Examining the Marginal Access Value of Private Health Insurance

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Abstract

According to a new theory advanced by Nyman (1999, 2003), an important access motivation underlies the demand for health insurance. However, little empirical research has attempted to quantify and explain changes in the access value of health insurance. By assuming the demand for health insurance is derived from the demand for good health, this paper shows mathematically that the marginal access value of private health insurance can be reasonably indexed by dividing the price of health insurance by a composite measure of medical prices. For the period from 1960 to 2002, national data for the U.S. suggests that the marginal access value of private health insurance has tended to increase over time. Based upon multiple regression analysis, marginal access value is shown to have increased over time in response rising income, more generous benefit coverage, new medical technologies, and, in recent years, the backlash against HMOs. In addition, expansions in the Medicaid program are shown to have slowed the growth of the marginal access value of private health insurance.

I. Introduction

John Nyman (1999, 2003) recently advanced a highly provocative theory indicating that many inconsistencies riddle the conventional theory of demand for health insurance. He points out that people do not necessarily purchase health insurance to avoid risk as conventional theory suggests, but to a large degree, because of an underlying access motivation.[1] Nyman notes that health insurance coverage provides financial access to medical care that some people could not otherwise afford because of their low net worth relative to the costs of many medical procedures. His theory argues that an individual gives up a premium payment (and the corresponding consumption of other goods and services) when healthy, to receive an income transfer from those who remain healthy when she becomes ill. For instance, one of his running examples pertains to the $300,000 cost associated with receiving a liver transplant. If one person out of 75 thousand people in an insurance pool requires a liver transplant per year, then for a $4 fair premium payment when healthy, the insured individual potentially receives a transfer of $299,996 from 74,999 other people when ill.

In Nyman's theory, access value is represented by the medical care expenditures that are beyond the consumer's liquidity constraint. Thus, Nyman (1999) measures the access value of private health insurance by examining "the expected consumer surplus from the health care services that would otherwise be inaccessible" (pp. 142-

[1] One of the inconsistencies is that prospect theory suggests that people prefer uncertain losses to certain losses of an equal expected magnitude. Conventional theory suggests that people prefer certain losses to uncertain losses of an equal expected amount. Also, as Nyman points out, uncertainty always exists with or without health insurance. If insured, consumers face uncertainty about whether or not they will remain healthy. If uninsured, the uncertainty is whether or not the consumer will remain healthy and continue spending the same amount of income on nonmedical goods and services.

143). Inaccessible and unaffordable medical care services are the same in Nyman's model. However, from a practical perspective, the access value associated with health insurance might be defined in broader terms. Consumers typically choose among alternative health plans with different amounts of insurance coverage that translate into varying amounts of access, broadly defined. For instance, some components of a health plan may marginally impede or improve access to medical care. These "access" components include, but are not limited to, out-of-pocket payments, the amount and type of health care provider reimbursement (fee-for-service, bonuses, capitation, etc.), waiting times, and any management strategies affecting consumer and provider choices such as preauthorization, utilization review, or the existence and extensiveness of health care provider networks.[2]

Consequently, this paper develops a relatively simple model to incorporate a broader measure of marginal access value into the demand for health insurance. The conceptual model incorporates access value by treating the demand for health insurance as being derived from the demand for good health. From the conceptual model, an index for marginal access value is produced. This paper then uses national data and multiple regression analysis to track and explain changes in the marginal access value of private health insurance over time at the national level in the U.S.

[2] For example, possessing health insurance coverage does not always guarantee access to medical care. Consider the Medicaid program where insufficient reimbursement of health care providers sometimes creates access problems for Medicaid recipients (Santerre 2002).

II. The Simple Mathematics of Marginal Access Value

The conceptual model begins by supposing that the representative consumer derives (actual) utility from consuming units of good health (H) and all other goods and services (Z). Health status is partly influenced by the quantity of medical services consumed (M) which in turn is determined by the chosen amount of insurance coverage (I). Thus, in agreement with Nyman (2003), this specification assumes that the demand for health insurance coverage can be treated as a derived demand. That is, the representative consumers indirectly benefits from insurance coverage because of the access to medical care that it provides.

