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Ownership and rent-seeking behavior in specialty health care practices

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Abstract

Specialty health care practices are unique in that they exhibit a wide range of ownership types, from large corporations controlled by third parties to those directly owned by practitioners (physicians, therapists, etc.). Many of these practices also employ licensed assistants whose labor is partially substitutable with those of the practitioners. This paper presents a theoretical model that examines the impact that different levels of ownership have on rent-seeking behavior and efficiency within specialty practices. Our primary focus is on whether lower levels of ownership induce practitioners to extract larger economic rents by substituting their services for those of their assistants. We find that if the practitioners are not required to be technically efficient then they unambiguously respond to lower ownership with rent-seeking. However, requiring the firm to be technically (but not allocatively) efficient, may be sufficient to mitigate this incentive.

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1. Introduction

Rent-seeking is a common activity for economic agents. When firms operate in imperfectly competitive markets, the owners and/or managers of these firms can make operating decisions that redistribute wealth from other members of society to themselves. This produces allocative inefficiency and reduces social welfare below the optimal level. The health care industry is no exception to this rule. For example, a recent study by Town *et al*. (2006) estimated that between 1990 and 2001, over $40 billion in consumer surplus was transferred from consumers to producers solely from mergers in the US hospital industry. Given that hospitals are only one (albeit a major) subset of the health care industry, and that other producers may also practice rent reeking, the social welfare implications of rent seeking in health care are highly significant.

A crucial issue is to whom these potential rents accrue. Firms operating in the health care industry are unique in that they have a wide array of ownership forms. For example, a firm may be completely controlled by an outside, third party, or it may be (at least partially) owned by a group of individuals supplying a crucial service(s) (such as insurance, inpatient hospitals services and/or physician services) within the production process. Since outside owners and medical personnel have different objectives, it stands to reason that the incentive to extract rents, as well as the allocation of those extracted rents, may differ depending on who owns the firm.

The literature on rent seeking in health care has been empirical[1], focused on physician behavior in general, acute care hospitals (particularly those that own, or are owned by, a HMO) and has attempted to identify whether various ownership structures lead to differences in rent seeking and efficiency. The explanation posited by most of these studies is that certain ownership types have a vested interest in providing a particular type of care, and unnecessarily substitute that service for other types of medical care (whenever possible) in order to increase the monetary gain to the individual or group providing that service. For example, Ahern *et al.* (1996) found that hospital-owned HMOs were more likely to over-utilize inpatient services than other types of HMOs. In doing so, the hospital could garner a larger portion of the available net revenue per patient. Unfortunately, by over-utilizing inpatient services to capture these rents, hospital-owned HMOs were necessarily less efficient than other HMOs. Other studies have found similar results for a number of different hospitals types, including HMO-affiliated (Siddharthan *et al.* 1997; Rosenman *et al.* 1997; Hillman *et al.* 1999; Siddharthan *et al.* 2000) and non-HMO-affiliated hospitals (Kuntz and Vera 2003).

Two recent trends have sparked renewed interest in rent seeking activity in health care. The first is the rapid proliferation of specialty care hospitals and medical practices (General Accounting Office 2003; Nallamothu *et al.* 2007). These firms differ from general, acute care hospitals in that they provide only a small range of services (for example, coronary care, physical therapy or inpatient psychiatric services), are more likely to be for-profit, and also focus on a narrower range of patients, usually those covered by insurance policies that reimburse generously for the service(s) being performed. Moreover, these firms also have disproportionately higher degrees of practitioner-ownership, which may increase the potential for rent seeking activity (Casalino *et al.* 2003).

The second trend is an increase in the use of variable inputs that exhibit a high degree of substitutability with a traditional practitioner's labor. For example, many firms (particularly

[1] To the best of our knowledge, the only theoretical treatment of rent seeking in health care was conducted by Ahern *et al*. (1996), which provides only a simple, graphical analysis of how vertical integration allows for transfer-pricing and rent-seeking within an organization.

those operating in the US and other industrialized nations) not only employ traditional medical practitioners such as physicians, pharmacists and therapists, but also licensed assistants (such as physician assistants, family nurse practitioners, pharmacy technicians, and physical and/or occupational therapy assistants) who are legally qualified to perform many of the same tasks as the practitioner under whom they work. There is currently much debate in the medical literature about the role these licensed assistants should play in the delivery of medical care (Riportella-Muller *et al.* 1995; Banham and Connelly 2002). While some degree of substitutability is certainly desirable, issues of medical ethics, the quality of care provided to patients (assuming patients, on average, experience a higher real and/or perceived outcome when treated by the practitioner and not the assistant) and the increased potential for rent seeking activity may lead policy makers to review and possibly regulate the extent to which these licensed assistants are used, particularly in specialty care settings.

