“Do Hospitals Use Service Intensity to Finance Inefficiency?”

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ABSTRACT
The purpose of this paper is to investigate some possible sources of inefficiency in nonproprietary health care providers. In particular, we focus on whether a provider’s choice of service intensity (for one or more patient groups) allows it to increase excess non-pecuniary spending, and thereby inefficiency. To do so, we present a theoretical model of a nonproprietary health care provider who has the ability to set service intensity. We use the model to derive some testable hypotheses about the relationship between service intensity and inefficiency, and subsequently test those hypotheses using a panel of hospitals from Washington State. We find that service intensity does influence inefficiency, but that the sign and magnitude of this relationship differs markedly, depending on the hospital’s objectives.

INTRODUCTION

Over the past few decades, the rapid pace of change in the structure of the healthcare industry, along with the rapid growth in health expenditures, has generated much interest in the behavior of healthcare providers. One key area of study has examined the inefficiency of these providers. For government decision-makers, reformers, and others looking to reduce the health care bill (and the taxes that correspond to these expenditures), inefficiency represents an easy target for blame, since reducing inefficiency is seen as a way of cutting costs without affecting access to care. Thus, the sources of inefficiency are of paramount concern.

One of the features distinguishing the health care industry is the still (albeit shrinking) significant portion of production by nonproprietary institutions.[1] It is believed that nonproprietary executives (who cannot directly capture the firm’s residual value) may have an incentive to spend firm resources on excess non-pecuniary benefits for themselves and their co-workers. As a result, the firm incurs higher average costs than comparable profit-maximizing firms, and consequently behaves inefficiently. Over the past three decades, this premise has become known as the property rights theory of the firm.

Much of the early work on property rights theory examined differences in allocative and technical efficiency between for-profit and non-profit firms. Newhouse (1970) found that non-profits have incentives that create a misallocation of resources, since their goal may not be that profit-maximization. Clarkson (1972) found that non-profit hospitals had more variability in their input use, indicating differences in allocative efficiency. Frech (1976) found that such nonproprietary decision makers will choose a level of wealth which is less than the private property rights optimum would suggest. Frech (1985) also concluded that non-profit nursing homes tended to have higher costs, at least a part of which corresponded to differences in property rights.

More recently, non-profits and other health care providers have experienced increased competition. And as more firms enter the health industry, studies (Tuckman and Chang, 1988; Bruning and Register, 1989; Register, Williams, and Bruning, 1991) have found evidence that increased competition has also reduced nonproprietary inefficiency (although not necessarily eliminated it). However, Friesner and Rosenman (2001) demonstrate that may not always be the case. Instead, non-proprietary firms may actually become *more* competitive by producing certain types of excess non-pecuniary benefits.[2]

[1] We use the term nonproprietary instead of non-profit, because nonproprietary firms also include those for-profit firms whose executives get a fixed salary (i.e., none or a very small percentage of stock ownership).

[2] One necessary requirement for their result to hold, however, is that the nonproprietary manager must be willing to sacrifice normal economic returns to obtain the desired amount of non-pecuniary expenditures.

The one interesting factor that is not addressed in these works is exactly *why* such inefficiency exists in the first place? In long run competitive markets, an inefficient firm should be driven to become efficient (or driven out of the market) by more efficient (or a larger number of) competitors. Yet, at least in the health care field, economists continue to find example after example of inefficiency and misallocation of resources. How is this possible?

The most obvious answer is that health care markets are not perfectly competitive. And economists have developed a number of arguments to explain the lack of competition in health care. For example, physicians exercise exclusive control over the types and intensities of services provided to patients. As a result, physicians may over-utilize firm resources in order to ensure that ethical (i.e., an obligation to provide high quality) and/or legal (i.e., reducing liability) considerations are met.[3] Government intervention in health care markets may also discourage competition. One example is that government policies create artificial barriers to entry by preventing firms from expanding the size of their facilities.[4] Another is the use of government tax dollars (or tax exemption) to subsidize not-for-profit hospitals. Lastly, government sponsored insurers (such as Medicare and Medicaid) have adopted reimbursement policies that force providers to charge different net prices and/or offer a different mix (or intensity) of services – which proxy as a firm's quality of care -, thereby segmenting health care markets and reducing the effects of competition.[5]

The purpose of this paper is to investigate some possible sources of inefficiency in nonproprietary health care providers. In particular, we focus on whether a provider's choice of service intensity (for one or more patient groups) allows it to increase excess non-pecuniary spending, and thereby inefficiency. To do so, we present a theoretical model of a nonproprietary health care provider who has the ability to set service intensity (and hence, discriminate based upon service intensity decisions). We use the model to derive some testable hypotheses about the relationship between service intensity and inefficiency, and subsequently test those hypotheses using a panel of hospitals from Washington State. We conclude the paper by discussing the implications of our findings and using those implications to present some policy recommendations.

THE MODEL

Consider a nonprofit health care entity that provides services to two distinct types of patients: those carrying an insurance policy that reimburses on a fixed fee for service basis and those carrying a health insurance policy that reimburses the price (or some predetermined percentage of the price) charged by the provider. For simplicity, we to the former insurance plan as government-sponsored insurance, while the latter we refer to as private insurance.[6] As is convention in the literature, such a the health care provider is considered a multiple-output producer in the health care market, whose output can be measured as the number of adjusted inpatient days for each group[7]. In this way, the price the firm receives for treating government-insured patients is exogenous, while the price charged to private patients is under the control of the provider. Service intensity is treated as a "private" good (ala Dranove and White 1998); that is, the producer can offer different patient groups different levels of service intensity.

Following Newhouse (1970), the objective of a health care provider is to maximize its prestige.

[3] This is a common example of moral hazard in health care markets.

[4] The most common example of government-enforced barriers to entry is the use of certificate of need (CON) capacity constraints. Essentially, this is a government-issued permit all health care providers must obtain prior to expanding the size of their facilities. In some cases (such as the U.S. nursing home industry), these permits are so difficult to obtain that many providers experience an excess demand for their services (Gertler 1989).

