing impact on medical care demand.

As expressed in Equation (14), once health insurance is endogenized, the gross price elasticity of medical care demand can be decomposed into two observable components—the insurance cost-sharing elasticity of demand for medical care, which is the focus of the literature, and the medical care gross price elasticity of insurance choice. When the latter component is accounted for, the gross price elasticity of medical care is no longer equivalent to the cost-sharing demand elasticity. As a result, the use of cost-sharing elasticities as a proxy for the gross price elasticities may produce results that are misleading.

If health insurance demand is decreasing in the gross price of medical care, then $\frac{\partial \sigma}{\partial p} > 0$ and $\epsilon_{\sigma,p} > 0$, and the extant estimates of insurance elasticity of demand for medical services $\epsilon_{m,\sigma}$ *understate* the gross price elasticity of demand. If health insurance demand is increasing in the gross price of medical care, then $\frac{\partial \sigma}{\partial p} < 0$ and $\epsilon_{\sigma,p} < 0$, and extant studies *overstate* the gross price elasticity of demand. Either way, elasticity estimates of $\epsilon_{m,\sigma}$ that do not adjust for the contract choice effect will not accurately measure the gross price elasticity of demand for medical care.

INSURANCE CHOICE AND EXPENDITURE RISK

In this section, we extend our modeling approach in order to shed light on the forces underlying the insurance contract choice effect. We assume that individual preferences over consumption and health are represented by an additively separable utility function

$$U(c, H) = V(c) + X(H(m, s)). \tag{16}$$

This assumption is common not only in health economics (Wagstaff, 1986; Blomqvist, 1997) but also in other fields employing multiperiod modeling approaches. Since we now have $U_{12} = 0$, the expression in (13) that determines the sign of the contract choice effect reduces to

$$\begin{aligned}\frac{\partial \Psi}{\partial p} = &- \int_S m[1 - \epsilon_{m,p}](U_1 - U_{11}\sigma mp)\, \mathrm{d}F(s) + \frac{\partial R}{\partial \sigma} \int_S U_{11}\sigma m[1 - \epsilon_{m,p}]\, \mathrm{d}F(s) \\ &- \frac{\partial^2 R}{\partial \sigma \partial p} \int_S U_1 \mathrm{d}F(s) + \frac{\partial R}{\partial p} \left(\frac{\partial R}{\partial \sigma} \int_S U_{11}\, \mathrm{d}F(s) + \int_S U_{11} mp\, \mathrm{d}F(s) \right).\end{aligned} \tag{17}$$

[22] See Phelps (2003, p. 134) for a proof.

TABLE 1
Selected Medical Care and Health Insurance Demand Elasticities

A. Own-Price Elasticity of the Demand for Medical Care
- Rosett and Huang (1973): −0.35 to −1.5
- Manning et al. (1987) [RAND Study]: −0.17 to −0.31
- Wedig (1988): −0.32
- Hughes and McGuire (1995): −0.37

B. Own-Price Elasticity of the Demand for Health Insurance
- Strombom et al. (2002): −2.5 (insurer-perspective demand elasticity)
- Ahking et al. (2009): −0.18 to −0.23 in the short-run (aggregate demand elasticity)

−0.28 to −0.32 in the long-run (aggregate demand elasticity)

C. Medical Care Gross Price Elasticity of the Demand for Health Insurance
- Feldstein (1973): 1.2

There are two major forces at work in (17). The first, captured in the first term, is the expenditure risk effect. Assuming that the neoclassical demand for medical care is inelastic,[23] an increase in the price of medical care increases medical care expenditures. The expenditure risk against which the consumer insures thus increases, prompting an increase in his demand for insurance. The second force, captured by the remaining three terms, is the supply-side effect. The first of the three terms represents the interaction of the expenditure risk effect and the price of health insurance. Although the consumer would like to purchase a more generous insurance policy having lower cost sharing, he recognizes that, in a perfectly competitive health insurance market,[24] this would lead to an increase in policy premiums, which mitigates his increasing insurance demand. The second term in the supply-side effect represents the effect of an increase in the price of medical care on the slope of R with respect to cost sharing σ. Here the incremental change in policy premiums in response to changes in cost sharing depends on changes in the gross price of medical care. To see how this slope changes with respect to changes in medical care prices, we note that a perfectly competitive health insurance market is incorporated into our model; insurance companies break even and charge an actuarially fair premium R (i.e., no load), as expressed in Equation (7). Using (7), one can show

