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Economic Rents Derived from Hospital Privileges in the Market for Podiatric Services

ABSTRACT

This study examines the relative impacts of human capital and market conditions on the economic rents associated with hospital privileges in the market for footcare. An empirical model of hospital privileges for podiatrists is formulated based on the Pauly-Redisch model of hospital behavior. The privilege model is then incorporated into a model of podiatrists' earnings via a selection adjustment as proposed by Heckman and Lee. The results indicate the persistance of economic rents even after controlling for unobserved "quality" factors.

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Introduction

Hospitals are centrally concerned with the competence of the practitioners who have access to their facility. One of the main mechanisms for controlling the quality of medical practice within a hospital is policy related to the granting of hospital privileges to practitioners. This is particularly true since the 1966 Darling v. Charleston Community Hospital Case[1] which extended the scope of malpractice liability beyond the individual practitioner to the hospital. Hospitals were found, in the Darling case as well as others, to bear legal responsibility for the quality of care delivered by their medical staffs. This created an incentive for hospitals to be very selective in the granting of staff privileges.

The medical profession is a key influence in developing national guidelines for the granting of hospital staff priveleges. Moreover, since hospital staffs are comprised largely of physicians, that profession exerts substantial influence on policy towards staff privileges, especially at the level of the individual hospital. While on one hand physicians are in an excellent position to judge professional competence, they are also in a position to use their influence to advance their economic interests by excluding competitors.

Obtaining hospital staff privileges may be critical to an individual practitioner's economic viability. Hospital privileges determine whether providers have any access to a hospital's surgical facilities, thereby defining the scope of procedures that they may perform and whether they are permitted to admit patients. For non-physician health professionals, the importance of privileges depends on the inpatient potential of their practices. The absence of access to a hospital may also have concommitant effects on the outpatient portion of a provider's practice. If a non-physician provider without privileges competes with a physician with privileges the non-physician provider may be viewed as less desirable because he/she does not offer a "full product line." This is particularly important in health care where there is uncertainty on the part of a patient as to: 1) the nature of their medical problem, and 2) the most appropriate treatment for their condition.

In the research reported here we analyze the economic consequences of obtaining various levels of hospital staff privileges for podiatrists. We specifically address the determinants of staff privileges focusing on the relative influence of quality and competitive factors. We then trace the impact of those privileges on the earnings of podiatrists. We provide estimates of the "rents" arising from full access to hospital facilities controlling for quality differences between providers. The paper is organized as follows: In the next section we provide background information on the market. The third section describes the empirical model of podiatric earnings. The fourth section describes the econometric technique used to assess the effect of privileges on earnings. The fifth and final sections report results and conclusions.

Background

In 1982 there were roughly 9500 actively practicing Doctors of Podiatric Medicine (DPMs) in the United States. Approximately 70 percent of podiatrists have some access to hospital facilities. Fifty-four percent have staff privileges that are equivalent to those granted to physicians. Podiatrists are concentrated in metropolitan areas on the east and west coasts. The average annual earnings of podiatrists are about $57,000. In contrast general practitioners earn roughly $68,000 and general surgeons $145,000. Podiatrists are in a rather unique position with respect to their scope of practice. While they have not enjoyed the unrestricted scope of practice of physicians, they have progressed considerably further than other non-physician health care professionals. For example, unlike psychologists, podiatrist services are paid for by third party payors in the same fashion as their medical counterparts.

Podiatrists are overwhelmingly located in urban areas, 95% are located in communities with populations over 10,000. They provide an average of roughly 79 visits per week to 69 patients. Most podiatrists spend the majority of their time in private office based practice. Eighty nine percent spend over fifty percent of their time in such practice. Only about 14 percent devote at least 10 percent of their time to hospital inpatient practice. The vase majority of podiatrists report that the majority of their time is spent in the general practice of podiatry as opposed to surgery, foot orthopedics, or sports medicine. Podiatrists spend an average of 15 percent of their time performing surgery[2].

It has been estimated that approximately 20 percent of an orthopedist's patient visits involve treatment of foot and ankle problems[3]. Orthopedists provide the majority of foot surgery undertaken by physicians. Overall orthopedic surgeons are estimated to perform roughly 13 percent of all elective foot surgery as opposed to 64 percent provided by podiatrists[4].

The 1979, Joint Commission on Accrediation of Hospitals (JCAH) standards stated that medical staff membership is limited to "individuals who are currently fully licensed to practice medicine and, in addition to licensed dentists"[5]. However, podiatrists may also become members of the "medical staff" under the JCAH rules. To include podiatrists, the hospitals must make bylaws with specific references to podiatric services. The scope and extent of surgical privileges granted must be defined for each podiatrist as is done for all medical staff surgical privileges. A second level of a hospital's staff membership, is the "professional" or "clinical" privilege. In the case of podiatrists, such membership may offer a range of limited privileges such as the ability to consult on patients who are hospitalized for non podiatric problems, or the ability to perform podiatric surgery in hospital operating rooms as long as a physician admits the patient. Also, a consultation with a physician is generally required prior to surgery.