[5] The former has been termed "cost shifting" by the literature, while the latter is known as "cost-adjusting". See Dranove and While (1998) and Rosenman et al (2000) for a discussion of cost shifting. Dor and Farley (1996), Gertler and Waldman (1992), Rosenman and Friesner (2002) and Gertler (1989) provide a discussion of cost-adjusting.

[6] Consistent with most government insurance programs, we also assume that any copay consumers are required to pay is unrelated to the amount reimbursed by the provider.

[7] It is assumed that the provider has significant market power over private price as well as any type of service intensity offered by the firm.

Prestige can take a number of forms, including profitability, obtaining grants and performing community service. We assume that prestige comes from several sources: the number of patent encounters for each group (which may be above the profit maximizing level of output, and so may contain excess "marketed non-pecuniary goods"), profitability, and purchasing/producing non-marketed non-pecuniary goods. The provider faces two constraints. The first is the traditional constraint that the firm's observed profit equals its observed revenue minus its observed costs. We call this the firm's "accounting budget constraint". The second is that (holding constant market conditions) every firm is capable of obtaining a level of profit commensurate with a purely profit maximizing firm. The difference between a profit-maximizing and a not-for-profit firm is that the not-for-profit cares more for excess non-pecuniary goods than the for-profit firm does (Friesner and Rosenman, 2002). Consequently, nonprofit firms purchase/produce excess non-pecuniary goods with their profit. We call this the firm's "economic budget constraint". The objective of the provider is to maximize its utility for prestige subject to the accounting and economic constraints:

$$\max_{q_1,q_2,p_1,N} \quad U\{N, q_1Y_1, q_2Y_2, \Pi\} \quad subject \quad to$$

$$\Pi^* = \Pi + S[\bullet]$$

$$\Pi = p_1Y_1 + p_2Y_2 - C[\bullet]$$

where:

$Y_1[P_1,q_1]$ is the quantity of privately insured patient encounters.

$Y_2[q_2]$ is the quantity of government-insured patient encounters.

P_1 is the price the provider charges for treating a privately insured patient.

P_2 is the price the provider is allowed to charge (recover) for treating a government patient.

q_1 is the intensity of service that a privately insured patient receives from the provider.

q_2 is the intensity of service that a government patient receives from the provider.

N is a non-marketed non-pecuniary good (note that having multiple N will give analogous results, so we use a single N for simplicity).

$C[q_1Y_1, q_2Y_2, N, P_2]$ is the provider's total (variable) cost function.

$S[q_1Y_1, q_2Y_2, N]$ are the provider's total expenditures on excess non-pecuniary goods.

Π is the firm's observed level of profit.

Π^* is the purely profit maximizing level of profit.

In this model, the provider's choice of private price and private service intensity influences the private demand for its services. However, the only way the provider is able to influence government demand is to adjust its level of government service intensity[8]. The structure of the cost function is that employed by Dor and Farley (1996). It is nonlinear and implicitly contains the possibility of both economies of scale and economies of scope. In addition, service intensity, defined as a weighting index, is multiplied by a firm's output to determine its "service intensity-adjusted output". The value of this approach is that it shows that a change in the level of service intensity will have a direct effect the firm's resource constraint (i.e., the number of patients the firm is able to treat) as well as an indirect effect on the number of patients willing to obtain treatment from the firm. By examining a firm's service intensity-adjusted output (instead of a firm's adjusted patient days), the simultaneous affects of service intensity on a firm's cost structure can be accounted for.

We solve the economic budget constraint for Π and substitute this expression into the utility function and remaining constraint. Then defining λ as the lagrange multiplier, the maximization problem becomes:

$$\begin{aligned} L &= U\{N, q_2Y_2, q_3Y_3, \Pi^* - S[\ ]\} \\ &+ \lambda\{\Pi^* - S[\ ] - P_1Y_1 - P_2Y_2 + C[\ ]\} \end{aligned} \tag{1}$$

The first order conditions are:

[8] In our model we define service intensity in a very broad manner (as an aggregate index inclusive of case-mix). However, this need not be the case. One may also decompose q into case-mix related and non-casemix service intensity, thereby allowing provider to control costs by adjusting case-mix (holding non-casemix service intensity constant). In this case, q denotes the provider's case-mix related service intensity. If one wishes to examine service intensity and case-mix simultaneously, one can adapt the approach used by Dor and Farley (1996) to this model with little loss of generality. However, to ease the exposition, we define the provider's service intensity inclusive of case-mix. Similarly, using this model to treat service intensity as a public good is also a trivial simplification of the one presented here.

$$\frac{\partial L}{\partial q_1} = \frac{\partial U}{\partial q_1 Y_1}\left[Y_1 + q_1 \frac{\partial Y_1}{\partial q_1}\right] - \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_1 Y_1}\left[Y_1 + q_1 \frac{\partial Y_1}{\partial q_1}\right] - \lambda P_1 \frac{\partial Y_1}{\partial q_1} + \lambda \frac{\partial C}{\partial q_1 Y_1}\left[Y_1 + q_1 \frac{\partial Y_1}{\partial q_1}\right] = 0 \quad (2)$$

$$\frac{\partial L}{\partial P_1} = \frac{\partial U}{\partial q_1 Y_1}\left[q_1 \frac{\partial Y_1}{\partial q_1}\right] - \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_1 Y_1}\left[q_1 \frac{\partial Y_1}{\partial P_1}\right] - \lambda\left[Y_1 + P_1 \frac{\partial Y_1}{\partial P_1}\right] + \lambda \frac{\partial C}{\partial q_1 Y_1}\left[Y_1 + q_1 \frac{\partial Y_1}{\partial P_1}\right] = 0 \quad (3)$$

$$\frac{\partial L}{\partial q_2} = \frac{\partial U}{\partial q_2 Y_2}\left[Y_2 + q_2 \frac{\partial Y_2}{\partial q_2}\right] - \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_2 Y_2}\left[Y_2 + q_2 \frac{\partial Y_2}{\partial q_2}\right] - \lambda P_2 \frac{\partial Y_2}{\partial q_2} + \lambda \frac{\partial C}{\partial q_2 Y_2}\left[Y_2 + q_2 \frac{\partial Y_2}{\partial q_2}\right] = 0 \quad (4)$$

$$\frac{\partial L}{\partial N} = \frac{\partial U}{\partial N} - \left[\frac{\partial U}{\partial \Pi} + \lambda\right]\frac{\partial S}{\partial N} + \lambda \frac{\partial C}{\partial N} = 0 \quad (5)$$

$$\frac{\partial L}{\partial \lambda} = \Pi * - S[\ ] - P_1 Y_1 - P_2 Y_2 + C[\ ] = 0 \quad (6)$$