Indeed, one might argue that health insurance coverage had less of an impact on consumer utility in the early 1900s than today because medical science had not yet progressed far enough to have a meaningful, positive impact on health (Frech, 2002). For example, Thomasson and Treber (2004) empirically analyze the shift in childbirths from homes to hospitals in the U.S. over the period from 1927 to 1940. They find that increased operative intervention by physicians and greater risk of infections caused greater maternal mortality in hospitals than homes prior to the introduction of sulfa drugs in 1937.[3]

The representative consumer maximizes utility by choosing the amounts of insurance coverage and all other goods to consume subject to the constraints of prices (P_I and P_Z) and income. In equilibrium, the representative consumer's utility is maximized when all income is spent and the following condition holds:

[3] But there was still a concern about the unaffordability of medical care in the early 1900s, as a reviewer points out. For example, Stevens (1987) notes that "there was a running joke in the late 1920s that there were two classes of people in hospitals, those who entered poor and those who left poor" (p. 134). In addition, Chenery (1924) notes the high cost of health care in the early 1920s and suggests that the U.S. consider adopting the private health insurance scheme that was being experimented with in Cuba.

$$P_I/P_Z = MU_I/MU_Z. \quad (1)$$

Note that the equilibrium condition in equation (1) shows the optimal amount of additional health insurance the consumer purchases relative to additional units of all other goods. As such, this optimal condition does not reflect the margin of some insurance versus no insurance, which would require an evaluation of the purchasing of inframarginal units of insurance coverage as well.[4]

Allowing for a derived demand specification, the marginal utility of health insurance can be written as the product of three terms:

$$MU_I = \frac{\Delta U}{\Delta I} = \frac{\Delta U}{\Delta H} \times \frac{\Delta H}{\Delta M} \times \frac{\Delta M}{\Delta I}. \quad (2)$$

The expression on the left of the three-term product captures the marginal utility of good health (MU_H) and reflects the increase in utility associated with a one-unit improvement in health status. The middle term stands for the marginal productivity of medical care (MP_M) and signifies the marginal contribution that an additional unit of medical care makes to good health. It follows that the product of MU_H and MP_M depicts the marginal utility of medical care (MU_M).

The last term on the right reveals the marginal access value of health insurance coverage (MAV_I). Marginal access value shows how an additional unit of health insurance coverage translates into additional units of medical care. As mentioned previously, access value reflects attributes of a health plan such as out-of-pocket payments, the nature of health care provider reimbursement, and any restrictive

[4] A reviewer is thanked for making this point.

management or financial strategies affecting consumer and provider choices such as the existence and depth of provider networks.

Nyman's (2003) model suggests that it may be inappropriate to attribute all of the additional medical care purchases resulting from increased insurance coverage solely to access value. First, the insurance payment may trigger an income effect that causes a person, not facing a liquidity constraint in the absence of health insurance, to purchase more medical care than they would have otherwise. Second, because the income transfer from the insurance contract takes place with a price payoff for monitoring reasons, some inefficient moral hazard, or frivolous spending, may result from the reduced out-of-pocket price of medical care.

Although we cannot completely rule out these effects, it should be pointed out that access is defined more broadly in this study so the interpretation of an increase in insurance coverage on consumer behavior becomes very complicated. For example, suppose the chosen plan did not initially cover the purchasing of drugs off the formulary or visiting physicians outside the network. Now suppose for some reason that the price of health insurance declines such that the representative consumer purchases more coverage and the additional coverage translates into more access in terms of fewer restrictions on these choices. If so, it would be very difficult to determine if these changes create more access to essential or frivolous types of care. In any case, this paper does not propose to accurately measure marginal access at a point in time but, instead, intends to develop and explain changes in an index of marginal access value over time in the U.S. As long as true marginal access remains a fairly constant proportion of any additional increases in health care spending resulting

from increased insurance coverage, and there is no reason to suspect otherwise, the possible overstating of marginal access value *at a point in time* may not pose a problem given the focus on explaining changes in its value over time.