The level and intensity of training obtained by podiatrists has changed dramatically since as late as 1962 (when the last major revisions in DPM education were made). Podiatric training occurs in one of 7 podiatric colleges. Ninety percent of the students admitted to podiatry schools have at least a baccalureate degree. Once admitted to podiatry school the course of training requires four years. The first two years involve classroom and laboratory study in the basic sciences such as biology, physiology, pathology, etc. The last two years are oriented largely towards clinical subjects and supervised patient care. The clinical subjects include areas such as dermatology, neurology, and general surgery among others. After successful completion of the four year program students are awarded the Doctor of Podiatric Medicine degree. In recent years it has become increasingly popular to follow receipt of the DPM degree with additional training in the form of a hospital residency (usually lasting one year). As the rigor of the podiatric training has increased, so has the perceived competence and acceptance of podiatrists.

Today, 37 of the states have laws that specifically allow or mandate full medical privileges for podiatrists[5]. Organized medicine has been identified with activities designed to restrict podiatrists' access to hospitals.[6] Anecdotal evidence on efforts to exclude podiatrists range from actions by associations of orthopedic surgeons to less formal efforts of such physicians on the staffs of individual hospitals.[7] Thus, interprofessional rivalry may play some part in making access to hospital privileges vary substantially across the nation.

However, since the level of training has changed rapidly in the podiatry profession, there is also likely to be considerable variation in the technical skills of licensed podiatrists. For these reasons we are interested in empirically assessing the importance of factors related to both technical proficiency and market conditions in explaining access to hospital staff privileges among podiatrists.

An Empirical Model of Earnings Differentials

In this section we describe our empirical model of podiatrists' earnings. We view analysis of wage differentials among podiatrists as being potentially clouded by selectivity issues. Observed outcomes in earnings are based on prior decisions concerning the granting of hospital staff privileges. That is, earnings of podiatrists are only observed after they have either been granted or denied some type of hospital privilege. The earnings that occur under other scenarios (types of privileges) are not observed for an individual podiatrist. In addition, the granting of privileges is likely to depend on observed factors, such as educational attainment and certification, as well as unobserved factors such as specific clinical and interpersonal skills. For these reasons we adopt the approach of Heckman and Lee to the analysis of earnings under conditions of selectivity.[8] Following that approach we propose a two stage approach to estimation of earnings differences associated with varying types of staff privileges. In the first stage we estimate a model of the determinants of staff privileges, while in the second stage we estimate a model of earnings controlling for selectivity effects.

We begin our analysis of the determinants of type of privileges with the assumption that all podiatrists would prefer to have access to full medical staff privileges at a hospital. Thus, variation in the possession of privileges depends on decisions made by individual hospitals' medical staffs. As described above there are three levels of staff privileges: 1) no privileges;

2) professional or clinical; and 3) medical staff. We posit the existence of two principal reasons for a hospital not to grant medical staff privileges to a podiatrist: a) concern about quality of care; and b) interprofessional competition.

Our model of the economics of interprofessional relations in hospitals draws on the work of Pauly and Redisch[9]. We assume that decisions regarding the granting of privileges and the size of the medical staff are dominated by the medical staff of each individual hospital (this has become less true since 1984). Factors outside the direct control of the medical staff, such as hospital beds, the stock of podiatrists and the stock of physicians in the market are assumed to be taken as fixed by the medical staff in its decisions to grant privileges to individual providers. The medical staff of the hospital is assumed to make decisions on the basis of majority rule thereby reflecting the preferences of the median voter. Following Pauly and Redisch we view the interests of the medical staff to be the maximization of the average income of staff members. We posit that the medical staff chooses the income maximizing levels of each type of provider (eg. pediatricians, cardiologists and foot specialists). The equilibrium level of the medical staff in this model was shown by Pauly and Redisch to occur where the marginal revenue product (MRPo) and average revenue product (ARPo) of medical staff members are equal. This is shown in Figure 1. Given the equilibrium foot specialist staff size of M*, medical staffs are hypothesized to try to select M* qualified orthopedists and then fill in any shortfall with podiatrists. Thus, in contrast to the Pauly-Redisch model we assume that in the short run the size of the medical staff is variable but the bed size of the hospital is not. These assumptions allow us to present the following hypotheses:

1) The greater the supply of orthopedists in a market area the lower the probability that a podiatrist will obtain staff privileges. This occurs because orthopedists, being licensed physicians, are more complementary inputs to the rest of the

medical staff than are podiatrists whose scope of activities are limited by training and medical practice acts. This means that orthopedists have higher marginal products than podiatrists. For these reasons medical staffs will try to reach M* with physician providers of foot care. The more plentiful the supply, the more likely they can reach M*.

2) Markets with greater numbers of beds, ceterus paribus, will be more likely to grant privileges to podiatrists. This hypothesis derives from tracing the change in the equilibrium medical staff, in our shortrun model, resulting from an increase in the number of hospital beds. While the Pauly-Redisch formulation does not lead to unambiguous comparative statics results, our hypothesis can be obtained by imposing several plausible restrictions on the production and demand constraints in the model. They are that the second partial derivative of quantity demanded with respect to price be non-negative, and that the production function for hospital services display positive cross partial derivatives of output with respect to medical staff and beds (this result appears in the appendix). The result of these restrictions can be seen on Figure 1. An increase in the number of beds would shift both the MRP and ARP curves to the right. This results in a larger equilibrium size of the medical staff (M**), which increases a podiatrist's chances of being offered staff privileges.