We also make the following assumptions:

where: $Y_{1P_1} = \frac{\partial Y_1[\bullet]}{\partial P_1} \leq 0;$

$$Y_{1q_1} = \frac{\partial Y_1[\bullet]}{\partial q_1} \geq 0;$$

$$Y_{2q_2} = \frac{\partial Y_2[\bullet]}{\partial q_2} \geq 0;$$

$$Y_{1P_1P_1} = \frac{\partial^2 Y_1[\bullet]}{\partial (P_1)^2} \leq 0;$$

$$Y_{1q_1q_1} = \frac{\partial^2 Y_1[\bullet]}{\partial (q_1)^2} \leq 0;$$

$$Y_{2q_2q_2} = \frac{\partial^2 Y_2[\bullet]}{\partial (q_2)^2} \leq 0;$$

$$C_1 = \frac{\partial C[\bullet]}{\partial (q_1 Y_1)} \geq 0;$$

$$C_2 = \frac{\partial C[\bullet]}{\partial (q_2 Y_2)} \geq 0;$$

$$U_1 = \frac{\partial U[\bullet]}{\partial (q_1 Y_1)} \geq 0;$$

$$U_2 = \frac{\partial U[\bullet]}{\partial (q_2 Y_2)} \geq 0;$$

$$C_{P_2} = \frac{\partial C[\bullet]}{\partial P_2} \geq 0;$$

$$S_N = \frac{\partial S[\bullet]}{\partial N} \geq 0;$$

$$U_3 = \frac{\partial U[\bullet]}{\partial N} \geq 0;$$

$$U_4 = \frac{\partial U[\bullet]}{\partial \Pi} \geq 0$$

The signs of the partial derivatives are from using standard economic assumptions. For example, private demand is decreasing in private price while private (government) demand is increasing in private (government) service intensity (ceteris paribus). Costs and utility are increasing in service intensity-adjusted output. Any economies of scale and scope are implicitly included in C_1 and C_2. Similarly, complimentarity and/or substitutability in utility across different service intensity-adjusted outputs are contained in U_1 and U_2. Finally, decreases in government reimbursement (p_2) cause total costs to decline, thereby increasing the firm's cost efficiency.[9]

[9] The increase in cost efficiency may be created through increases in technical efficiency, a change in the mix of inputs used in the production process, or a combination of the two. Given that we have explicitly included non-marketed, excess non-pecuniary goods in our cost function, it is very likely that the sign and magnitude of this partial is very close (if not equal) to

Our first objective is to determine the marginal impact of service intensity on total non-pecuniary expenditures. We begin by solving (2) and (3) separately for P_1 and then setting the two expressions equal (to eliminate P_1) and simplifying yields:

$$\frac{\partial U}{\partial q_1 Y_1} - \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_1 Y_1} + \lambda \frac{\partial C}{\partial q_1 Y_1} + \frac{Y_{1q_1}}{Y_{1P_1}} = 0 \qquad (7)$$

Now set (4) and (7) equal:

$$\begin{aligned} &\frac{\partial U}{\partial q_2 Y_2}\left[Y_2 + q_2 Y_{2q_2}\right] \\ &- \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_2 Y_2}\left[Y_2 + q_2 Y_{2q_2}\right] \\ &- \lambda P_2 \frac{\partial Y_2}{\partial q_2} + \lambda \frac{\partial C}{\partial q_2 Y_2}\left[Y_2 + q_2 Y_{2q_2}\right] \qquad (8) \\ &= \frac{\partial U}{\partial q_1 Y_1} - \left[\lambda + \frac{\partial U}{\partial \Pi}\right]\frac{\partial S}{\partial q_1 Y_1} \\ &+ \lambda \frac{\partial C}{\partial q_1 Y_1} + \frac{Y_{1q_1}}{Y_{1P_1}} \end{aligned}$$

Solve (5) for $\left[\lambda + \frac{\partial U}{\partial \Pi}\right]$, plug this expression into (8) and simplify, which yields:

$$Y_{1q_1} + P_2 Y_{2q_2} Y_{1P_1} = 0 \qquad (9)$$

Equations (9) and (6) contain all relevant information in the system of first order conditions. Solving (6) for S[•] and taking the derivative with respect to P_2, while holding all else constant gives:

$$\frac{dS}{dP_2} = -Y_2 + \frac{\partial C}{\partial P_2} \underset{>}{\overset{<}{-}} 0 \qquad (10)$$

The sign of (10) is ambiguous, so whether lower government reimbursement reduces total non-pecuniary spending is a fundamentally empirical issue, depending on how changes in P_2 affect the firm's profitability. The first term ($-Y_2$) shows the marginal revenue lost when P_2 declines. The second term shows the cost (or efficiency) savings induced by lower government reimbursement. Normally, we would expect the second term to be positive, but small in magnitude (Rosenman and Friesner 2002, Dranove and White 1998), making the sign of (10) very likely negative.