To date, there has been little theoretical explanation about the impact of ownership on rent-seeking within specialty care practices that utilize both practitioner and licensed assistant labor. Moreover, there has been no theoretical exploration of how the *degree* of firm ownership impacts (and potentially mitigates) the incentive to rent-seek. This paper presents a theoretical model that examines the impact that different levels of practitioner ownership have on rent-seeking behavior and efficiency within specialty practices. Our primary focus is on whether lower levels of ownership induce practitioners to extract larger economic rents by substituting their services for those of their assistants. In doing so, we provide some policy prescriptions which can be used to curb rent seeking behavior. To the extent that the substitution of practitioner for assistant labor manifests itself in the quality of care (whether real or perceived), our analysis also allows us to theoretically characterize the relationship that exists between rent seeking, efficiency and the quality of medical care. Thus, our analysis provides a theoretical rationale for why (and how) quality discrimination and cost adjusting might occur (Dor and Farley 1996; Friesner and Rosenman 2004; Rosenman, Friesner and Stevens 2005).

2. A Simple Model of 3rd Party Ownership

To establish a useful benchmark, we begin by modeling the third party ownership of a typical, for-profit specialty practice. These owners do not supply factors of production, but instead purchase a quantity of "practitioner labor" (x_1) and a quantity of "assistant labor" (x_2) at prices $W_1(x_1)$ and $W_2(x_2)$, respectively. We note in passing that if input markets are perfectly competitive then the input supply functions W_1 and W_2 are exogenously determined constants. The inputs are transformed into a single output (which we will define as "specialty health care services") using a continuously (at least) twice-differentiable production function $Q = f(x_1, x_2)$. [2] We assume that $f(\bullet)$ satisfies all usual regularity conditions. The firm has the ability to set prices in the output market, where the price is given by $P= p(Q)$. We further assume that $p(Q)$ is (at

[2] Clearly, the production of health services, even in specialty practices, is more complicated than the process described above. Not only do these firms utilize fixed inputs such as office space and major equipment, but also other variable inputs, including (but not limited to) utilities and supplies. However, because fixed inputs are not chosen by the firm and do not qualitatively impact the first order conditions of the model, we suppress these variables in the interests of parsimony. Similarly, incorporating additional variable inputs will not change the signs of our comparative statics, and thus any policy implications derived from out model. Lastly, in the case where a specialty firm provides a wider array of services, one can interpret our output measure as a weighted average of these different services, where the weights are defined by the severity of the illness being treated (for example, in terms of RBRVS units or case mix-adjusted admissions).

least) twice-differentiable, real-valued, and finite function for all non-negative values of Q. The first derivative of P must also be non-positive for all allowable values for Q.[3]

Based on these assumptions, the firm's profit function can be expressed as:

$$\Pi = R(x_1, x_2) - W_1(x_1)x_1 - W_2(x_2)x_2 \qquad (1)$$

where $R(x_1, x_2)$ is the firm's revenue function, which can be represented as the product of the inverse demand and production functions:

$$R(x_1, x_2) = p(f(x_1, x_2)) \bullet f(x_1, x_2) \qquad (2)$$

The third-party owners are assumed to choose x_1 and x_2 to maximize profit. Substituting (2) into (1), taking partial derivatives with respect to x_1 and x_2, and setting these expressions equal to zero gives the necessary first order conditions:

$$\frac{\partial \Pi}{\partial x_1} = (\frac{\partial p}{\partial f} \bullet f + p)\frac{\partial f}{\partial x_1} - \frac{\partial W_1}{\partial x_1} x_1 - W_1 = 0 \qquad (3)$$

$$\frac{\partial \Pi}{\partial x_2} = (\frac{\partial p}{\partial f} \bullet f + p)\frac{\partial f}{\partial x_2} - \frac{\partial W_2}{\partial x_2} x_2 - W_2 = 0 \qquad (4)$$

where $\frac{\partial p}{\partial f} < 0$; $\frac{\partial f}{\partial x_i} > 0$; and $\frac{\partial W_i}{\partial x_i} > 0$ for i =1,2

The first term in equations (3) and (4) is the marginal revenue product of input x_i, for i = 1,2 while the second and third terms jointly represent the marginal factor cost for the practice. One can rewrite equation (3) and (4) in terms of the input's marginal product:

$$\frac{\partial f}{\partial x_1} = \left(\frac{\partial W_1}{\partial x_1} x_1 + W_1\right) \Big/ \left(\frac{\partial p}{\partial f} \bullet f + p\right) \qquad (3a)$$

$$\frac{\partial f}{\partial x_2} = \left(\frac{\partial W_2}{\partial x_2} x_2 + W_2\right) \Big/ \left(\frac{\partial p}{\partial f} \bullet f + p\right) \qquad (4a)$$

Let x_1^* and x_2^* denote the optimum demand for x_1 and x_2 derived from equations (3a) and (4a). Then assuming diminishing marginal returns, the smaller the value on the right-hand side of each equation, the larger the value of x_i^* for i = 1,2.