Given this theoretical frame work we specify our empirical model of podiatrist privileges (L) in the following manner:

(1) L = L(D, HC, Market, Regulation)

Demographic characteristics of podiatrists (D) are included as control variables. These are age, sex, and race.[11] Because the nature of podiatric training has changed dramatically over time as have the prerequisites for admission to podiatry school, age is included in the model. The relationship is specified as quadratic because we expect that younger podiatrists are not yet established in the community while old podiatrists are less well trained.

In order to measure the level of technical preparation of a podiatrist (HC) we measure two types of credentials. First, is whether the podiatrist has completed a formal residency program, usually comprised of post-graduate hospital based surgical training. The second credential measured is whether a podiatrist has qualified for board certification. Both of these variables indicate advanced training in surgical techniques, often key issues in a hospital's appraisal of the quality of an applicant for privileges. (It should be noted that residency training is not a necessary prerequisite for obtaining board certification.)

The theoretical model described above characterizes the medical staff as viewing the stock of podiatrists and physicians and the number of beds as fixed. Our specification of market conditions therefore consists of four variables. They are the orthopedist to population ratio, the podiatrist to population ratio, the bed to population ratio and the ratio of other physicians to the population in the market. The stock of other physicians is included because a number of them provide some footcare.

Finally, we include several indicators of the overall environment for the practice of podiatry. The presence of a podiatry school or residency training program is included as an indicator of the costs to medical staffs of obtaining information about podiatrists. The presence of a school or training program is hypothesized to lower such costs because staff physicians interact with faculty and students in the training program. This variable also serves as a proxy for the existance of a podiatry service in hospitals (a condition for podiatrists to receive privileges in JCAH standards). A variable which indicates whether podiatrists are restricted by state law to performing procedures on the foot only is also entered into the model (Regulation). A number of states define the scope of podiatric practice to include the foot and ankle or all areas below the knee. More restrictive regulations on the scope of practice are likely to be associated with a reluctance to grant full medical privileges to podiatrists.[12] This variable captures the regulatory climate in a state. We also include regional dummy variables to control for a variety of unmeasured factors that have been shown to vary across geographic areas.

The second stage of our analysis involves estimation of an earnings model. At the core of our model is the human capital formulation of earnings.[13] That is, the earnings of a podiatrist are hypothesized to depend on investments in education, on-the-job training and the development of other attributes which enhance productivity. Besides attributes that result from individual choices, a variety of structural features in the market for foot care that may affect the earnings of podiatrists are also taken into account. For example, because the quality of a provider is difficult to judge and because information is costly there may be returns to obtaining a "quality related" certification. Thus, in addition to describing education, residency training and years of experience we include a variable which indicates whether a podiatrist has been board certified. We also describe market conditions in the market for footcare. The intensity of both inter and intraprofessional competition is measured by the podiatrist to population ratio and the orthopedist to population ratio. Since the scope of practice may be limited by state law, we include the variable indicating if podiatrists are limited to performing procedures on the foot only. We also control for several demand characteristics of the market place. These include: the population over the age of 65 years, and the per capita income of the population in the market area. The presence of foot problems is particularly prevalent among the elderly.[14] It is therefore important to control for this population attribute.

Finally, podiatrists' earnings are hypothesized to depend on access to hospital facilities. Our view of this mechanism is rather straight forward. A key element in the economics of podiatric practice is the development and maintenance of a professional relationship with a patient. The podiatrist who cannot offer a full line of service because he or she does not have access to a hospital loses income due to restrictions on his or her ability to offer inpatient care. A podiatrist with access to the hospital but not full medical privileges must in part surrender professional control of patients who need to be hospitalized for their foot care. The loss of patients may extend beyond the hospital if providers offering inpatient services are viewed as more attractive to patients in need of outpatient services. We would therefore expect that, other factors equal, podiatrists with full medical privileges will have the highest earnings, followed by those with some staff privileges and lastly those with no privileges.[15]

The Estimation Technique

The econometric problem is to compare the earnings of individual podiatrists with a particular set of attributes when they have various levels of hospital privileges. The main difficulty in making this comparison is that individual podiatrists with differing levels of hospital privileges may differ along lines we do not observe. For example, there are a variety of attributes concerning a podiatrist's reputation, interpersonal skills, and technical skill level that we cannot measure. In addition, we observe the conduct of competition in the market in rather crude ways. Thus, it is likely that a standard earnings equation such as that of Griliches[13] would leave certain characteristics of individuals and the markets within which they operate uncontrolled. This raises the possibility of omitted variables bias. It is to address this problem that the techniques of Heckman[16] and Lee[17] were developed. Our description of the estimation approach draws on the expositions of Lee[18], Domenrich and McFadden[19] and Maddala.[20]

We can describe the analysis of podiatrist earnings (W) within the context of an ordered polychotomous choice situation where there are three categories for selection (full medical privileges, staff privileges and no privileges)

(2) $W_{ci} = X_{ci} B_c + u_{ci}$

(3) $I_{ci} = Z_{ci} d_c + n_{ci}$

where X_{ci} is a vector of exogenous factors which determine earnings and Z_{ci} is a vector of exogenous influences on the type of privileges granted the (i^{th}) podiatrist as described in (1) above. $E(u_c | X_c , Z_c) = 0$; W_c is observed only if the c th category is selected. I is a polychotomous response variable which in our study may take the value of 0, 1 and 2.[21] In our case since we consider a hiearchical choice, it may be particularly reasonable to assume that a single distribution underlies the choice response I_c. This enables us to use an ordered polychotomous logit model to obtain estimates for the distribution function underlying I_c19. Using these first stage estimates we apply the two stage approach of Heckman and Lee. The first stage estimates are used to calculate the inverse of the Mills ratio (λ).[22]