Totally differentiating (9) yields:

$$\begin{aligned} &\left[Y_{1q_1q_1} + P_2 Y_{2q_2} Y_{1P_1q_1}\right]dq_1 + \left[Y_{1q_1P_1} + P_2 Y_{2q_2} Y_{1P_1P_1}\right]dP_1 \\ &+ \left[Y_{1P_1} Y_{2q_2}\right]dP_2 + \left[P_2 Y_{1P_1} Y_{2q_2q_2}\right]dq_2 = 0 \end{aligned} \qquad (11)$$

We can use (9) to obtain the following comparative statics:

$$\frac{dq_2}{dP_2} = -\frac{Y_{2q_2}}{P_2 Y_{2q_2q_2}} > 0 \qquad (12)$$

$$\frac{dq_1}{dP_2} = -\frac{Y_{1P_1} Y_{2q_2}}{\left(Y_{1q_1q_1} + P_2 Y_{2q_2} Y_{1P_1q_1}\right)} \underset{<}{\overset{>}{-}} 0 \qquad (13)$$

Equation (12) indicates that the provider has an unambiguous incentive to respond to lower government reimbursement by lowering service intensity to government patients. Thus, the provider is cost-adjusting with respect to this patient group. Equation (13) indicates that a provider's incentive to cost adjust with respect to privately insured patients is ambiguous, the sign of which depends on the cross partial of private demand. If $Y_{1P_1q_1}$ is negative (or sufficiently small and positive), then the sign of (13) is negative, and the provider does not cost adjust. This makes sense, since a negative sign for this cross-partial indicates that demand becomes less sensitive to price as service intensity increases. So the provider can offset a decline in P_2 by raising both service intensity and price to privately insured patients, thereby increasing its revenue (through higher P_1) and offsetting the reduction in government reimbursement. However, if $Y_{1P_1q_1}$ is large and positive, then the provider cannot offset a smaller P_2 by using quality as a rationale for higher private prices. As a result, the provider must offset the lower reimbursement through other means, most notably cost adjusting.

Combining our two sets of comparative statics we find that:

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zero. Empirical evidence (Friesner et al 2005; Dranove and White, 1998) also supports this conjecture. However, we leave P_2 as an explicit argument in the cost function to make the analysis as general as possible.

$$\frac{dS}{dq_1} = \frac{dS}{dP_2} \bullet \frac{dP_2}{dq_1} = -\left(\frac{Y_{1q_1q_1}}{Y_{2q_2} Y_{1P_1}} + \frac{P_2 Y_{1P_1q_1}}{Y_{1P_1}} \right) \bullet \left(\frac{\partial C}{\partial P_2} - Y_2 \right) \gtrless 0 \quad (14)$$

$$\frac{dS}{dq_2} = \frac{dS}{dP_2} \bullet \frac{dP_2}{dq_2} = -\left(\frac{P_2 Y_{2q_2q_2}}{Y_{2q_2}} \right) \bullet \left(\frac{\partial C}{\partial P_2} - Y_2 \right) \gtrless 0 \quad (15)$$

Our first comparative static (14) tells us the relationship between the service intensity for private consumers and the total amount of excess spending, or inefficiency. The ambiguity of the sign is not surprising. If people don't want to pay for higher levels of service, firms will find it difficult to pay for the service intensity increase by raising price. Instead, they will have to pay for the increase through some other means, including cutting back on excess non-pecuniary expenditures, making the sign of (14) negative. On the other hand, if the private sector is willing to pay for higher levels of service intensity, the firm can use the extra revenue generated through the service intensity increase to fund higher levels of inefficiency. In that case, the sign for equation 14 would be positive.

The other comparative static (15) tells us of the similar relationship with the government-insured consumer. Although the sign is ambiguous, we expect that the second term would be negative and thus the comparative static as a whole would be negative. Since the provider can't affect P_2, any increase in service intensity would require firms to become more efficient in order to provide higher service intensity.

We may also use an alternative approach to determine the marginal impact of service intensity on the firm's production of specific, excess non-pecuniary expenditures. Totally differentiating (6) we have:

$$\begin{aligned} \partial \Pi^* & - \left[Y_1 + P_1 Y_{1P_1} - \frac{\partial C}{\partial q_1 Y_1} q_1 Y_{1P_1} + \frac{\partial S}{\partial q_1 Y_1} q_1 Y_{1P_1} \right] dP_1 \\ & - \left[\begin{array}{l} P_1 Y_{1q_1} - \frac{\partial C}{\partial q_1 Y_1}\left[Y_1 + q_1 Y_{1q_1} \right] \\ + \frac{\partial S}{\partial q_1 Y_1}\left[Y_1 + q_1 Y_{1q_1} \right] \end{array} \right] dq_1 \\ & - \left[Y_2 - \frac{\partial L}{\partial P_2} \right] dP_2 - \left[\frac{\partial S}{\partial N} - \frac{\partial C}{\partial N} \right] dN \\ & - \left[\begin{array}{l} P_2 Y_{2q_2} + \frac{\partial S}{\partial q_2 Y_2}\left[Y_2 + q_2 Y_{2q_2} \right] \\ - \frac{\partial C}{\partial q_2 Y_2}\left[Y_2 + q_2 Y_{2q_2} \right] \end{array} \right] dq_2 = 0 \end{aligned} \quad (16)$$

Using (16), we can create the following comparative statics:

$$\frac{dN}{dP_2} = -\frac{\left(Y_2 - \frac{\partial C}{\partial P_2} \right)}{\frac{\partial S}{\partial N} - \frac{\partial C}{\partial N}} \gtrless 0 \quad (17)$$

The interpretation on (17) is similar to that of (12) and (13). The top of this expression indicates the marginal profitability that is lost due to reductions in P_2. The denominator of this expression shows how reductions in N affect the firm's (marginal) profitability. That is, reductions in N also reduce total excess spending (which hurts the manager's utility), but also produces cost savings, which enhances the firm's profitability.

Equations (17) and (12) give the following:

$$\frac{dN}{dq_2} = \frac{dN}{dP_2} \bullet \left(\frac{dq_2}{dP_2} \right)^{-1} = \left(\frac{Y_2 - \frac{\partial C}{\partial P_2}}{\frac{\partial S}{\partial N} - \frac{\partial C}{\partial N}} \right) \bullet \left(\frac{P_2 Y_{2q_2q_2}}{Y_{2q_2}} \right) \gtrless 0 \quad (18)$$

$$\frac{dN}{dq_1} = \frac{dN}{dP_2}\left(\frac{dq_1}{dP_2}\right)^{-1} =$$

$$\left(\frac{Y_2 - \frac{\partial C}{\partial P_2}}{\frac{\partial S}{\partial N} - \frac{\partial C}{\partial N}}\right) \bullet \left(\frac{Y_{1q_1q_1}}{Y_{2q_2} Y_{1P_1}} + \frac{P_2 Y_{1P_1q_1}}{Y_{1P_1}}\right) \begin{matrix} > \\ - \\ < \end{matrix} 0 \qquad (19)$$

Not surprisingly, our findings here are similar to those of (14) and (15). Equation (18), expresses the marginal relationship between the actual units of our non-pecuniary good and service intensive for publicly funded patients. We expect this to be negative since firms will have to reduce excess expenditures and the cost savings is expected to be small. In (19), for the private sector, we again find that it depends on the willingness of the private sector to fund increases in service intensity.