3. The Case of Constrained Practitioner Ownership

One interesting extension of the above problem is the case where one of the input suppliers (namely a group of practitioners) is a partial owner of the firm. Because the practitioners now own part of the firm, they not only receive a share of its profits, but they also have the ability to determine input usage. Moreover, as the practitioners alter the use of their own services, they move along the marginal revenue product curve for practitioner services, thereby altering their wage. This last point is important, because it implicitly assumes that the practitioners have the ability to set the level of use for their input (or the price charged for their input) based on the *demand* curve for those services. Thus, regardless of the degree of ownership, the practitioners are constrained in that they must choose a technically, but not necessarily allocatively efficient level of resource usage for the firm. We define "unconstrained control" as the case where the

[3] In a few cases, specialty care practices may derive the entirety of their revenues by treating patients covered by an insurance plan (such as Medicare) that reimburses solely on a fixed fee for service basis. In that case, the firm cannot directly control the price it sets for its services. This special case can easily be incorporated into our model without loss of generality by restricting P to a constant.

practitioners have the ability to set prices based off of the *supply* curve for x_1, and thus can induce both allocative and technical inefficiency. This model is discussed in section 4.

Assuming that all of the firm's practitioners act as a cohesive unit, the practitioners' total return function consists of a share of the profit plus infra-marginal rents. Defining this function as G(•), these returns are given by:

$$G = \lambda\left[p(f(x_1,x_2)f(x_1,x_2) - MRP_1(x_1,x_2)x_1 - W_2(x_2)x_2\right] + \left[MRP_1(x_1,x_2)x_1 - \int_0^{x_1} W_1(x_1)dx_1\right] \quad (5)$$

where λ is the (exogenously determined) share of physician ownership in the firm (which is normalized to the (0,1] interval) and $W_1(x_1)$ is the supply function for the practitioners to provide their services.[4] In equation (5), the first bracket is simply the total amount of firm profit earned by the practitioners. The second bracket represents the infra-marginal rents the practitioners are able to extract for their services. Unlike marginal factor costs, the marginal revenue product will be a function of other inputs, since we assume that changes in the level of one of the inputs affect the marginal products of the other inputs; that is, the production function is not separable. Under these conditions, the practitioners will maximize their gain by setting the necessary first order conditions equal to zero:

$$\frac{\partial G}{\partial x_1} = \lambda\left[(\frac{\partial p}{\partial f}\bullet f + p)\frac{\partial f}{\partial x_1} - \frac{\partial MRP_1}{\partial x_1}x_1 - MRP_1\right] + \left[\frac{\partial MRP_1}{\partial x_1}x_1 + MRP_1 - W_1\right] = 0 \quad (6)$$

$$\frac{\partial G}{\partial x_2} = \lambda\left[(\frac{\partial p}{\partial f}\bullet f + p)\frac{\partial f}{\partial x_2} - \frac{\partial MRP_1}{\partial x_2}x_1 - \frac{\partial W_2}{\partial x_2}x_2 - W_2\right] + \left[\frac{\partial MRP_1}{\partial x_2}x_1\right] = 0 \quad (7)$$

Since the wage is now determined by the firm's demand curve, these equations do not match up with the third party ownership case. However, to allow for a meaningful comparison across models, it is useful to express (6) and (7) in terms of their marginal products:

$$\frac{\partial f}{\partial x_1} = \left(\frac{\frac{\partial MRP_1}{\partial x_1}x_1 + MRP_1}{\frac{\partial p}{\partial f}\bullet f + p}\right) - \left(\frac{\frac{\partial MRP_1}{\partial x_1}x_1 + MRP_1 - W_1}{\lambda(\frac{\partial p}{\partial f}\bullet f + p)}\right) \quad (6a)$$

$$\frac{\partial f}{\partial x_2} = \left(\frac{\frac{\partial MRP_1}{\partial x_2}x_1 + \frac{\partial W_2}{\partial x_2}x_2 + W_2}{\frac{\partial p}{\partial f}\bullet f + p}\right) - \left(\frac{\frac{\partial MRP_1}{\partial x_2}x_1}{\lambda(\frac{\partial p}{\partial f}\bullet f + p)}\right) \quad (7a)$$