In the second stage we add to the three earnings equations implied by equation (2) as regressors.[23] The second stage can be expressed as follows:

(4a) $W_{NPi} = X_i B_{NP} + b_{NP} \lambda_{NPi} + V_{NPi}$

(4b) $W_{SPi} = X_i B_{SP} + b_{SP} \lambda_{SPi} + V_{SPi}$

(4c) $W_{MPi} = X_i B_{MP} + b_{MP} \lambda_{MPi} + V_{MPi}$

where MP, SP and NP are medical privileges, staff privileges and no privileges respectively. Use of ordinary least squares results in consistent estimates of the B's. The variance estimates are biased in an unknown direction as pointed out by Greene[24] and Maddala[25]. Two sets of problems have been associated with the use of two stage estimators. They are 1) collinearity between the X's and λ if the variables in Z are the same as in X; and 2) non-robust estimates of B's.[24] The first problem is avoided since our two models contain different variables. The dummy for presence of podiatry schools or residency programs was excluded on a priori grounds because it was viewed as to related to the costs of assessing quality of podiatrists rather than determinants of earnings (see note 12). The Beds variable was excluded on empirical grounds. We experimented with beds in the earnings equations and found the coefficients to be close to zero and not significant (see note 15). To examine the second problem we made a number of specification changes in the privilege selection equation and examined the resulting estimates. Few visible differences were noted and no statistically significant differences were found.

The key comparison for the purposes of this paper is to compare W_{NP}, W_{SP}, and W_{MP} holding constant both observed and unobserved characteristics of the podiatrist and the market within which he or she operates. We use the traditional single log specification of the earnings model given by equations (4a) through (4c). This means that predictions of W_c must be transformed into natural units. Assuming normality of the error term, the predicted earnings for individual i with privilege class c is

$$(5)\ W_{ci} = \exp[X_i\hat{B}_c + (\frac{S_c^2}{2})]$$

where S_c is the standard error of the estimate and $\wedge$ indicates an estimator. The arithmetic mean is therefore a function of the geometric mean $[\exp(X_iB_c)]$ and its variance. The coefficient estimators are consistent. This is not necessarily the case for estimates of the arithmetic mean. The estimator will be inconsistent if the V_{ci} distribution is not normal. Assuming departures from normality, however, would be inconsistent with the assumptions underlying the Heckman-Lee approach. We therefore rely on the transformation given in equation (5).[26]

Data

The data used for analysis of the earnings of podiatrists were drawn from a survey conducted between November of 1983 and September of 1984. The survey was conducted by researchers at the Virginia Polytechnic Institute (VPI) under contract to the American Podiatric Medical Association (APMA). A questionnaire aimed at collecting a variety of information on the practices of podiatrists, their attitudes towards work and their backgrounds was distributed to 9,746 podiatrists with mailing addresses. Four thousand eight hundred seventy three questionnaires were returned for a response rate of 50.3 percent. The response rate varied somewhat by region of the country.

In order to trace consequences of the variation in response rate by state we probed the existing data for evidence of systematic bias. We weighted the VPI data to reflect the national distribution of podiatrists and compared the demographic characteristics of the weighted to the unweighted sample. The only difference observed was in the portion of podiatrists in the 35 to 44 and 45 to 65 year old age groups. These differences were small and not statistically significant. The lack of other information precluded further analysis of non-response influences.

For the purposes of analyzing the economics of podiatric practice we augmented the VPI data with data from two other principal sources: the area resouce file (ARF) and a compilation of state regulations that govern the practice of podiatry. The ARF contains information on the availability of various health care resources at the county and metropolitan statistical area (MSA) level. Included among these health care resources are the number of physicians by specialty, the number of hospital beds, various demographic characteristics of the population in a geographical region. The data on regulations were compiled by the APMA. The regulations included specific statutes that restrict the scope of podiatric practice and limit the types of technologies that can be used by podiatrists.[27] Table 1 reports definitions, means, standard deviations and sources for key variables included in the analysis.

It should be noted that the analysis file was constructed so that market areas were associated with individual podiatrists. The market areas were defined as MSAs. This resulted in the exclusion of 801 podiatrists practicing outside of MSAs. The analysis data set was thereby reduced to 4,072 podiatrists. The VPI survey asked podiatrists their net income from podiatric practice. This response was coded in $20,000 categories. The earnings variable was constructed by taking the mean of each category and dividing that number by the number of weekly hours spent in podiatric practice times forty-eight (the average number of weeks worked per year).[28] Clearly there is measurement error in this variable, however since it is used only as a left hand side variable the consequence is to add "noise" to the data.

The remainder of the variables described in Table 1 are measured in a rather straight forward fashion as described in the table. (Copies of the questionnaire are available from the authors).

<u>Results</u>

Table 2 presents the first stage polychotomous logit estimates for the type of hospital privileges held by a podiatrist. These results are interesting in their own right. Our measures of training are the most important variables for explaining type of hospital privilege held by a podiatrist. Both the Residency and Board certification variables have estimated coefficients which are positive and significantly different from zero at conventional levels. The possession of board certification appears to dominate residency training. This indicates the importance of obtaining a "brand name" in order to signal quality to consumers with poor information.