At this point, it is important to note that, while all nonproprietary firms face the same qualitative incentives, the magnitude of these incentives may differ. Thus, if our data set contains different types of nonprofit firms (for example government hospitals and private, nonprofit firms), then we will want to disaggregate our sample into 2 parts to adequately measure the magnitudes of our comparative statics.

DATA

The data used in this study consist of hospitals in Washington State. Each hospital submits and certifies an annual report of financial and utilization data to the Washington State Department of Health. All of the data used in this analysis comes from these reports for the years 1994 through 1999[10]. The data contain information on each facility's charges, collections, costs and utilization patterns. In addition, population and minority data (per county) were collected from the US census bureau's home page, while data on the average wage per job in each county was collected from the Bureau of Economic Analysis' web site. There were 107 hospitals in the complete sample; however, missing or unreliable data left 61 hospitals and 289 observations available for use in the analysis[11]. As a result, our panel is unbalanced; however, this provides no loss in the generality of our results. Of the 61 hospitals, 34 of the providers were private, nonprofit firms, while the remaining 27 hospitals were government (i.e., community, district or state) hospitals. Since our theoretical model indicates that different types of providers may have different quantitative incentives concerning the relationship between quality and non-pecuniary expenditures, we subsequently divided our data set into two sub-samples, one for each type of provider.

Tables 1 and 2 contain the names and descriptive statistics, respectively, for each of the variables used in the analysis. All nominal variables in Table 2 were converted to real 1982 dollars using PPI for inputs or the CPI for outputs. We measure total excess non-pecuniary spending using a three-step process. First, we use linear programming (data envelopment analysis) methods to calculate cost inefficiency scores for each firm and time period (Coelli 1996). These scores are bounded between zero and one, with zero being the most cost efficient firm in the sample (with zero inefficiency) and one the maximum amount of cost inefficiency possible[12]. As a result, these scores can

[10] In order to implement our empirical methodology, it was necessary to construct lagged values of certain variables. As a result, most data used in this analysis is from the years 1995 through 1999, with the 1994 data being used solely to construct lagged values of these variables.

[11] We eliminated hospitals from the sample based on two primary considerations. First, we excluded all specialty and for-profit hospitals on the premise that they provide a fundamentally different set of services than do general, nonprofit hospitals, and so it is inappropriate to compare levels of excess spending across both types of firms. While it would be interesting to examine the behavior of the general, for-profit hospitals in our data set, we were unable to do so because of the limited number of these hospitals (2) that provided a complete set of information necessary to run the analysis. We also eliminated all hospitals that did not report revenue or other information (including those facilities operated by Group Health Cooperative).

[12] The linear programming technique used in this analysis requires data on outputs, inputs and input prices. Outputs were measured as the number of adjusted patient days for each of our two patient groups. Following Gertler (1989) and Vita (1990), we also included three (real) input prices: those for capital, labor and supplies. The three inputs used were the number of FTE's, the square footage of each facility and the number of available beds. The procedure allows for variable returns to scale and explicitly includes both technical and allocative inefficiency.

be interpreted as the percent of a firm's total expenses (i.e., the sum of total costs and total excess spending) that are spent inefficiently, normalized against the most efficient firm in the sample. We subsequently multiply this percent by the firm's total expenditures to arrive at a metric of total excess (or inefficient) spending. Finally, because excess spending is normalized so that the most efficient firm has zero excess expenditures, our current measure is censored, which complicates the analysis. We remove the censoring by taking the z-score of this variable. This simply re-normalizes our measure of excess spending so that the mean level of inefficiency is zero and its standard deviation is one, thereby allowing us to use standard regression analysis techniques to analyze this variable. We employ the (real) dollar value of charity care as our measure of specific, "good" non-pecuniary spending. We use the (real) dollar value of long-term debt as a measure of specific "bad" excess spending. As with total spending, we measure the excess levels of charity care and long-term debt spending relative to the sample mean and standard deviation (Friesner and Rosenman, 2002)[13].

Our data set also allowed us to construct a number of input prices, output prices and quality proxies. The price of capital was measured as the sum of interest, lease and rental expenses, divided by the PPI and the square footage of each hospital. The price of labor was calculated as the sum of wages and benefits, divided by the PPI and the number of FTE's. The price of supplies was measured as the sum of utilities, purchased supplies and other services, divided by the PPI and the number of available beds. The (net) price for treating government patients was calculated as the total amount of government-insurance collections, divided by the number of adjusted patient days for government patients. Finally, we utilize average lengths of stay for each patient group as our service intensity measures, which should proxy for a firm's (unobservable) levels of quality[14].

Examination of Table 2 shows a number of differences between the two types of firms. Nonprofit firms tend to be larger than government firms, as measured by both the number of licensed beds as well as the number of adjusted patient days. They also exhibit higher prices for capital, labor and supplies than government hospitals. Additionally, these firms exist in markets where they are able to exercise a high degree of monopoly power (i.e., a higher population to firm ratio) and have higher net prices for treating government patients. They also provide more charity care than government firms[15]. Both types of firms show relatively similar demographic patterns. Interestingly, private, nonprofit firms exhibit higher average lengths of stay and average casemix values.

ECONOMETRIC METHODOLOGY

Our objective is to estimate a quasi-reduced form system of equations to determine the signs, magnitude and significance of (14)-(15) and (18)-(19), controlling for as many important exogenous factors as possible[16]. Defining φ_j, β_j and γ_j for j = 1, …, J as model parameters to be estimated, our empirical model takes the following form:

Finally, the Coelli program produces estimates (within the 0 – 1 interval) that measure *efficiency*, with the most efficient firm carrying a score of 1. We convert this variable to a measure of inefficiency by subtracting each efficiency score from 1.