$$\frac{\partial^2 R}{\partial\sigma\,\partial p} = -\int_S \left\{(1-\epsilon_{m,p})\left[m-(1-\sigma)\frac{\partial m}{\partial\sigma}\right]+(1-\sigma)m\frac{\partial\epsilon_{m,p}}{\partial\sigma}\right\}\mathrm{d}F(s). \qquad (18)$$

Acknowledging the empirical evidence, we assume that the neoclassical demand for medical care is inelastic. We know that $\frac{\partial m}{\partial\sigma} < 0$ if medical care is noninferior and

[23] The empirical literature in health economics suggests that the demand for medical care is inelastic. See Table 1 for a list of estimates of the elasticity of the demand for medical care and demand for health insurance.

[24] This can be seen by analyzing the first derivative of R with respect to σ. Please see footnote 13.

that the demand for medical care becomes more elastic as cost sharing increases (i.e., $\frac{\partial \epsilon_{m,p}}{\partial \sigma} > 0$). Thus, $\frac{\partial^2 R}{\partial \sigma \partial p} < 0$; the slope of R with respect to cost sharing becomes less steep as the price of medical care increases. If the consumer decides to purchase a more generous policy characterized by a lower percentage of cost sharing, he faces a premium increase that is higher than it would have been had he made this same choice prior to the medical care price increase. This would lead to a decrease in the demand for insurance as the price of medical care increases. The third term in the supply-side effect represents the effect of an increase in the price of medical care on the demand for insurance through its effect on the insurance policy premium R. Although the first two terms of the supply-side effect are positive, this last term is ambiguous. Since a positive supply side response is the most plausible outcome, we place a restriction on the slope of the policy premium function to ensure it, i.e.,

$$\frac{\partial R}{\partial \sigma} < \frac{-p \int_S U_{11} m \mathrm{d}F(s)}{\int_S U_{11} \mathrm{d}F(s)} < 0. \tag{19}$$

Since $\frac{\partial R}{\partial p} > 0$,[25] we have $\frac{\partial R}{\partial p}(\frac{\partial R}{\partial \sigma} \int_S U_{11}\, \mathrm{d}F(s) + \int_S U_{11} mp\, \mathrm{d}F(s)) > 0$.

The above shows that the incremental change in the demand for health insurance in response to a change in the gross price of medical care is determined by the net effect of two opposing forces: if the expenditure risk effect outweighs the supply-side effect, then $\frac{\partial \sigma}{\partial p} < 0$; i.e., an increase in the price of medical care causes a decline in σ. Since a decline in σ means choosing a health insurance plan with a lower degree of consumer cost sharing, the demand for health insurance is increasing. If, on the other hand, the supply-side effect outweighs the expenditure risk effect, then the demand for health insurance is decreasing in response to an increase in the price of medical care. Feldstein's (1973) finding that an increase in the price of hospital services causes an increase in insurance demand suggests a dominant expenditure risk effect.

SUMMARY AND CONCLUSIONS

Consumers with health insurance pay a *net* price for medical care, given by the percentage of cost sharing times the gross price. Much of the extant literature studies the demand for medical care by examining responses to changes in cost sharing, with the gross price held constant and the choice of health insurance contract remaining fixed. However, if one wants to compare medical care demand with the demand for other goods or categories of goods—or if one simply recognizes the fact that most insured consumers choose from among several insurance plans and can alter their intended choice—then the response to a change in gross price is important.

[25] This can be seen by analyzing the first derivative of R with respect to p.

$$\frac{\partial R}{\partial p} = \int_S (1-\sigma) m [1 - \epsilon_{m,p}]\, \mathrm{d}F(s) > 0$$

if the neoclassical demand for medical care is inelastic.