The indicators of market conditions were, by and large, estimated to have impacts consistent with our hypotheses.[29] The orthopedist to population ratio was estimated to have a negative and significant effect on the likelihood of a podiatrist obtaining privileges. This is consistent with our view of the decision making model of medical staffs. The beds variable was positive and significant which is also in keeping with the Pauly-Redisch model presented above. The coefficient estimate for the DPM variable is positive and significant. This finding is difficult to interpret.[30] In order to test the sensitivity of the model to this variable we omitted it and reestimated the model. The coefficient estimates were not significantly altered by the change (results are available from the authors).[31] The results for the podiatry school and training program coefficient suggest that podiatrists in areas with training programs have a higher probability of obtaining privileges than do those in other areas. This result is consistent with the notion that the costs of assessing quality are lower where training programs exist.

Finally, our variable which indicates regulatory restrictions on scope of podiatric practice (limiting providers to procedures on the foot only) had essentially no impact on the likelihood of a podiatrist holding hospital privileges. This suggests that hospitals in states with policies that restrict the practice of podiatry do not exert significant influence on individual hospital decisions to grant privileges.

Table 3 presents results of the two stage earnings model estimates by type of hospital privileges. The coefficient estimates generally display similar patterns across equations. The R^2 statistics range from 0.13 to 0.22.

Several specific results are worth noting prior to assessing the earnings differentials associated with hospital privileges. The impact of board certification is large and significant. For podiatrists with no hospital privileges obtaining board certification increases earnings approximately 28 percent.[32] Similar results occur for those podiatrists with partial privileges, while the effect is considerably smaller for podiatrists with full medical privileges (17 per cent). Completion of a residency seems to have little effect on earnings for podiatrists with less than full medical privileges. The negative and significant estimate for the Residency variable in the full privileges equation is anomalous. One possible explanation for this finding is that a number of board certified podiatrists were "grand fathered" into board certification and earn more without having been residency trained. We probed this possibility by creating interaction terms with age, residency status and board certification. The results did not change significantly with the inclusion of interaction terms. The regulation of scope of practice variable, which is equal to one when podiatric practice is limited to the foot only, had a negative and significant impact on earnings for cases on no privileges or full privileges. The coefficients suggest a 9 to 14 percent decrease in earnings attributable to these statutes. The scope of practice regulation coefficient for the partial privileges equation was negative but not significant at conventional levels.

In assessing the 't' tests reported on Tables 2 and 3 it is important to recognize that if there are "permanent market effects" in the observed geographic areas the regression disturbance terms for individual podiatrists from the same geographic areas will be correlated. This autocorrelation results in downwardly biased estimates of standard errors. The variables describing the market areas (e.g. orthopedists per capita) are especially likely to be affected by autocorrelation. In order to take this possibility into account we estimated aggregate privilege and wage equation models for the 287 geographic areas in the sample.

The results for the privileges model indicates that two coefficients had considerable bias in their estimated t statistics. They were the orthopedist to population ratio and the presence of a podiatry school or training program. Their t statistics fell from 4.85 to 2.02 and 5.15 to 2.48 respectively. In both cases while there was considerable bias we could still reject the null hypothesis at the 0.05 level.

For the wage equations there were no significant changes in the estimate t statistics. For example in the estimates of full privileges the t for the orthopedist to population ratio is 2.07 on Table 3 and was 2.27 for the aggregate wage equation. Similarly the standard errors for per capita income and the podiatrist to population ratio were unaffected.

Table 4 reports comparisons between simple mean hourly earnings, predicted hourly earnings based on OLS estimates and predictions using the Heckman-Lee estimates. Predicted earnings were calculated for the entire sample (all 4,072 podiatrists). Thus the two sets of predicted earnings are expected to differ from the simple means for the three privilege types because we use the full sample to predict earnings for each type of privilege status. The characteristics of podiatrists in the full sample differ significantly from those of podiatrists in the subsets that have been selected into each privilege class. The results suggest that when selection effects are taken into account the earnings differentials attributable to hospital privileges increase for full privileges and are the same for professional privileges.

The rents from obtaining full medical hospital staff privileges amount to approximately $10.34 per hour over not having any access to the hospital using the Heckman-Lee model. The predictions based on the OLS model indicate a $5.16 per hour difference in earnings due to the possession of full medical privileges over no privileges. The impact of unobserved factors correlated with selection is therefore considerable. For the Heckman-Lee model the difference between full and no privileges earnings was significant at the 0.05 level (using a two tailed test). The difference for the OLS predictions was not significant. The difference between medical and professional privileges was not significantly different from zero at conventional levels in either model. The results suggest that controlling for both observed and unobserved market and provider attributes there is a substantial economic rent to be collected from the possession of full medical staff privileges. If only observed attributes are taken into account the rents associated with privileges are quite small. Moreover, as the first stage estimates indicate, factors related to the training and skill of a podiatrist as well as the market forces are important in assignment of hospital privileges.

Conclusions

This study was undertaken to address several issues. First, was a determination of the extent to which after controlling for both characteristics of the individual podiatrist and the market within which he or she operates rents are collected from acquiring hospital privileges. A second objective was to assess the relative contribution of market conditions versus the training and credentials of a podiatrist to variation in podiatrist earnings.