13 Since these mean values of spending may differ from each firm's efficient level of spending, our measures are undoubtedly measured with error. However, measurement error of the dependent variable will not affect the consistency of our results, as any measurement error will be absorbed into the intercept and the (firm-specific, time-specific and white noise) error terms of our regression equations.

14 Given that all output measures utilized in this study are expressed in units of inpatient measurement (as opposed to outpatient units), utilizing average lengths of stay for our quality proxies should provide no loss of generality in our results.

15 Nonprofit firms also have the highest average levels of total excess spending. However, since this variable is likely to be influenced by firm size, we do not attempt to make any inferences about this variable based solely on the descriptive statistics.

16 We define (20) - (22) as a quasi-reduced form because, in order to estimate the signs and significance of (14)-(15) and (18)-(19), the service intensity variables (which are chosen by the provider) must be on the right hand side of the equation.

$$XSSPENDING_{it} = \varphi_0 + \varphi_1 GOVALOS_{it} + \varphi_2 OTHALOS_{it} + \varphi_3 PGOV_{it} + \varphi_4 CASEMIX_{it} + \sum_{k=1}^{5} \varphi_{i+4} X_{it}^{k} + \sum_{j=1}^{3} \varphi_{j+9} Z_{it}^{j} + \vartheta_i + \zeta_t + \psi_{it} \tag{20}$$

$$XSCHARITY_{it} = \beta_0 + \beta_1 GOVALOS_{it} + \beta_2 OTHALOS_{it} + \beta_3 PGOV_{it} + \beta_4 CASEMIX_{it} + \sum_{k=1}^{5} \beta_{i+4} X_{it}^{k} + \sum_{j=1}^{3} \beta_{j+9} Z_{it}^{j} + \nu_i + \eta_t + \varepsilon_{it} \tag{21}$$

$$XSPLABOR_{it} = \alpha_0 + \alpha_1 GOVALOS_{it} + \alpha_2 OTHALOS_{it} + \alpha_3 PGOV_{it} + \alpha_4 CASEMIX_{it} + \sum_{k=1}^{5} \alpha_{i+4} X_{it}^{k} + \sum_{j=1}^{3} \alpha_{j+9} Z_{it}^{j} + \kappa_i + \rho_t + \chi_{it} \tag{22}$$

$$XSLTDEBT_{it} = \gamma_0 + \gamma_1 GOVALOS_{it} + \gamma_2 OTHALOS_{it} + \gamma_3 PGOV_{it} + \gamma_4 CASEMIX_{it} + \sum_{k=1}^{5} \gamma_{i+4} X_{it}^{k} + \sum_{j=1}^{3} \gamma_{j+9} Z_{it}^{j} + \lambda_i + \delta_t + \mu_{it} \tag{23}$$

where i = 1,…,n denotes each firm; t = 1,…,T denotes time; X^k, k = 1, …, 5 are exogenous variables that control for hospital-specific characteristics; Z^j, j = 1, …, 5 are exogenous variables that control for socio-demographic characteristics; ϑ_i, ν_i κ_i and λ_i are firm specific effects; ζ_t, η_t ρ_t and δ_t are time specific effects and ψ_{it}, ε_{it} χ_{it} and μ_{it} are white noise error terms. We apply our empirical model to each sub-sample of data separately. This allows us to examine whether private, nonprofit firms behave differently than government hospitals with respect to their quality and efficiency decisions[17].

Specifying the firm specific effect is consistent with the notion that other unobservable, time-invariant factors (such as a provider's profit-maximizing level of wealth) may impact excess spending. Similarly the time specific effects capture the mean impact of (unobserved) time-varying determinants of excess spending. Since these unobservable factors are likely to have non-zero means and be correlated with the other specified regressors, we estimate (20) - (22) using a fixed effect/LSDV model, which provides consistent estimates in the presence of such correlation. Additionally, since GOVALOS, OTHALOS and CASEMIX are very likely to be endogenous, we also estimate our fixed effect model using two-stage least squares[18].

Our reduced form system also allows us to test a number of related hypotheses about the relationship between a provider's choices of service intensity and inefficiency. Specifically, a positive and statistically significant estimate for any of the service intensity coefficients implies that increasing service intensity to one or more patient groups

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17 A pair of comments is in order here. First, we use the number of licensed beds as a measure of firm size (as opposed to the square feet of each facility) because it must be approved by the government, and so it is more likely to be exogenous. When including a measure of the price of labor, our data set actually allows us to consider two measures: the price calculated using firm data and the average wage per job supplied by the BEA. Again, we choose the latter on the grounds that it is more likely to be exogenous, especially given the fact that executives may over-spend on employee benefits and salaries for themselves and their colleagues.

18 Multicollinearity is a common problem when estimating an LSDV model with two-stage least squares. To reduce the potential for this phenomenon, we make two corrections of note. First, we specify an LSDV/fixed effect model in which both the firm and time-specific effects are measured as contrasts. That is, we drop the first firm-specific effect and the first time-specific effect. Doing so changes the interpretation of our fixed effects, but does not affect the consistency of our remaining parameter estimates. Additionally, to reduce excess correlation, we use lagged values of our independent variables as additional instruments in the first stage of the procedure.

increases firm spending. If φ_1 and/or φ_2 are positive and significant, then service intensity is being used to enhance inefficiency overall, while positive and significant estimates for β_1, β_2, γ_1 and/or γ_2 indicate that service intensity is being used to finance excess charity care and/or excess long-term debt. Similarly, the signs and significance of φ_4, β_4 and γ_4 measure the impact of changes in casemix on inefficiency. Finally, our system of equations allows us to test the hypothesis that government policy can force inefficient firms to become more efficient. In particular, a positive and statistically significant estimate for φ_3 indicates that reductions in government reimbursement force providers to become more efficient overall, while a positive and statistically significant estimate for β_3 and/or γ_3 implies that reductions in government reimbursement force providers to reduce their provision of specific excess non-pecuniary goods.

