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THE RISING PRICE OF PHYSICIANS' SERVICES: A COMMENT

Douglas M. Brown and Harvey E. Lapan

In a recent article in this REVIEW, Martin Feldstein (1970) attempted to explain the pricing of physicians' services in the United States between 1948 and 1966.[1] In his attempt to measure the demand for physicians' services, Feldstein found a positive price coefficient which led him to conclude that ". . . the aggregate pricing and use of physicians' services can be understood best by assuming that permanent excess demand prevails."[2] Further, since his estimates imply a backward-bending supply curve for physicians' services, he infers ". . . that government policies to restrain price inflation may increase excess demand but will not decrease and may even increase the quantity of physicians' services provided."[3] We intend to show that (1) the positive price elasticity Feldstein obtains in trying to estimate the demand curve might result from difficulties in defining his price variable (and from the fact that insured and uninsured pay different prices), and (2) his supply estimates are biased because of his use of a dependent variable, inputs (paramedical personnel, equipment, etc.), as an independent variable in his supply equation.[4]

I The Demand for Physicians' Services

The Feldstein demand model relates physicians' services per capita to net price (NP),[5] the price of other goods, income per capita, and governmental provision of medical services per capita. Using a loglinear form, a positive coefficient is obtained for NP. After splitting NP into its two components, average price (AP) and insurance (Ins), Feldstein found AP to be insignificant while Ins was significant and positive. Feldstein argued that a plausible explanation for his inability to estimate directly the parameters of the demand function was that at observed prices excess demand prevailed.

Since Ins is defined as the ratio of AP to NP, these regressions ($D3$ and $D4$, p. 125) are equivalent to using AP *and* NP (as well as the other variables) as independent variables. The estimated coefficient of AP in this context would be the sum of his estimates for AP and Ins, while the estimated coefficient of NP is the negative of his estimated coefficient for Ins. If we perform this transformation, we find that the coefficient of AP is negative, while that of NP is positive. Therefore, if we interpret AP as the true price variable, then our demand curve has the "proper" slope — whereas if we interpret NP as the price, the demand curve is positively sloped.

It is an open question as to whether Feldstein's AP or NP should be considered the 'true' price variable and this ambiguity stems, in our minds, from the rather strange definition of the demand curve. Due to the presence of both uninsured and insured people, the aggregate demand curve really entails aggregating two separate demand curves (for insured and for uninsured), and this aggregation is carried out at different prices. This consideration leads us to a more fundamental question, i.e., what is the meaning of the Feldstein demand curve and what is the meaning of his price indices?

Upon dividing the population into insured (I) and uninsured (N), we see that total demand depends upon the demands of people in each class, as well as the relative strength of these classes. Therefore, as P rises, other things being equal, any given individual within a class (I, N) may buy less physicians' services. However, if the increase in the costs of physicians' services induces more people to become insured and consequently to buy more physicians' services than they did before the price increase, total demand may actually rise.

More formally, we could write:

$$D_I = F_I \cdot d_I(PZ, Y_I, S) \tag{1}$$

$$D_N = F_N \cdot d_N(Pk, Y_N, S), \tag{2}$$

where:

d_i = per family demand of class, i, $i = I, N$; D_i = total demand of class i, $i = I, N$; P = cost of physician's service/unit; Z = fraction of the costs of physicians' services that insured pay themselves; k = fraction of costs that physicians charge uninsured; Y_i = average income of families in class i; F_i = number of families in class i; S = vector of other variables, such as price of other goods; θ = per cent of population insured; F = total number of families.

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[1] Martin S. Feldstein, "The Rising Price of Physicians' Services," this REVIEW, LII (May 1970), pp. 121–133.

[2] *Ibid.*, p. 132.

[3] *Ibid.*

[4] It is not clear to us whether Feldstein uses physical inputs or the total costs of these inputs in his supply equation; however, either variable is properly a dependent variable, so that his estimates will be biased.

[5] Net price is defined as the customary price charged less insurance compensation.