This article analyzes consumer medical care demand response to a change in gross price. In so doing, we recognize that the net price of medical care changes both exogenously, when the gross price changes, and endogenously, when the consumer changes the optimal choice of health insurance plan, paying a different insurance premium for a different percentage cost sharing. As a result, an increase in the price of medical care evokes a direct price effect, which decreases the demand for medical care, and an indirect insurance choice induced moral hazard effect. This occurs when an increase in the price of medical care increases the demand for insurance, which in turn increases the demand for medical care. If the demand for insurance is medical care price elastic, the direct price effect is outweighed by the insurance choice induced moral hazard effect and it is thus possible to observe an individual consumer medical care demand curve that is upward sloping. For this to occur, the demand for health insurance must be increasing in the price of medical care, a relationship that has some empirical support. We provide its theoretical rationale by developing the analytical condition (a dominant expenditure risk effect) under which the relationship holds.

We also demonstrate that the gross price elasticity of demand for medical care can be decomposed into two separate observable elasticities—the medical care gross price elasticity of insurance choice and the cost-sharing elasticity of medical care—and show how the two can be combined in order to determine a measure of the gross price elasticity of demand. When one allows for the contract choice response, the gross price elasticity of demand for medical care and the cost-sharing demand elasticity diverge. Consequently, using cost-sharing elasticities as a proxy for gross price elasticities would be unwise, if not misleading.

REFERENCES

Ahking, F. W., C. Giaccotto, and R. E. Santerre, 2009, The Aggregate Demand for Private Health Insurance Coverage in the United States, *Journal of Risk and Insurance*, 76: 133-157.

Arrow, J. K., 1963, Uncertainty and the Welfare Economics of Medical Care, *American Economic Review*, 53: 941-973.

Baumgardner, J. R., 1991, The Interaction Between Forms of Insurance Contract and Types of Technical Change in Medical Care, *RAND Journal of Economics*, 22: 36-53.

Blomqvist, A., 1997, Optimal Non-Linear Health Insurance, *Journal of Health Economics*, 16: 303-321.

Briys, E., G. Dionne, and L. Eeckhoudt, 1989, More on Insurance as a Giffen Good, *Journal of Risk and Uncertainty*, 2: 415-420.

Cameron, A. C., P. K. Trivedi, F. Milne, and J. Piggott, 1988, A Microeconometric Model of the Demand for Health Care and Health Insurance in Australia, *Review of Economic Studies*, 55: 85-106.

Centers for Medicare and Medicaid Services, World Wide Web: http://www.cms.hhs.gov/NationalHealthExpendData/ (accessed November 15, 2007).

Cutler, D. M., and R. J. Zeckhauser, 2000, The Anatomy of Health Insurance, in: J. A. Culyer and J. P. Newhouse, eds., *Handbook of Health Economics* (Amsterdam: Elsevier).

Dardanoni, V., and A. Wagstaff, 1990, Uncertainty and the Demand for Medical Care, *Journal of Health Economics*, 9: 23-38.

Deb, P., C. Li, P. K. Trivedi, and D. M. Zimmer, 2006, The Effect of Managed Care on Use of Health Care Services: Results From Two Contemporaneous Household Surveys, *Health Economics*, 15: 743-760.

Dowd, B., R. Feldman, S. Cassou, and M. Finch, 1991, Health Plan Choice and the Utilization of Health Care Services, *Review of Economics and Statistics*, 73: 85-93.

Dusansky, R., and Ç. Koç, 2007, The Capital Gains Effect in the Demand for Housing, *Journal of Urban Economics*, 61: 287-298.

Feldman, R., and B. Dowd, 1991, A New Estimate of the Welfare Loss of Excess Health Insurance, *American Economic Review*, 81: 297-301.

Feldstein, M., 1971, Hospital Cost Inflation: A Study of Non-Profit Price Dynamics, *American Economic Review*, 61: 853-872.

Feldstein, M., 1973, The Welfare Loss of Excess Health Insurance, *Journal of Political Economy*, 81: 251-280.

Feldstein, M., and B. Friedman, 1977, Tax Subsidies, the Rational Demand for Insurance and the Health Care Crisis, *Journal of Public Economics*, 7: 155-178.