Combining equations (1) and (2) and recalling the identities results in:

$$P_I/P_Z = (MU_M \times MAV_I)/MU_Z. \quad (3)$$

Equation (3) simply means that in equilibrium, the consumer's willingness to pay for health insurance in terms of Z equals the marginal utility of medical care times the marginal access value of health insurance in relation to the marginal utility of all other products. For example, if the marginal access value of insurance equals zero, the consumer's willingness to pay for insurance also equals zero even if a high value is assigned to medical care. In this case, the consumer is made better off by self-insuring. It also stands to reason that the willingness to pay for health insurance rises with its marginal access value for nonzero values of the marginal utility of medical care.

Similar to the equilibrium condition for health insurance in equation (1), we can think of the representative "self-insured" consumer setting the marginal rate of substitution between medical care and all other goods (MU_M/MU_Z) equal to the relative price of medical care (P_M/P_Z) in the process of maximizing utility. Solving for MU_M and substituting into equation 3 gives:

$$MAV_I = P_I/P_M. \quad (4)$$

Equation (4) implies that the marginal access value of private health insurance, MAV_I, can be approximated by dividing the price of health insurance, P_I, by the price of medical care, P_M. In Nyman's theory, the health insurance premium represents

price because it captures how much of all other goods and services a consumer knowingly gives up when healthy to receive a transfer from those who are healthy when she becomes ill.[5] Thus, by dividing the health insurance premium by some index of medical prices, the marginal access value of health insurance can be gauged to some degree. Intuitively, this expression for marginal access value makes some sense. People are willing to pay for health insurance in excess of the "uninsured" medical prices because of the access value generated by the insurance coverage. More insurance benefits such as increased quality of services, no required preauthorization, low out-of-pocket payments, and unlimited choice of health care provider, raise the premium and the higher premium relative to the price of medical care reflects increased access value. Whether some consumers are willing to pay for the added access value and give up other goods and services when healthy is another matter, however.

III. Tracking and Explaining the Access Value of Private Health Insurance

National data can be used to track changes in the marginal access value of private health insurance over time in the U.S. Data are currently available for aggregate private health insurance premiums from 1960 to 2002 from the national health accounts at the Centers for Medicare and Medicaid Services (CMS). Dividing aggregate premiums by the total enrollment in private health insurance plans provides

[5] If it could be measured, the marginal price of an additional unit of coverage would provide a better indicator of the price of health insurance. The loading fee, the difference between the premium and expected medical benefits paid out, is the price of health insurance in the conventional model.

an estimate of premium per enrollee.[6] The Bureau of Labor Statistics (BLS) collects and reports data on various price indices including the medical price index. It should be pointed out that medical price indices, as developed by the BLS, often fail to control adequately for quality and technological changes. As a result, the reported medical price indices tend to rise over time. Yet several studies such as Cutler, McClellan, Newhouse, and Remler (1998) suggest that medical prices have actually declined over time once the productivity of new medical interventions is considered. These researchers find that the real quality-adjusted price of treating health attacks declined by 1.1 percent per year between 1983 and 1994. Thus the calculated index for the marginal access value of private health insurance may be biased downward to the extent that the reported prices by the BLS overstate true medical prices.[7]

With this qualification in mind, exhibit 1 depicts time series estimates of the marginal access value of health insurance in the U.S. over the period from 1960 to 2002. It is the trending rather than the level of the index at any particular point in time that deserves consideration. According to the exhibit, the marginal access value of health insurance has grown over time but with some fluctuation. Nyman points out that the value of private health insurance has tended to grow over time because health insurance provides people with access to the life extensions and improvements that new medical technologies have increasingly offered. Notice, however, that marginal access value did not continuously increase at a constant rate throughout the 43-year

[6] Data for private health insurance enrollment come from HIAA (1999) for the period 1960 to 1966 and from Sean Keehan in the Office of the Actuary at CMS for the period 1967 to 1986, and from the Bureau of the Census from 1987 to 2002.