Then the total demand function is:

$$D = F[\theta \cdot d_I(PZ, Y_I, S) + (1-\theta) d_N(Pk, Y_N, S)]. \quad (3)$$

Now we can talk of a total demand function as dependent upon price as Feldstein does; nevertheless, it is seen that this is a rather curious demand function. Suppose only P changes:

$$\frac{\partial D}{\partial P} = F\left(\theta \cdot \frac{\partial d_I}{\partial (PZ)} \cdot Z + (1-\theta) \cdot k \cdot \frac{\partial d_N}{\partial (Pk)} + (d_I - d_N) \cdot \frac{\partial \theta}{\partial P}\right). \quad (4)$$

Even if d_I and d_N are negatively sloped, it is possible to have a positively sloped total demand curve. Since $d_I > d_N$,[6] if the fraction of the population insured increases as prices rise, total demand may actually increase as a result of the price increase, *ceteris paribus*. Therefore, we do not feel that Professor Feldstein's finding of a positive price coefficient is a sufficient reason to assume that excess demand prevails.

It is also possible to show that the "aggregate" price variables Feldstein uses are of questionable value. For example, consider Feldstein's NP, the variable that is supposed to reflect the price consumers face. In terms of our notation:

$$NP = P\left\{ Z + \left(\frac{(k-Z)(1-\theta)D_N}{\theta D_I + (1-\theta)D_N} \right) \right\}.$$

As P rises, the term in brackets may decrease (due to changes in θ), and hence it is possible that $\partial(NP)/\partial P < 0$. Therefore, even if total demand falls as price increases, Feldstein may find the opposite:[7]

$$\frac{\partial D}{\partial P} < 0, \frac{\partial D}{\partial (NP)} = \frac{\partial D}{\partial P} \cdot \frac{\partial P}{\partial (NP)} > 0.$$

Alternatively, it is possible that demand increases as prices rise, and that NP also rises:

$$\frac{\partial D}{\partial P} > 0, \frac{\partial (NP)}{\partial P} > 0 \rightarrow \frac{\partial D}{\partial (NP)} > 0.$$

This result just highlights the problem of measuring an aggregate demand curve in a market where different classes of people pay different prices, and in attempting to define a "price" for this market.

Drawing upon our previous discussion, it is possible to estimate the insured and uninsured demand curves. In addition to the variables used in equations (1) and (2), following Feldstein we hypothesized that demand may depend upon government medical expenditures per capita (G/POP) and time. Also, some medical needs can be fulfilled by home remedies; thus, we included the price of medical care without physicians' services (P^*_{mc}) as a regressor. Our results for d_I, when using a linear form of the demand curve, consistently gave a negative price coefficient with or without (G/POP) or P^*_{mc}. On the other hand, the loglinear form of the insured demand curve and all estimates of the uninsured demand curve gave perverse results.[8] The results of the linear form of the insured demand curve are:

$$Q_{D_I} = \underset{}{82.6} - \underset{(1.26)}{2.05\, P_I} - \underset{(.07)}{.18\, CPI} + \underset{(.008)}{.023\, Y_I} - \underset{(4.3)}{13.6\, t} + \underset{(.86)}{2.15\, P^*_{mc}} + \underset{(5.03)}{.29\, G/POP}, \quad (5)$$

where $\bar{R}^2 = .864$, and standard errors are shown under the coefficients.

One possible explanation for the 'poor' results of the uninsured demand curve is that we may be aggregating over people who pay drastically different prices. It is not likely that all the uninsured pay the same constant fraction, k, of the price of physicians' services; rather this "k" is likely to depend upon the income of the person. Thus, if over time many of the middle-income people become insured, leaving largely the poor (and the very rich) uninsured, the aggregate value of k will change (presumably decrease). Therefore, even if P increases, it may be that 'kP' declines. Again, k depends on the income distribution of the uninsured and in turn, the fraction and type of people insured depends on P; hence, k may depend on P. Clearly, therefore, we need more disaggregated data to actually determine the demand curve for the uninsured.