Hau, A., 2008, When Is a Coinsurance-Type Insurance Policy Inferior or Even Giffen? *Journal of Risk and Insurance*, 75: 343-364.

Hosek, S. D., M. S. Marquis, and K. B. Wells, 1990, Health Care Utilization in Employer Plans with Preferred Provider Organization Options, RAND Report No. R-3800-HHS/NIMH.

Hoy, M., and A. J. Robson, 1981, Insurance as a Giffen Good, *Economics Letters*, 8: 47-51.

Hughes, D., and A. Mcguire, 1995, Patient Charges and the Utilization of NHS Prescription Medicines, *Health Economics*, 4: 213-220.

Jack, W., 2002, Equilibrium in Competitive Insurance Markets With Ex Ante Adverse Selection and Ex Post Moral Hazard, *Journal of Public Economics*, 84: 251-278.

Jensen, G., M. Morrisey, S. Gaffney, and D. Liston, 1997, The New Dominance of Managed Care: Insurance Trends in the 1990s, *Health Affairs*, 16: 125-136.

Kaiser Family Foundation, Health Care Spending in the United States and OECD Countries, January 2007, World Wide Web: http://www.kff.org/insurance/snapshot/chcm010307oth.cfm (accessed December 28, 2007).

Lee, L.-F., 1983, Generalized Econometric Models With Selectivity, *Econometrica*, 51: 507-512.

Manning, W. G., and M. S. Marquis, 1996, Health Insurance: The Tradeoff Between Risk Pooling and Moral Hazard, *Journal of Health Economics*, 15: 609-640.

Manning, W. G., J. Newhouse, N. Duan, E. B. Keeler, A. Leibowitz, and S. Marquis, 1987, Health Insurance and the Demand for Medical Care: Evidence From a Randomized Experiment, *American Economic Review*, 77: 251-277.

Mougeot, M., and F. Naegelen, 2009, Adverse Selection, Moral Hazard, and Outlier Payment Policy, *Journal of Risk and Insurance*, 76: 177-195.

Newhouse, J. P., J. E. Rolph, B. Mori, and M. Murphy, 1980, The Effect of Deductibles on the Demand for Medical Care Services, *Journal of the American Statistical Association*, 75: 525-533.

Pauly, V. M., 1968, The Economics of Moral Hazard, *American Economic Review*, 58: 531-537.

Phelps, C. E., 1976, Demand for Reimbursement Insurance, in: R. Rosett, ed., *The Role of Health Insurance in the Health Services Sector* (New York: National Bureau of Economic Research).

Phelps, C. E., 2003, *Health Economics*, 3rd edition (New York: Addison-Wesley).

Rosett, R. N., and L. F. Huang, 1973, The Effect of Health Insurance on the Demand for Medical Care, *Journal of Political Economy*, 81: 281-305.

Spence, M., and R. Zeckhauser, 1971, Insurance, Information, and Individual Action, *American Economic Review*, 61: 380-387.

Strombom, B. A., T. C. Buchmueller, and P. J. Feldstein, 2002, Switching Costs, Price Sensitivity and Health Plan Choice, *Journal of Health Economics*, 21: 89-116.

Wagstaff, A., 1986, The Demand for Health: Some New Empirical Evidence, *Journal of Health Economics*, 5: 195-233.

Wedig, G., 1988, Health Status and the Demand for Health: Results on Price Elasticities, *Journal of Health Economics*, 7: 151-163.

Vera-Hernandez, A. M., 1999, Duplicate Coverage and Demand for Health Care: The Case of Catalonia, *Health Economics*, 8: 579-598.

Zeckhauser, R., 1970, Medical Insurance: A Case Study of the Tradeoff Between Risk Spreading and Appropriate Incentives, *Journal of Economic Theory*, 2: 10-26.

Zweifel, P., and W. G. Manning, 2000, Moral Hazard and Consumer Incentives in Health Care, in: J. A. Culyer and J. P. Newhouse, eds., *Handbook of Health Economics* (Amsterdam: Elsevier).