Our results indicate that there are significant differences in the earnings of podiatrists according to the hospital privileges they hold. These differences occur only when one controls for observed and unobserved characteristics of the podiatrist and his or her market environment. When we controlled for only observed factors, estimated earnings differences between those podiatrists having no privileges and those with full privileges were small ($5.16 per hour). There are however, substantial rents ($10.34 per hour) associated with hospital privileges when one uses the selection bias model to measure them.

This result appears to be counter intuitive. That is, one might expect earnings differentials to close when "unmeasured quality" is controlled. We interpret the result as suggesting that the unmeasured quality attributes are most useful in hospital based practice. Examples of such attributes might include skill in specialized surgical procedures and use of specialized technologies (e.g.; lasers) for performing foot surgery. Thus, podiatrists with these specialized skills and interests need full privileges to realize their earnings potential.

Market conditions play a substantial role in indirectly determining earnings by their role in explaining which podiatrists are most likely to obtain hospital privileges. They also directly influence the demand for podiatrist services and thereby put downward pressure on earnings. Indicators of training and technical proficiency also exert important influence on earnings differentials for podiatrists. In both the privileges and earnings equations the individual human capital attributes of podiatrists had substantial explanatory power. The importance of competitive factor appears to decrease as access to the hospital becomes more complete.

Finally, our results lend support to the Pauly-Redisch characterization of hospital staffing decisions. Further probing of staffing behavior using other models would constitute a worthwhile next step.

Footnotes

1. Darling vs. Charleston Community Hospital 331 Ill. 2nd 326, 211 N.E. 2 d 253, Certification denied 383 U.S. 946 1966.

2. American Podiatric Medical Association, Profile of Podiatric Medicine 1984, Washington, D.C.: American Podiatric Medical Association 1984.

3. U.S.DHHS, Office Visits to Orthopedic Surgeons, National Ambulatory Medical Care Survey: 1980-81, NCHS Advance Data No. 117 DHHS Pub #(PHS86-1250).

4. Weiner J.P., Steinwachs D.M., Frank R.G. and Schwartz K. "Effective Podiatric Foot Surgery: The Relative Roles of Doctors of Podiatric Medicine and Orthopedic Surgeons", American J. Public Health (in press).

5. Parrot D., Profile of Hospital Podiatry, J. American Podiatry Association, 71:646-656, 1981.

6. Lazarus W., Levine, E.S. and Levin, L.S. Competition Among Health Practitioners: The Influence of the Medical Profession on the Health Manpower Market; The Federal Trade Commission, Washington, D.C. February 1981.

7. op cit IV 44-45.

8. Heckman, J.J. "Sample Selection Bias as a Specification Error" Econometrica 47 (January 1979) 153-161; and Lee, L.F. "Unionism and Wage Rates: A Simultaneous Equations Model with Qualitative and Limited Dependent Variables" International Economic Review 19 (June 1978) 415-433.

9. Pauly M.V. and Redisch M. "The Not-For-Profit Hospital as a Physicians Cooperative", American Economic Review 63(1) 1973, 87-99.

10. From discussions with several hospital administrators and Michael Morrissey, who recently completed a survey of hospital medical staff decision making, the median voter approach appears appropriate for larger urban hospitals which are likely to be those most relevent to podiatrists in this study in 1982.

11. We experimented with a % female variable since women tend to have more foot problems. However, it was zero in all models and other coefficient estimates were not effected by the removal of the variable

Footnotes (continued)

12. 37 States have passed laws in support of privileges for podiatrists. Very few podiatrists practice in state without such laws because they are smaller rural states (Mississippi , North Dakota). Thus as well as having a direct measure of regulatory restrictiveness (limitations to the foot only) we view the poridatry school variable as an exogenous in this shortrun model. Moreover it serves as an identifying variable with use of the two stop estimator.

13. See Griliches, Z. "Wages of Very Young Men" Journal of Political Economy 84(4) Part II 1976 69-86.

14. We also experimented with this variable in the privilege equation where it had a t statistic of 0.25. Thus we excluded it from that model.

15. Beds could be considered for inclusion in the earning model. The rationale for this seems weak because for those DPMs with no privileges beds are dearly irrelevant. For those with full privileges they may matter. In order to test this proposition we entered the beds variable into the earning equations. The t statistics ranged from 0.21 to 0.50. We therefore exclude this questionable variable from the final specifications.

16. Heckman op cit ref. 8.

17. Lee op cit ref 8.

18. Lee, L.F. "Approaches to the Correction of Selectivity Bias" Review of Economic Studies 49:357-82.

19. Domencich, T. and McFadden, D., Urban Travel Demand: A Behavioral Analysis Amsterdam, North Holland 1975.

20. Maddala, G.S., Limited-Dependent and Qualitative Variables in Econometrics Cambridge U.K. Cambridge University Press 1983.

21. Domencich and McFadden address the estimation issues underlying the Multichotomous logit model.

22. Our econometric procedure follows that outlined in maddala (note 19) pages 275-278. In particular we use the second method described of pages 275 and 276.

23. λ is calculated as given by Welch, W.P., Frank, R.G. and Diehr, P. "Health Care Costs in HMOs: Correcting for Self Section" in Scheffler and Rossiter (ed) Advances in Health Economics and Health Services Research Vol. 5 Greenwich: JAI Press 1984.