II The Supply of Physicians' Services

As Professor Feldstein correctly asserts, doctors should be treated as utility-maximizing individuals, not profit-maximizing firms. However, he feels that this formulation is not necessarily fruitful, and subsequently postulates that the quantity of physicians' services supplied depends on average fees, price of other goods (CPI), inputs, government services per physician ($G/PHYS$), and time. Furthermore, since doctors are assumed to desire interesting cases, they are presumed to set prices such that excess demand prevails. Finally, it is assumed that the uninsured pay a fixed fraction of the price charged insured. Using this framework, Professor Feldstein estimates the supply curve of physicians' services, and finds its price elasticity to be negative. Though we do not reject the possibility of a backward-bending

[6] Since $k > Z$, one would expect the insured to purchase more physicians' services, assuming their income was at least as large as that of the uninsured.

[7] The mathematical conditions for which $\{\partial(NP)/\partial P\} < 0$ differ than those for which $\{\partial D/\partial P\} > 0$.

[8] The estimates of the price and income coefficients were opposite to that which economic theory would predict.

supply curve, we do have the following reservations concerning the postulated behavior of physicians:

(a) As Feldstein notes, the uninsured pay about two-thirds of what the insured pay. But why do uninsured pay less? If it is to equalize the costs of administering insurance, then presumably the relevant price variable is the fee paid by the uninsured, not the average fee. On the other hand, if it is because doctors get some psychic utility from helping the uninsured (poor), then their psychic pay plus remuneration may exceed the payment by the uninsured, but should, at the margin, equal their pay for treating the insured. Hence, in this case the relevant price variable is what Feldstein calls the customary price. To be sure, given that the fraction paid by the uninsured is constant, it really does not matter whether one uses the price the insured pay or the price the uninsured pay. It is clear, however, that the average fee is not the appropriate price variable for the supply equation.

(b) If, as Feldstein does, one assumes that the appropriate description of the market is one of excess demand in which the doctors "have had substantial discretionary power to vary both price and quantity," (p. 128) then it would not be consistent to assume that doctors are price-takers. This implies that price cannot be properly treated as an independent variable (to doctors), and hence his estimation of the supply equation will be biased. It appears that a simultaneous model is more appropriate to Feldstein's framework.

(c) Commenting upon his empirical findings, Professor Feldstein asserts: "The estimates of the elasticity with respect to inputs are positive as expected . . ." (p. 131). If one interprets the dependent variable as quantity of labor supplied per physician then we fail to see why an increase in inputs, *ceteris paribus*, will lead to an increase in physician services. Assuming that inputs and physician's labor are substitutes, we would expect a negative coefficient unless fixed proportions prevail, in which case inputs are strictly determined by the supply of physician's labor. On the other hand, if the dependent variable is interpreted as a measure of output attributable to physician's labor and inputs,[9] then the coefficient should have the interpretation of the marginal product of inputs. If this latter interpretation of the dependent variable holds, then the negative price coefficient appears somewhat less plausible. As is well known, a backward-bending supply curve of an input (doctor's labor) is a necessary, but not sufficient, condition for a backward-bending product supply curve (the supply of output rendered by physicians and other inputs).

(d) No matter how one interprets the dependent variable, it seems clear that inputs cannot properly be treated as an independent variable. Clearly each doctor decides how much to hire of an input (per unit of his services) based upon its price, his fee, the *CPI*, etc.[10] Thus, the appropriate independent variables should be prices, not the total quantity of inputs, and therefore Feldstein's estimates are biased.

(e) Finally, it is not clear to us how the excess demand for physicians' services allows the doctors to treat interesting cases. Feldstein seems to assume that doctors pick their patients, accepting some ("interesting ones"), while rejecting others. While this is feasible, it does not really seem compatible with professional ethics ("professional ethics preclude a physician from refusing care to certain cases" — Feldstein, p. 122). Rather, it would seem more plausible that a queue forms, and there seems to be no reason to believe that the "interesting cases" will be nearer the front of the queue. Thus, it is by no means certain that excess demand will in fact provide the doctor with more "interesting cases"; in fact, if the demand for treatment by "interesting cases" is less elastic than the overall demand for physicians' services and if the queue theory is appropriate, the creation of excess demand by doctors may, in fact, be self-defeating.