[7] This downward bias because of the overstating of true medical prices may be offset by the upward bias in access value as a result of the income effect in the absence of a liquidity constraint and any inefficient moral hazard, as discussed previously.

period. It's rate of growth slowed down during the late 1960s, mid-1970s, mid-1980s, and the 1990s, for example.

Some of the reasons for the observed changes in the marginal access value of private health insurance can be gleaned with multiple regression analysis. Not only does Nyman (2003) suggest that access value may depend on the medical benefits offered by new technologies but also on alternatives to private health insurance such as charitable care and Medicaid insurance. As a result, the estimated annual index of marginal access value is specified as a function of several variables designed to capture the benefits of new medical technologies, alternatives to private health insurance, and the extensiveness of benefit coverage.

Real income per capita is one variable included in the multiple regression equation to explain changes in the marginal access value of health insurance.[8] A priori, the theoretical relationship between income and access value is unclear. On the one hand, higher income may indicate that people can more easily afford medical care, thus diminishing the access value of private health insurance. On the other hand, higher income may mean that people have more human capital at stake and, as a result, the access value of private insurance becomes more important. In addition, greater income may simply mean that people can more easily afford the higher premiums resulting from increased access value.

The next variable, life expectancy at birth in the prior year, may also capture the benefits associated with increased medical access. The notion is that increased life

[8] To compute real income per capita, aggregate nominal income data and data for the consumer price index were gathered from the Bureau of Economic Analysis and Bureau of Labor Statistics, respectively. Poverty was also experimented with in the regression analysis but proved insignificant in the presence of real income per capita because of colinearity (simple correlation of the first difference of these two variables equals -0.61). Population and poverty data come from the Bureau of the Census.

expectancy at birth may reflect the cumulative benefits, in terms of longevity, that existing and new medical technologies have to offer as of each year. Hence, improved life expectancy at birth may signal the general importance of, or utility from, better access to medical care.[9]

Two additional variables are specified in the empirical model to reflect alternatives to private health insurance. The first variable is the percentage of the population enrolled in the Medicaid program. The marginal access value of private health insurance is expected to decline with expansions in the Medicaid program because of a reasonably viable, low-priced alternative.[10] Note that this anticipated relation is consistent with the empirical findings concerning the Medicaid crowding-out hypothesis (e.g., Cutler and Gruber 1996). The second variable is the percentage of beds in nonprofit hospitals to capture changes in the amount of charitable care over time (Chernew, Cutler, and Keenan, 2004). Compared to for-profits, nonprofit hospitals are expected to offer both increased quality of care and greater amounts of charitable care, especially to the financially indigent, because they face a nondistribution constraint (Hansmann, 1980). Therefore, nonprofit hospitals may be viewed as an alternative provider of access value. If so, it follows that the access value of private health insurance declines with a greater percentage of nonprofit beds.[11]

The next two variables specified in the multiple regression equation reflect more direct measures of access value. The first variable is the percentage of the privately

[9] Life expectancy at birth data come from the Center for Disease Control and Prevention. A one year lag proved to provide a better fit for this variable.
[10] Medicaid enrollment data come from the CMS.
[11] Data for the percentage of nonprofit beds come from various editions of *Hospital Statistics* published by the American Hospital Association.

insured enrolled in health maintenance organizations (HMOs). Although empirical evidence is mixed (Miller and Luft, 1994), many argue that HMOs reduce the access value of health insurance by denying care and making health insurance plans more restrictive with respect to consumer choice and physician practices. Accordingly, a greater percentage of the privately insured enrolled in HMOs is expected to be associated with a reduction in the marginal access value of private health insurance.[12]

The last variable specified in the regression equation measures the percentage of private medical costs that are covered by the insurance contract. The expectation is that increased dollar coverage results in higher premiums, all other factors held constant. Increased dollar coverage means greater access to medical care because a person does not have to depend on his or her own, perhaps limited, financial resources. This variable is measured by dividing the amount reimbursed by private insurers by total private personal health care expenditures.