In section 5, we use comparative static analysis to determine how a small change in the share practitioner ownership affects input usage, and consequently rent-seeking activity. However, at this point it is interesting to consider the two discrete cases: where λ is either one or less than one. We begin with the case where λ equals one; that is, where the practitioners receive all of the firm's profit. In this case (6a) and (7a) simplify to:

[4] Note that W_1 actually represents the practitioners' opportunity costs. As such, there is no reason to consider the portion of the W_1 curve above the practitioners' actual opportunity cost since the firm will decide input usage based upon their demand curve, the MRP_1.

$$\frac{\partial f}{\partial x_1} = \left(\frac{W_1}{\frac{\partial p}{\partial f} \bullet f + p} \right); \qquad \frac{\partial f}{\partial x_2} = \left(\frac{\frac{\partial W_2}{\partial x_2} x_2 + W_2}{\frac{\partial p}{\partial f} \bullet f + p} \right) \tag{6b, 7b}$$

Equation (6b), when compared to (3a) indicates that the firm will use more of x_1, or practitioner services, than in the case of third party ownership. Since the numerator of (6b) is smaller than that of (3a), the optimal value of the marginal product must be smaller. Given diminishing returns, the optimal level of x_1 must also be higher. In the third party case, the firm has monopsony power. As a result, the marginal revenue product of practitioner services is greater than the opportunity cost for practitioners at that point. Since the practitioners can act as perfect wage discriminators for themselves, they will increase profit, as well as their rents, by increasing the use of x_1 until its marginal revenue product is equal to the opportunity cost for practitioners.

Equations (7b) and (4a) are exactly the same in form. However, since the optimal level of x_1 has changed, the values for (7b) will likely be different than those of (4a). As a result, whether the optimal level of x_2 is higher or lower under third party ownership is an empirical issue.

To the extent that greater net use of practitioners enhances the quality of care (whether real or perceived), these findings imply that full practitioner ownership, in the majority of cases, leads to both more rent seeking and higher quality of care. The practitioners unambiguously use more of their own services, and may or may not use fewer licensed assistants. If both inputs are increased, quality is made unambiguously better off. Quality of care is also increased, albeit to a lesser extent, if licensed assistant use is decreased, but the decrease is disproportionately smaller than the increase in practitioner usage. It is only when the potential decrease in licensed assistants outweighs the increase in practitioner use that there is a concern about the quality of care offered to patients.

Now consider the case where $\lambda < 1$. Here the practitioners may want to charge a higher price for their services than when they fully own the firm. Although the amount of x_1 will decrease, as will the firm's profits, the practitioners gain more rents than before. Again, this becomes an empirical issue. For certain values of x_1, the increased rents will offset the loss in practitioner profits. However, other values of x_1 lead to less rent-seeking because the gain in profitability offsets the incentive to rent-seek.

As for the use of input x_2, the denominator on the third term is larger than that of the second term. Meanwhile, both terms have the same numerator. If the two inputs are substitutes in production (i.e., if $\frac{\partial MRP_1}{\partial x_2}$ is negative), then the firm will use more x_2 than when λ is one. If the two inputs are complements in production (i.e., if $\frac{\partial MRP_1}{\partial x_2}$ is positive), then the firm will use less x_2. Thus, whether there is a positive or negative relationship between rent seeking activity and the quality of care is a fundamentally empirical issue, depending on both revenue conditions as well as the substitutability/complementarity of the two inputs.

4. The Case of Unconstrained Practitioner Ownership

We also wish to examine the case where the practitioners have an ownership stake and unconstrained control over input usage in the sense that they can set both the price and the quantity of the firm's inputs. The price of the input is now determined along the practitioners' supply curve; thus we use W_1 instead of MRP_1 when determining the price of x_1. As such, the firm can be both technically and allocatively inefficient. This creates a new profit function for the practitioners (which we define as H(•)), as shown below:

$$H = \lambda\left[p(f(x_1,x_2))f(x_1,x_2) - W_1(x_1)x_1 - W_2(x_2)x_2\right] + \left[W_1(x_1)x_1 - \int_0^{x_1} W_1(x_1)dx_1\right] \quad (8)$$

The first-order conditions that result are:

$$\frac{\partial H}{\partial x_1} = \lambda\left[(\frac{\partial p}{\partial f}\bullet f + p)\frac{\partial f}{\partial x_1} - \frac{\partial W_1}{\partial x_1}x_1 - W_1\right] + \left[\frac{\partial W_1}{\partial x_1}x_{11}\right] = 0 \quad (9)$$

$$\frac{\partial H}{\partial x_2} = \lambda\left[(\frac{\partial p}{\partial f}\bullet f + p)\frac{\partial f}{\partial x_2} - \frac{\partial W_2}{\partial x_2}x_2 - W_2\right] = 0 \quad (10)$$