EMPIRICAL RESULTS

The results of the regressions are posted in tables 3 and 4. The first note of interest is the sign of Govalos (our measure for Medicare/Medicaid patient service intensity) is positive for private non-profits but negative for government non-profit hospitals. This is a rather interesting result. It denotes a difference in operating procedure between the two types of hospitals. On the other hand, the coefficient for casemix is negative for private firms but positive for the government non-profits. Looking at the difference between the two types of firms, we see that casemix is higher for private hospitals. This difference in sign could be due to different marginal values. The location of the various types could also play a role. Finally, for government non-profits, the sign of φ_3 is negative. If the government reduces the reimbursement rate for Medicare patients, it means that government hospitals spend more on non-pecuniary goods.

When looking at some specific forms of excess non-pecuniary spending, charity spending falls at private hospitals when government patient service intensity increases. For government non-profits, charity spending falls when there are service intensity increases for non-government patients. For the private firm, if revenue from government patients is fixed, increases in care mean increases in costs that have to be paid from somewhere. For government hospitals, the fact that non-government patient care has this negative relationship may be due to differences in economies of scale and scope between the two types of firms. Also, government hospitals tend to have better access to funding. For government firms, increases in casemix lead to lower levels of charity spending, which makes sense. Extra critical care patients use up funds that otherwise would have gone to charity care.

As for spending on long-term debt, only private hospitals are significantly affected. Increases in government reimbursement or casemix lead to higher levels of long-term debt or investment to handle more patients (due to higher price received) and more ill patients would needed a larger infrastructure. Again, better alternative funding sources may explain why government hospitals are seemingly unaffected.

Lastly, we look at the results on excess spending on labor. For both types of hospitals, an increase in service intensity for government patients tends to reduce excess spending on employees. Interestingly, an increase in service intensity for non-government patients only tends to reduce excess labor spending for government hospitals. It would seem that, perhaps due to better market power, private hospitals can make more service intensity adjustments for non-government patients and that government non-profits cannot. As casemix increases for government hospitals, their spending on excess labor increases, denoting that for more critical patients, a larger number of specialists and care-givers are required.

CONCLUSIONS

There are a few conclusions that can be drawn. First of all, it would seem that government reimbursement is not an effective policy tool for generating efficiency. Indeed for government firms, higher levels of government reimbursement are associated with less excess non-pecuniary spending. The question, of course, is why and how this is so. The answer is speculative. Lowering government reimbursement changes the margins on which firms operate. Although these are not profit maximizing firms, perhaps the new margins make it more appealing to exercise market power in private patient market, raising price and thereby lowering the number of patients. Since this diminishes one argument in the utility function, the firm responds by raising another argument – non-pecuniary spending. This speculation is supported by what we found in the relationship between service intensity and non-pecuniary spending for government hospitals. Higher service intensity was associated with more efficiency (less non-pecuniary spending). Higher service intensity brings in more patients, thus prestige in enhanced, and there is less need to augment utility with non-pecuniary spending.

Of course, we found a different relationship for private non-profit hospitals, which have a positive relationship between service intensity and non-pecuniary spending. This may reflect differences on the margins, or different goals within the firms. Patients may expect more luxuries or supplements at private hospitals, as compared to public facilities; thus, both service intensity and non-pecuniary spending may need to increase to attract more patients.

There are some similarities between the two types of firms. Both demonstrate a negative relationship between service intensity for government patients and excess spending on labor, and between charity care and quality for any type of patient. Since patients are less likely to observe these types of non-pecuniary spending, they are less likely to respond to them. Thus, to attract patients, hospitals must put extra resources into service intensity rather than non-pecuniary spending. It is true that long-term debt tends to be an issue only for the private non-profits, perhaps due to sources of funding.

This is an incomplete study. Most obviously, the growth in the number of for-profit hospitals nationwide, along with the different relationships we found between service intensity and non-pecuniary spending on the part of two types of not-for-profit firms, calls for an important extension to study for-profit hospitals. This is especially so because government firms showed a negative relationship between potential market power and excess non-pecuniary spending, while private not-for-profit firms had a positive relationship. There have been two sources of growth in for-profit hospitals – new hospitals and private, not-for-profit hospitals becoming for-profit entities. It is important to see if their behavior in spending with respect to quality of care continues.

TABLE 1: VARIABLE DEFINITIONS

VARIABLE	DEFINITION
GOVALOS	Average length of stay for government patients
OTHALOS	Average length of stay for non-government patients
GOVADJDAY	Adjusted patient days for government patients
OTHADJDAY	Adjusted patient days for non-government patients
PGOV	Average (real) price for government patients
CASEMIX	Hospital casemix index
RWAGE	Real average wage per job and county
PCAPITAL	Average (real) price of capital
PSUPP	Average (real) price of supplies, utilities and purchased services.
COMP	Measure of (potential) competition within each market
LBEDS	Number of Licensed Beds
CASEMIX	Firm case-mix index
PELDER	% of population age 65 and older
PAA	% of population that is African-American
PHISP	% of population that of Hispanic heritage
INEFF	Measure of firm cost inefficiency
SPENDING	Total (real) excess firm spending
XSSPENDING	The z-score of total (real) excess firm spending
CHARITY	Total (real) charity care expenditures
XSCHARITY	The z-score of total (real) charity care expenditures
LTDEBT	Total (real) long-term debt
XSLTDEBT	The z-score of total (real) long-term debt
PLABOR	The average (real) price of labor
XSPLABOR	The z-score of the average (real) price of labor