Footnotes (continued)

24. Green, W.H.; "Sample Selection Bias as a Specification Error: Comment" Econometrica 49 (May 1981) 795-798.

25. See Maddala (note 19) and Heckman (note 8).

26. A smearing estimator for the non-normal case is proposed in Duan, N., Manning, W.G., Morris, C.N. and Newhouse, J.P.; A Comparison of Alternative Estimators for the Demand for Medical Care, Rand Corporation Report R-2754 HHS Santa Monica 1982. They propose use of the simple average of the exponentiated residuals:

$S_j = \text{Sum} \exp (U_{ci})/N_c$.

We experimented with the smearing estimator and non-normality; the results were essentially the same.

27. We did not include important regulations that have been adopted by all or nearly all states.

28. This approach makes use of information contained in the hours of work variable rather than relying solely on 7 categories of income. The categories used were as follows: <$30,000; $30-50,000; $50,-70,000; $70-90,000; $90-110,000; $110,000-130,000; $130,000+. The open ended category mean was estimated in three ways that yielded similar results. First was to obtain the maximum podiatrist income from APMA and use the midpoint of the constrained category. The second was to use a Pareto distribution to obtain an estimate of the category. The third used a log normal distribution to obtain an estimate of the open ended category's mean.

29. We tested an alternative model of privileges, it is somewhat more general.

$$I = A \; ORTHO^{\partial} \; OTHERUMD^{B} \; BEDS^{\gamma} \; POPULATION^{\phi} \; e^{\Sigma \gamma_i X_i}$$

The results were as follows:

$\partial = -0.63$ $B = -0.06$ $\gamma = 0.65$ $\phi = -0.22$

(3.31) (0.25) (3.09) (0.91)

(t statistics in parenthesis)

30. Since the sample observations are on individual podiatrists and the DPM variable is an SMA level measure, it is our view that simultaneity is not likely to be a major difficulty.

31. When the privileges model without DPM/Population was used to re-estimate the earnings models reported below, there was no difference in ordering under the new specification and only small differences in the absolute predicted values.

32. To obtain expressions for the percentage change (Δ) we transform the estimated coefficients (b) in the following manner $\Delta = e^b - 1$.

TABLE 1

Means and Standard Deviations

	$\bar{X}$	SD	SOURCE
Age	43.18	12.49	VPI
Net Income[1]	56,903	38,533	VPI
Practice Hours/Week	37.51	11.01	VPI
Earnings (Net Income / Hours (48))	34.52	35.03	VPI
Resident (1 = yes)	0.35	(0.48)	VPI
Medical Staff Priv. (1)	0.52	0.50	VPI
Other Staff Priv. (1)	0.21	0.43	VPI
Sex (1 if female)	0.036	0.02	VPI
White (1 if white)	0.96	0.98	VPI
DPM/100,000	6.28	3.22	ARF
Orthopedists/100,000	6.10	2.18	ARF
Beds/100,000	472.05	91.85	ARF
Board Certified/ Board Eligible	0.60	0.46	VPI
Per Capita Income 1980	9550	1749	ARF
OTHER MDs/100,000	180	70	ARF
Podiatry Schools and Residency Programs present = 1	0.21	0.41	APMA

[1]Taken as mean of $20,000 groupings and then averaged.

TABLE 2

Multichotomous Logit Results

Variable	Coefficient	t*
α 1	-2.848	1.85
α 2	-3.831	2.48
Age	0.052	1.63
Sex	-0.624	3.44
Race	-0.268	1.23
Board Certified	0.848	10.60
Residency trained	0.497	6.21
LOG Orthopedists	-0.689	4.85
LOG Podiatrists	0.246	2.66
LOG BEDS	0.623	2.87
LOG Other Mds	0.019	0.54
Practice Limited to foot only	0.087	0.88
$(Age)^2$	-0.001	4.50
Podiatry School or training program	0.521	5.15
x^2	861.86	

8 regional dummies included

* asymptotic t

TABLE 3

Heckman-Lee Regression Results*

Variable	No Priv	Part Priv	Full Priv
Age	0.102 (7.84)	0.143 (7.28)	0.159 (14.43)
Sex	-0.338 (3.47)	-0.134 (0.97)	-0.124 (1.37)
Race	-0.140 (1.29)	-0.207 (1.25)	-0.219 (2.56)
Residency Trained	-0.070 (1.25)	0.047 (0.77)	-0.081 (1.97)
Board Certified	0.254 (3.87)	0.246 (3.26)	0.163 (2.95)
Log Orthopedists	-0.018 (1.55)	-0.023 (1.75)	-0.005 (0.57)
Per Capita Income	0.001 (1.81)	0.001 (1.66)	0.002 (2.07)
Practice Limited to Foot Only	-0.090 (1.70)	-0.042 (0.67)	-0.127 (3.45)
$(Age)^2$	-0.001 (6.88)	0.001 (6.05)	-0.001 (12.04)
Population	0.0001 (0.20)	0.0001 (0.43)	0.0001 (1.49)
Log Podiatrists	-0.015 (1.00)	-0.007 (0.48)	-0.015 (1.63)
λ	-0.338 (0.98)	-0.041 (0.25)	0.060 (0.99)
Constant	0.811 (2.19)	-0.118 (0.22)	-0.211 (0.56)
R^2	0.13	0.22	0.22
F	7.80	9.63	29.67
N	1042	714	2112

* t's in parentheses
8 regional dummies included

TABLE 4

Predicted Hourly Earnings
by Type of Privileges
Using Varying Estimators

	Simple Mean	OLS Model	Heckman-Lee Model
No Privilege	32.78	25.90	24.95
Professional	31.61	26.81	25.04
Full (Medical)	36.18	31.06	35.29
N	-	4024	4024
Full-No Privileges	3.40	5.16	10.34