For comparison, we can rewrite these equations as:

$$\frac{\partial f}{\partial x_1} = \left(\frac{\frac{\partial W_1}{\partial x_1}x_1 + W_1}{\frac{\partial p}{\partial f}\bullet f + p}\right) - \left(\frac{\frac{\partial W_1}{\partial x_1}x_1}{\lambda(\frac{\partial p}{\partial f}\bullet f + p)}\right); \qquad \frac{\partial f}{\partial x_2} = \left(\frac{\frac{\partial W_2}{\partial x_2}x_2 + W_2}{\frac{\partial p}{\partial f}\bullet f + p}\right) \quad (9a, 10a)$$

The second term in equation (9a) is unambiguously positive as long as $\lambda \neq 0$. Thus, the value of $\frac{\partial f}{\partial x_1}$ in the case of unconstrained practitioner ownership is smaller than the third party case as long as the practitioners have some ownership stake. With diminishing marginal returns, this means the level of x_1 is larger regardless of the magnitude of λ (as long as λ is positive). Unlike the constrained case, the wage earned by x_1 when practitioners have unconstrained control increases as the level of x_1 increases, since the wage is determined by the supply curve. As a result, the rents actually increase for the input-suppliers of x_1. As long as these rent-seeking gains are greater than the loss in profit for the firm, the input-supplier will continue to increase x_1. Meanwhile, equation (4a) and (10a) are identical in form. However, with a different level of x_1 being chosen, we expect the level of x_2 to differ as well. Whether this is an increase or a decrease is an empirical issue. As long as the use of licensed assistants either increases, or decreases a sufficiently small amount, then rent seeking will lead to equal or higher quality care. It is only when the decrease in licensed assistant hours outweighs the increase in practitioner hours that there is any concern about a reduction in the quality of care.

5. A Comparative Static Analysis

We are now in a position to not only examine how a change in the degree of practitioner ownership affects the incentive to rent-seek, but also to determine whether and how these marginal incentives differ across each of our models. Our key parameter of interest is the level of ownership by the practitioners, λ. We begin by creating comparative statics for our constrained ownership model. As shown in the appendix, the comparative statics of interest are given by:

$$\frac{dx_1}{d\lambda} = \frac{-G_{1\lambda}G_{22} + G_{2\lambda}G_{12}}{G_{11}G_{22} - G_{12}G_{21}} \quad (11)$$

$$\frac{dx_2}{d\lambda} = \frac{-G_{11}G_{2\lambda} + G_{21}G_{1\lambda}}{G_{11}G_{22} - G_{12}G_{21}} \quad (12)$$

where $G_{1\lambda}$, $G_{2\lambda}$, G_{11}, G_{22}, G_{12} and G_{21} are defined in the Appendix.

In general, both of these expressions are ambiguous in sign. However, we can identify some general conditions under which each of these expressions is unambiguously signed. The denominator for both (11) and (12) is the stability condition for a maximization problem, which must be unambiguously positive. G_{11} and G_{22} must also be unambiguously negative to ensure that the objective function is maximized. As such, the sign of (11) is determined by the signs and relative magnitudes of $G_{1\lambda}$, $G_{2\lambda}$ and G_{12}. The first two terms are the marginal profitability of x_1 and x_2, respectively, while the last term is the impact of a change in x_2 on the marginal net benefit of x_1. As discussed earlier, the practitioners in this problem have an incentive to over-utilize x_1, making $G_{1\lambda}$ negative in sign. This also makes the first set of terms in the numerator of (11) negative. Thus, if $G_{2\lambda}$ and G_{12} are opposite in sign, then (11) is unambiguously negative, and practitioners react to lower levels of ownership by over-utilizing x_1. In short, the practitioners are rent-seeking. The same is true if $G_{2\lambda}$ and G_{12} are the same sign, but the product of these terms is smaller in magnitude than $-G_{1\lambda}G_{22}$. The only time no rent seeking occurs is when $G_{2\lambda}$ and G_{12} are the same sign, and the product of these terms is greater in magnitude than $-G_{1\lambda}G_{22}$. Whether this last event occurs depends on the complementarity or substitutability of the two inputs in the production process. If the inputs are highly substitutable, then decreasing practitioner ownership would likely lead to more rent seeking, as it allows the practitioners a greater ability to over-utilize x_1 in order to recoup lost profit. Higher levels of complementarity would allow for less over-utilization (and thus a positive sign for (11)), especially when ownership is low or declining.