Given the above comments, and assuming that doctors maximize their utility, we can derive a supply equation for physicians' services within the context of an equilibrium model. Included as independent variables are P, CPI, nurses' fees (R), $G/PHYS$, and time.[11] The a priori argument for including $G/PHYS$ as an independent variable is that the fraction of physicians available for private medical care is inversely related to that variable (see Feldstein, p. 131). Following these arguments, we obtain: [12]

$$\begin{aligned} Q_{PHYS} = 1.17 &+ \underset{(1.32)}{3.60\,P} + \underset{(.77)}{2.69\,CPI} - \underset{(.79)}{2.45\,R} \\ &- \underset{(.023)}{.103(G/PHYS)} - \underset{(.191)}{.636 \log t}. \\ &\bar{R}^2 = .965 \qquad (6) \end{aligned}$$

Equation (6) indicates that the supply of physi-

[9] We feel this definition is more appropriate to the model.

[10] If fixed proportions between doctor's labor and inputs prevail, then the quantity of inputs is determined solely by the quantity of doctor's labor. However, the doctor's decision on how much to work should then depend on his net fee (after subtracting the cost of inputs per unit of his labor). Thus, in this case, Feldstein's price variable would be inappropriate.

[11] Lagged income was also included, but found to be insignificant.

[12] This equation is in logarithmic form; standard errors are given in parentheses.

cians' services increases as price increases and decreases as ($G/PHYS$) increases.

III Summary and Conclusions

For many reasons it was difficult to identify the meaning of the Feldstein demand model. Specifically, his price definition generated many problems which disaggregation seemed to clarify, at least for the insured group of the population. In his supply model Feldstein used inputs as an independent variable and found a negatively sloped supply equation. Thus, he argued that if policy makers could lower the price of physicians' services, the quantity of services supplied would increase, *ceteris paribus*. Using prices and $G/PHYS$ as independent variables, we found a positive sloping supply equation. Clearly in the context of our model, a decrease in physicians' prices will not increase the quantity of physicians' services, *ceteris paribus*.

A further result of our model, which is inconsistent with Feldstein's findings, is that by increasing the amount of nurses P declines. As the supply of nurses increases, R will fall, which means (see equation (6)) that physicians' services increase. Thus, assuming a negatively sloped demand curve, the price of physicians' services will decline.[13] In summary, our findings, which are exactly opposite to Feldstein's, lead to different policy statements, and are consistent with standard economic theory.

[13] This result also holds if the demand curve is positively sloped, assuming the slope of the demand curve exceeds that of the supply curve (so that the market is stable).

APPENDIX

Description and Source of Variables

Q	The quantity of physicians' services is total expenditures on physicians' services divided by the CPI for physicians' services (Health Insurance Institute, 1968).
I	Total number of the insured population includes all those with regular medical and surgical insurance (Health Insurance Institute, 1968).
N	Total number of the uninsured population was found by subtracting I from the total population (POP) as found by U.S. Department of Commerce, 1969.
PZ	The price of physicians' services paid by the insured was the CPI for physicians' services times Z, where Z is the proportion of a physician's charges paid by the insured. Z was obtained from R. Anderson and O. W. Anderson in 1967 and Feldstein, 1970. Intervening years were extrapolated.
Pk	The price paid for physicians' services by the uninsured was proxied by the CPI for physicians' services.
Q_I	The quantity of physicians' services purchased by the insured was obtained by dividing the benefit payments to the insured (Health Insurance Institute, 1968) by $(1-Z)$, and then adjusting for changes in price.
Q_N	$Q - Q_I$.
Y_I	Average family income of the insured was derived by extrapolating data from Public Health Service, 1964, U.S. Chamber of Commerce, 1954 and 1969.
Y_N	Since we know total family income in the United States (Y_T), $Y_N = \frac{[Y_T - Y_I F_I]}{F_N}$, where $F_{I,N}$ are the total number of families insured and uninsured respectively.
θ	Per cent of the population insured is I divided by POP.
P^*_{mc}	The price of medical care (Health Insurance Institute, 1968) without physicians' services is obtained by adjusting the overall price index for medical care.
G/POP	Government expenditures per capita were found by U.S. Department of Commerce, 1969.
R	Nurses' wages were proxied by the weekly wage of industrial nurses from various cities around the United States as found by U.S. Department of Labor.
P	Price of physicians' services (Health Insurance Institute, 1968).
$PHYS$	U.S. Department of Commerce, 1969.