Appendix

(A1) $Q^d = Q^d(P_T)$ $\qquad \partial Q/\partial P_T < 0$ $\qquad$ Demand Function

Q^d = Quantity demand
P_T = Total Price

(A2) $Q = F(\bar{B}, L, M,)\ F_{L,M} > 0 \quad F_{LL},\ F_{MM} < 0$

$\bar{B}$ = Fixed Beds
L = Non-medical staff labor
M = Medical staff

(A3) $Y = (P_T Q - c\bar{B} - wL)/M$

c,w = input prices

Maximization of (3) subject to (1) and (2) leads to the equilibrium

(A4) $P_T \quad \partial Q/\partial M + \partial P_T/\partial Q \quad \partial Q/\partial M \quad Q \quad - \quad P_T(F\ \bar{B},L,M))F(\bar{B},L,M) \quad /M$

$= 0$

(4) can be rewritten as

(A4') $Ym = g(M,B)$

which be totally differentiation obtain the following expression

(A5) $$\frac{dM}{dB} = -\frac{gBB}{gBM}$$

If $gBB < 0$ than the sign of DM/DK depends on $g_B m$ which is

$$gBm = P_T \quad \partial^2 Q/\partial M \partial B + \quad \partial^2 P_T/\ \partial Q^2/ \quad \partial MB\ \partial Q + \partial Q/\ \partial B\ \partial^P T/\ \partial Q\ \partial Q/\ \partial M \quad -$$

$$(P_T \quad \partial Q/\ \partial B + \partial^P T/\ \partial B \quad \partial Q/\ \partial B\ Q)$$

if $\partial^2 Q/\partial M \partial B > 0$ and $\partial^2 P_T/\ \partial Q^2 \geq 0$ then $g_{k_m} > 0$

and $\frac{dM}{dB} > 0$

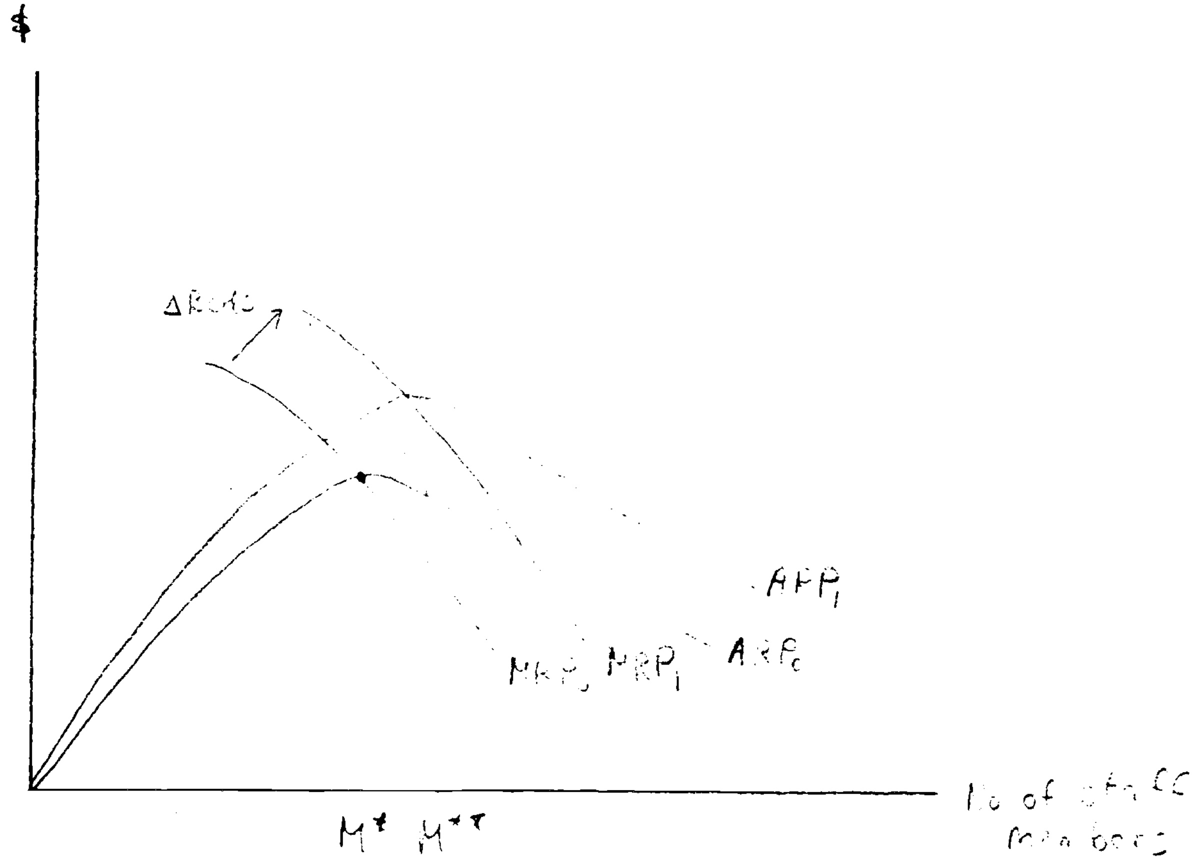

Figure 1
Pauly-Redisch Model
with Fixed [illegible]