The sign of (12) also depends on the signs and relative magnitudes of $G_{1\lambda}$, $G_{2\lambda}$ and G_{12}. However, in this case the only time when (12) is clearly positive is when $G_{2\lambda}$ is positive and G_{12} is negative. And when $G_{2\lambda}$ is negative and G_{12} is positive then (12) is negative. All other possibilities lead to ambiguous results. In both of these cases, the sign of (11) is negative, implying that rent seeking occurs. So whether rent seeking leads to more or less use of the other input (x_2) depends on whether the two inputs are substitutes or complements in the production process, and also how this relationship impacts the marginal profitability of both inputs.

In general one would expect that as ownership share increased, the value of any extracted rents would begin to disappear, as these rents become more of a dollar for dollar transfer between the two sources of income. Meanwhile, the loss of profit from the inefficient choice of inputs would become a larger loss for the practitioner owners. Therefore, the practitioners would increase the use of x_1 until it reached the level of use for perfect competition. Again, while a fundamentally empirical issue, these findings that, unless the practitioners and their assistants exhibit extremely high degrees of complementarity, rent seeking is likely to result in higher (real and/or perceived) quality of care offered to patients.

There are also comparative statics for the case of unconstrained ownership. As shown in the Appendix, the comparative statics are given by

$$\frac{dx_1}{d\lambda} = \frac{-H_{1\lambda}H_{22} + H_{2\lambda}H_{12}}{H_{11}H_{22} - H_{12}H_{21}} \tag{13}$$

$$\frac{dx_2}{d\lambda} = \frac{-H_{11}H_{2\lambda} + H_{21}H_{1\lambda}}{H_{11}H_{22} - H_{12}H_{21}} \tag{14}$$

where $H_{1\lambda}$, $H_{2\lambda}$, H_{11}, H_{22}, H_{12} and H_{21} are defined in the Appendix.

As in the constrained problem, the denominator for both (13) and (14) is the stability condition for a maximization problem, which must be unambiguously positive. H_{11} and H_{22} must also be unambiguously negative to ensure that the objective function is maximized. Since the practitioners over-utilize x_1 relative to the pure profit maximization case, $H_{1\lambda}$ must also be negative. The primary difference between the constrained and unconstrained cases is that we can now sign $H_{2\lambda}$. As long as λ is positive, (10) guarantees that $H_{2\lambda} = 0$. As such, the sign of (13) is unambiguously negative. That is, in the unconstrained problem practitioners always rent-seek when their ownership share declines. The sign of (14) is ambiguous, and depends on conditions analogous to those for signing (12). The only time when (14) is clearly positive is when $H_{2\lambda}$ is positive and H_{12} is negative. And when $H_{2\lambda}$ is negative and G_{12} is positive then (14) is negative.

6. Conclusions and Policy Implications

In this paper, we investigate whether increasing or decreasing the degree of firm ownership increases or decreases the likelihood of rent-seeking on the part of practitioners. In general, we find this relationship to be ambiguous, particularly when the practitioners must ensure that the firm is technically efficient. On the other hand, when the firm can be both allocatively and technically efficient, the practitioners unambiguously respond to lower ownership levels by increased rent-seeking.

Our findings present several implications for policy makers and administrators. First, administrators have both a "carrot" and a "stick" to prevent practitioners from rent-seeking. The "stick" involves penalties for practitioners who waste resources. By focusing on waste reduction policies, practitioners are constrained to be less technically inefficient, and thus less likely to rent-seek. The "carrot" is simply to give practitioners a larger ownership share in the firm. Our study suggests that rent-seeking is a response to a reduction in practitioner ownership. Thus, if practitioner ownership increases, there is less incentive to rent-seek, since rent-seeking reduces profitability.

A second implication is that the type of medical care offered by the firm is crucial in whether or not rent-seeking occurs. Rent seeking is much less likely when inputs are not substitutable. Thus, rent-seeking is much more likely in firms providing multiple, but similar types of specialized care. This may be the reason, for example, why rent-seeking is likely to occur when firms provide both ambulatory and inpatient services (Ahern *et al*. 1996). Additionally, policy makers may be able to mitigate (or enhance) rent seeking activity by limiting the tasks licensed assistants can legally perform, thereby reducing their substitutability with practitioners.

A third implication is that policy makers need to be careful when designing policies to reduce rent seeking and enhance firm efficiency. To the extent that higher use of practitioners leads to higher real or perceived quality of care, the profit that is transferred to practitioners and the resulting inefficiency incurred by the firm may ultimately create benefits in the form of better patient care. However, a crucial issue in whether rent seeking leads to higher quality depends on i) what aspects of quality are important to administrators and policy makers and ii) the complementarity/substitutability of the practitioners and their assistants. Future work to empirically identify the nature of the rent-seeking/quality tradeoff in specific types of health care practices would provide valuable insights about whether and how this welfare transfer impacts patient care.