The multiple regression equation is specified in the following specific form (with time subscripts suppressed):

$$\log MAV_I = \beta_0 + \beta_1 INC + \beta_2 LIFEXP + \beta_3 MCAID + \beta_4 PCNP + \beta_5 HMO + \beta_6 BEN \qquad (5)$$

(? over β_1INC; + over β_2LIFEXP; - over β_3MCAID; - over β_4PCNP; - over β_5HMO; + over β_6BEN)

where:

$\log MAV_I$	=	logarithm of the marginal access value of health insurance (i.e., premium/medical CPI)
INC	=	real income per capita
LIFEXP	=	life expectancy at birth in the prior year
MCAID	=	percent of population receiving Medicaid

[12] Data for private HMO enrollment as a percent of the total privately insured were graciously provided by Sean Keehan in the Office of the Actuary at the CMS for the period 1966 to 2002. Since HMO enrollment remained at 4 percent over the period from 1966 to 1973, a 4 percent figure was assumed for the period from 1960 to 1965.

PCNP	=	percent of beds in nonprofit hospitals
HMO	=	percent of privately insured enrolled in HMO plans
BEN	=	fraction of private medical expenditures reimbursed by insurers (i.e., benefit coverage)
β_i's	=	parameters to be estimated with expected signs indicated above.

The dependent variable, marginal access value, is expressed in logarithmic form to allow for diminishing returns with respect to the independent variables and also because experimentation showed that this specification provides superior results.

Evidence of serial correlation necessitated first differencing of the data. First differencing of the data seems particularly appropriate because diagnostic tests revealed the presence of unit roots in several of the time series data (e.g., marginal access value and real income per capita) before they were first differenced. Unit roots can result in spurious correlations among variables (Granger and Newbold, 1974 and Phillips, 1986). Thus, the empirical findings show how changes in the various explanatory variables relate to changes in marginal access value.

The results are shown in exhibit 2. About 43 percent of the variation in marginal access value is explained by the right hand side variables, which represents a fairly sizeable amount for a first difference time series regression equation. For the most part, the results are strongly supportive of Nyman's theory that an access motivation underlies the demand for health insurance. Although the precise theoretical relationship was unclear, the empirical findings indicate that a direct relationship holds between real income per capita and marginal access value. It follows that a rising standard of living in the U.S. partly accounts for the increasing marginal access value of health insurance, as depicted in exhibit 1.

Moreover, the rest of the estimated coefficients possess their expected signs. Improvements in medical technologies, as proxied by changes in life expectancy at birth, are directly related to access value. This coefficient estimate is statistically significant at better than the 10 percent level for a one-tailed test. As anticipated, greater enrollment in the Medicaid program is associated with a reduction in the marginal access value of private health insurance. Indeed, some of the dips in access value that can be observed in exhibit 1 may have been caused by the introduction of the Medicaid program in the late 1960s, cuts in Medicaid during the early 1980s, and several expansions of the Medicaid program during the 1990s (e.g., State Children's Health Insurance Program).

The sign of the estimated parameter on the percentage of nonprofit beds lends support for the expected inverse relation between charitable care and the marginal access value of private health insurance but the coefficient is not different from zero at conventional levels of statistical significance. In addition, the empirical findings indicate that marginal access value diminishes with greater enrollment in HMOs. The implication is that HMOs reduce the access value of private health insurance through their restrictive policies.[13] Finally, as anticipated, a direct relation is found between access value and the fraction of medical costs reimbursed by private insurers.

[13] Because values were assumed for the percent enrolled in HMOs prior to 1966, only observations from 1966 to 2002 were used in another regression model to test the robustness of the findings. The results remain very similar except that the coefficient estimate on life expectancy becomes statistically significant at better than the 5 percent level for a one-tailed test (prob value = 0.031).

IV. Conclusion

Nyman (2003) makes an important contribution to the literature by reminding us that health insurance is demanded in part because of the access value it generates. This paper provides a way to incorporate a broad measure of access value into the demand for health insurance by treating the demand for health insurance as being derived from the demand for good health. According to the simple mathematics of this paper, an index of marginal access value can be approximated by the ratio of health insurance premium to the price of medical care.