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THE RISING PRICE OF PHYSICIANS' SERVICES: A REPLY

Martin S. Feldstein *

The three primary conclusions of my previous study can be summarized briefly. First, there appears to be a permanent excess demand for physicians' services. The observed prices and quantities are not points on the demand function and the market does not follow a Marshallian or Walrasian process of adjustment to remove the excess demand. Second, physicians' fees rise when patients' ability to pay improves through higher income or more complete insurance coverage. More than a third of the potential gain from improved insurance coverage has been dissipated by induced price increases. Third, the supply equation indicates that physicians reduce the quantity of services provided when fees rise. This in turn implies that government action to control physicians' fees may increase the quantity of services provided.

Professors Brown and Lapan raise some questions about the research and about the first and third of these conclusions. However, a careful analysis of their note shows that the original conclusions can remain unchanged. Their own discussion, on the other hand, contains a number of serious errors.

I The Demand for Physicians' Services

Brown and Lapan claim to reject the conclusion that an aggregate demand curve can not be estimated from the data, i.e., that the parameter values are inconsistent with any theory of demand. More specifically, they advance three reasons for disregarding my estimate of a positive price elasticity of demand.

The first argument involves a simple error. Paragraph 2 of their section I suggests that my regressions $D3$ and $D4$ be reinterpreted as a regression of demand on both "average price" (AP) and "net price" (NP) instead of AP and insurance. If this is done, the coefficient of average price is negative while the coefficient of net price is positive. They then commit the fallacy of saying "if we interpret AP as the true price variable, then our demand curve has the 'proper' slope . . ." The error, of course, is including both price variables in the same equation and their focusing attention on only one of them. What possible meaning can one attach to the response of demand to changes in average price when net price is held constant? Moreover, as the original paper explained, the relevant variable to the patient who demands care is not the average price received by the physician but the net price that the patient must pay.

The next point advanced by Brown and Lapan (paragraphs 3 through 6) is that the response of demand to changes in price may well be positive if a higher gross price induces more insurance which in turn lowers the average net price.[1] This argument shows a misunderstanding of the basic specification of the demand equation. Equations $D1$ and $D2$ describe the patients' response to changes in a net price, in which the level of insurance is already taken into account; equations $D3$ and $D4$ describe their response to changes in the gross price *given a level of insurance* and to changes in the level of insurance *given a gross price*. These are specifications of the basic structural equation for one aspect of consumer behaviour. The partial reduced form that would allow for the change in insurance in response to the change in gross price has not been investigated. Furthermore, the suggestion that demand might actually be increased by a rise in the gross price implies an unstable market in which higher demand increases the price which then increases demand, etc.[2]

Finally, the authors report their own estimates of a demand equation (paragraphs 7 and 8). This work makes the useful contribution of attempting to estimate separate demand equations for the uninsured population and the insured population. The equations for the uninsured population are not shown in their note but are described as supporting my finding of a "perverse" price elasticity. An equation for the insured population, estimated as linear in the logarithms of the variables, also is reported to have a positive price elasticity. Only if a linear form of the equation is estimated and a new variable ($P*mc$) is added does the price variable enter with a negative (although insignificant at the ten per cent level) coefficient. The equation is also

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[1] They deal with the special case in which an increase in insurance occurs by a change in the proportion of the population that is insured.

[2] For a discussion of the interrelations between the price of care and the demand for insurance with estimates relating to hospital services, see my recent paper (1971).