Appendix: Creating the Comparative Statics

We begin with the constrained ownership problem, and re-define equations (6) and (7) as follows:

$$G_1 \equiv \frac{\partial G}{\partial x_1} \tag{A1}$$

$$G_2 \equiv \frac{\partial G}{\partial x_2} \tag{A2}$$

Totally differentiating (A1) and (A2):

$$dG_1 = G_{11}dx_1 + G_{12}dx_2 + G_{1\lambda}d\lambda = 0 \tag{A3}$$

$$dG_2 = G_{21}dx_1 + G_{22}dx_2 + G_{2\lambda}d\lambda = 0 \tag{A4}$$

where:

$$G_{1\lambda} = \left(\frac{\partial p}{\partial f} \bullet f + p\right)\frac{\partial f}{\partial x_1} - \frac{\partial MRP_1}{\partial x_1}x_1 - MRP_1 \tag{A5}$$

$$G_{2\lambda} = \left(\frac{\partial p}{\partial f} \bullet f + p\right)\frac{\partial f}{\partial x_2} - \frac{\partial MRP_1}{\partial x_2}x_1 - \frac{\partial W_2}{\partial x_2}x_2 - W_2 \tag{A6}$$

$$\begin{aligned} G_{11} = \lambda&\left[\frac{\partial^2 p}{\partial f^2}\left(\frac{\partial f}{\partial x_1}\right)^2 f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_1^2} f + 2\frac{\partial p}{\partial f}\left(\frac{\partial f}{\partial x_1}\right)^2 + p\frac{\partial^2 f}{\partial x_1^2} - \frac{\partial^2 MRP_1}{\partial x_1^2}x_1 - 2\frac{\partial MRP_1}{\partial x_1}\right] \\ &+ \left[\frac{\partial^2 MRP_1}{\partial x_1^2}x_1 + 2\frac{\partial MRP_1}{\partial x_1} - \frac{\partial W_1}{\partial x_1}\right] \end{aligned} \tag{A7}$$

$$\begin{aligned} G_{22} = \lambda&\left[\frac{\partial^2 p}{\partial f^2}\left(\frac{\partial f}{\partial x_2}\right)^2 f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_2^2} f + 2\frac{\partial p}{\partial f}\left(\frac{\partial f}{\partial x_2}\right)^2 + p\frac{\partial^2 f}{\partial x_2^2} - \frac{\partial^2 MRP_1}{\partial x_2^2}x_1 - \frac{\partial^2 W_2}{\partial x_2^2}x_2 - 2\frac{\partial W_2}{\partial x_2}\right] \\ &+ \left[\frac{\partial^2 MRP_1}{\partial x_2^2}x_1\right] \end{aligned} \tag{A8}$$

$$\begin{aligned} G_{12} = \lambda&\left[\frac{\partial^2 p}{\partial f^2}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_1 \partial x_2} f + 2\frac{\partial p}{\partial f}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} + p\frac{\partial^2 f}{\partial x_1 \partial x_2} - \frac{\partial^2 MRP_1}{\partial x_1 \partial x_2}x_1 - \frac{\partial MRP_1}{\partial x_2}\right] \\ &+ \left[\frac{\partial^2 MRP_1}{\partial x_1 \partial x_2}x_1 + \frac{\partial MRP_1}{\partial x_2}\right] \end{aligned} \tag{A9}$$

$$G_{21} = \lambda\left[\frac{\partial^2 p}{\partial f^2}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_2 \partial x_1} f + 2\frac{\partial p}{\partial f}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} + p\frac{\partial^2 f}{\partial x_2 \partial x_1} - \frac{\partial^2 MRP_1}{\partial x_2 \partial x_1}x_1 - \frac{\partial MRP_1}{\partial x_2}\right] + \left[\frac{\partial^2 MRP_1}{\partial x_2 \partial x_1}x_1 + \frac{\partial MRP_1}{\partial x_2}\right] \quad \text{(A10)}$$

In order to guarantee that the objective function is maximized, G_{11} and G_{22} must both be negative. Additionally, while symmetry requires that $G_{12} = G_{21}$ the signs of these expressions are unknown. Having defined (A5) – (A10), we can express (A3) and (A4) in matrix form as:

$$\begin{bmatrix} G_{11} & G_{12} \\ G_{21} & G_{22} \end{bmatrix} \times \begin{bmatrix} dx_1 \\ dx_2 \end{bmatrix} = -\begin{bmatrix} G_{1\lambda} \\ G_{2\lambda} \end{bmatrix} d\lambda \quad \text{(A11)}$$