National data are then used to track changes in marginal access value over time in the U.S. According to the index that is developed, the marginal access value of private health insurance increased over the period from 1960 to 2002 but not at a constant rate. In 2002, the marginal access value of health insurance stood at a much higher level than that observed in 1960. According to the multiple regression results, rising incomes, increased benefit coverage, and medical care induced longevity partly account for the rise in access value over time. The recent backlash against HMOs may have also contributed to the rise in the marginal access value of private health insurance in the last few years. Finally, the availability and expansion of the Medicaid program at various points in time may have slowed the growth of the access value associated with *private* health insurance. Although the analysis departs from Nyman's definition of access value, the empirical analysis lends strong support for Nyman's theory that an important access motivation underlies the demand for health insurance coverage.

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Exhibit 1: The Access Value of Health Insurance

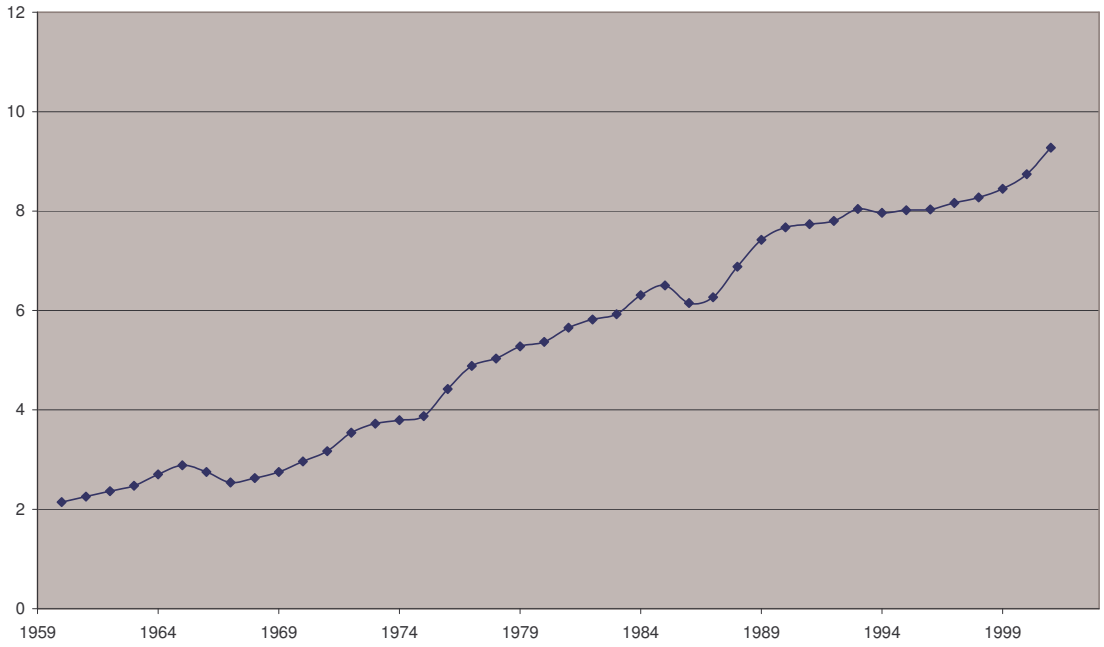

Exhibit 2: Multiple Regression Results

Dependent Variable: **First Difference Of the Log of Marginal Access Value**			
Sample: 1960 to 2002			
Variable	Coefficient	Std. Error	t-Statistic
First Difference of Real Income per Capita	0.057	0.014	4.11
First Difference of Life Expectancy at Birth in the Prior Year	0.037	0.022	1.66
First Difference of the Fraction of the Population Enrolled in the Medicaid Program	-2.288	0.822	-2.78
First Difference of the Percentage of Beds in Nonprofit Hospitals	-0.493	1.749	-0.282
First Difference of the Fraction of the Privately Insured Enrolled in HMOs	-1.249	0.443	-2.82
Fraction of Medical Costs Reimbursed by Insurers	3.128	0.524	5.96
Adjusted R-squared	0.43		
Durbin-Watson stat	1.79		