Solving for the comparative statics using Cramer's rule leads to:

$$\frac{dx_1}{d\lambda} = \frac{-G_{1\lambda}G_{22} + G_{2\lambda}G_{12}}{G_{11}G_{22} - G_{12}G_{21}} \quad \text{(A12)}$$

$$\frac{dx_2}{d\lambda} = \frac{-G_{11}G_{2\lambda} + G_{21}G_{1\lambda}}{G_{11}G_{22} - G_{12}G_{21}} \quad \text{(A13)}$$

Comparative statics for the unconstrained problem can be created in an analogous fashion. First, we re-define equations (9) and (10) as follows:

$$H_1 \equiv \frac{\partial H}{\partial x_1} \quad \text{(A14)}$$

$$H_2 \equiv \frac{\partial H}{\partial x_2} \quad \text{(A15)}$$

Taking the total differential, we find:

$$dH_1 = H_{11}dx_1 + H_{12}dx_2 + H_{1\lambda}d\lambda = 0 \quad \text{(A16)}$$

$$dH_2 = H_{21}dx_1 + H_{22}dx_2 + H_{2\lambda}d\lambda = 0 \quad \text{(A17)}$$

where:

$$H_{1\lambda} = \left(\frac{\partial p}{\partial f} \bullet f + p\right)\frac{\partial f}{\partial x_1} - \frac{\partial W_1}{\partial x_1}x_1 - W_1 \quad \text{(A18)}$$

$$H_{2\lambda} = \left(\frac{\partial p}{\partial f} \bullet f + p\right)\frac{\partial f}{\partial x_2} - \frac{\partial W_2}{\partial x_2}x_2 - W_2 \quad \text{(A19)}$$

$$H_{11} = \lambda\left[\frac{\partial^2 p}{\partial f^2}\left(\frac{\partial f}{\partial x_1}\right)^2 f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_1^2} f + 2p\left(\frac{\partial f}{\partial x_1}\right)^2 + p\frac{\partial^2 f}{\partial x_1^2} - \frac{\partial^2 W_1}{\partial x_1^2} x_1 - 2\frac{\partial W_1}{\partial x_1}\right] + \left[\frac{\partial^2 W_1}{\partial x_1^2} x_1 + \frac{\partial W_1}{\partial x_1}\right] \tag{A20}$$

$$H_{22} = \lambda\left[\frac{\partial^2 p}{\partial f^2}\left(\frac{\partial f}{\partial x_2}\right)^2 f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_2^2} f + 2p\left(\frac{\partial f}{\partial x_2}\right)^2 + p\frac{\partial^2 f}{\partial x_2^2} - \frac{\partial^2 W_2}{\partial x_2^2} x_2 - 2\frac{\partial W_2}{\partial x_2}\right] \tag{A21}$$

$$H_{12} = \lambda\left[\frac{\partial^2 p}{\partial f^2}\frac{\partial f}{\partial x_2}\frac{\partial f}{\partial x_1} f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_1 \partial x_2} f + 2\frac{\partial p}{\partial f}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} + p\frac{\partial^2 f}{\partial x_1 \partial x_2}\right] \tag{A22}$$

$$H_{21} = \lambda\left[\frac{\partial^2 p}{\partial f^2}\frac{\partial f}{\partial x_2}\frac{\partial f}{\partial x_1} f + \frac{\partial p}{\partial f}\frac{\partial^2 f}{\partial x_2 \partial x_1} f + 2\frac{\partial p}{\partial f}\frac{\partial f}{\partial x_1}\frac{\partial f}{\partial x_2} + p\frac{\partial^2 f}{\partial x_2 \partial x_1}\right] \tag{A23}$$

As before, in order to guarantee that the objective function is maximized, H_{11} and H_{22} must both be negative. Additionally, while symmetry requires that $H_{12} = H_{21}$ the signs of these expressions are unknown. Having defined (A18) – (A23), we can express (A16) and (A17) in matrix form as:

$$\begin{bmatrix} H_{11} & H_{12} \\ H_{21} & H_{22} \end{bmatrix} \times \begin{bmatrix} dx_1 \\ dx_2 \end{bmatrix} = -\begin{bmatrix} H_{1\lambda} \\ H_{2\lambda} \end{bmatrix} d\lambda \tag{A24}$$

Solving for the comparative statics using Cramer's rule leads to:

$$\frac{dx_1}{d\lambda} = \frac{-H_{1\lambda}H_{22} + H_{2\lambda}H_{12}}{H_{11}H_{22} - H_{12}H_{21}} \tag{A25}$$

$$\frac{dx_2}{d\lambda} = \frac{-H_{11}H_{2\lambda} + H_{21}H_{1\lambda}}{H_{11}H_{22} - H_{12}H_{21}} \tag{A26}$$

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