TABLE 2: Hospital Specific Statistics by Ownership

Variable	Mean	Std. Deviation
Private, Nonprofit Hospitals		
(160 Cases)		
GOVALOS	4.80	1.33
OTHALOS	4.01	1.63
GOVOUT	35435.60	25976.80
OTHOUT	31345.70	30116.20
PGOV	495.97	131.25
CASEMIX	0.992446	0.214224
RWAGE	11973.70	2604.42
PSUPP	106672.00	39198.90
PCAPITAL	24.39	9.92
COMP	69818.70	40380.80
LICBEDS	246.03	179.27
PELDER	0.118597	0.016430
PBLACK	0.031510	0.025598
PHISP	0.090287	0.104469
INEFF	0.243119	0.151531
SPENDING	9934350.00	9380750.00
RCHARITY	739753.00	629831.00
PLABOR	35534.70	3227.74
LTDEBT	16257900.00	19408900.00
Government Hospitals		
(129 Cases)		
GOVALOS	4.11	1.60
OTHALOS	3.44	1.67
GOVOUT	15575.00	21965.50
OTHOUT	13365.60	17747.00
PGOV	492.42	130.81
CASEMIX	0.855775	0.240463
RWAGE	11023.40	2688.25
PSUPP	94853.60	57656.80
PCAPITAL	19.60	7.79
COMP	43295.60	35621.70
LICBEDS	102.20	119.19
PELDER	0.131943	0.035494
PBLACK	0.015390	0.019204
PHISP	0.067748	0.050256
INEFF	0.288395	0.170592
SPENDING	2532220.00	2424340.00
RCHARITY	667458.00	2358830.00
PLABOR	33807.40	3870.50
LTDEBT	5809790.00	7945720.00

TABLE3: Private, Nonprofit Firms

Dependent Variable	XSSPENDING		XSCHARITY		XSPLABOR		XSLTDEBT	
Regressor	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**
CONSTANT	-15.14	-1.57	17.90	3.32 **	-7.86	-0.86	1.80	0.29
PGOV	0.000194	0.45	-0.000371	-1.55	-0.000634	-1.57	0.000868	3.20 **
GOVALOS	0.401319	2.10 **	-0.182550	-1.71 *	-0.328695	-1.82 *	0.092484	0.76
OTHALOS	0.045707	0.37	-0.053033	-0.77	0.148736	1.28	-0.020425	-0.26
CASEMIX	-5.36	-2.47 **	-0.303523	-0.25	1.100020	0.54	4.08	2.96 **
RWAGE	-0.000023	-0.23	0.000088	1.61	-0.000030	-0.32	0.000186	3.00 **
PSUPP	0.000001	0.45	-0.000004	-2.13 **	0.000000	-0.06	-0.000001	-0.53
PCAPITAL	0.015545	1.08	0.000487	0.06	-0.022468	-1.65 *	0.006343	0.69
COMP	0.000072	1.69 *	-0.000010	-0.41	-0.000083	-2.07 **	-0.000028	-1.04
LICBEDS	0.019281	2.46 **	-0.011248	-2.58 **	-0.003052	-0.41	0.001428	0.29
PAA	-38.80	-0.38	-163.20	-2.90 **	164.03	1.72 *	-69.84	-1.09
PHISP	6.79	0.80	6.76	1.44	1.00	0.13	5.34	1.00
PELDER	0.950062	0.03	48.06	2.65 **	87.05	2.84 **	-24.50	-1.19
Time Specific Effects								
1999	-0.420348	-1.58	0.052797	0.36	1.26	5.02 **	0.180642	1.07
1998	-0.096227	-0.49	-0.071791	-0.65	0.746284	4.02 **	0.043724	0.35
1997	-0.246153	-1.40	-0.016653	-0.17	0.531232	3.21 **	0.017210	0.15
1996	-0.049468	-0.43	0.015764	0.25	0.054841	0.50	0.034980	0.48
Firm Specific Effects								
(Firm Number)								
2	7.77	2.23 **	-6.47	-3.33 **	-2.40	-0.73	-2.82	-1.28
3	7.88	1.87 *	-7.34	-3.12 **	0.556052	0.14	-0.685776	-0.26
4	11.92	2.34 **	-7.32	-2.58 **	-2.00	-0.42	-0.923403	-0.29
5	9.61	1.39	-15.76	-4.08 **	-3.93	-0.60	-4.03	-0.92
6	4.20	0.67	-18.58	-5.32 **	4.65	0.79	-3.22	-0.81
7	8.64	1.82 *	-3.37	-1.27	-4.81	-1.08	0.835704	0.28

10	14.09	1.81 *	-21.62	-4.98 **	-5.77	-0.79	-3.62	-0.73
11	13.09	1.78 *	-20.31	-4.94 **	-5.90	-0.85	-4.54	-0.97
12	9.32	1.30	-18.83	-4.72 **	-1.26	-0.19	-4.64	-1.03
13	9.32	1.25	-21.75	-5.24 **	-3.29	-0.47	-4.35	-0.92
14	3.17	0.59	-13.04	-4.32 **	8.60	1.69 *	-2.84	-0.83
15	11.15	1.48	-19.03	-4.54 **	-1.11	-0.16	-6.56	-1.37
16	15.09	1.74 *	-24.11	-5.00 **	-6.53	-0.80	-5.00	-0.91
17	7.63	1.76 *	-9.39	-3.88 **	-2.85	-0.70	-1.10	-0.40
18	10.31	2.24 **	-9.49	-3.69 **	-2.22	-0.51	-1.53	-0.52
19	11.58	1.81 *	-7.94	-2.22 **	-6.61	-1.09	1.45	0.36
20	7.20	1.26	-17.38	-5.43 **	2.36	0.44	-2.92	-0.80
21	-2.92	-0.40	-12.40	-3.07 **	14.81	2.17 **	1.82	0.40
22	8.33	1.28	-17.53	-4.83 **	4.47	0.73	-3.96	-0.96
23	11.87	1.89 *	-7.91	-2.26 **	-5.92	-1.00	0.216639	0.05
24	6.02	1.23	-12.45	-4.56 **	4.69	1.02	-2.96	-0.95
25	11.45	1.53	-18.83	-4.52 **	2.49	0.35	-6.32	-1.34
26	3.69	0.88	-11.05	-4.71 **	3.75	0.95	-4.58	-1.72 *
27	12.13	1.52	-21.67	-4.86 **	0.149192	0.02	-6.26	-1.24
28	8.32	1.88 *	-3.36	-1.36	-4.25	-1.02	2.18	0.78
29	9.71	1.46	-19.07	-5.13 **	2.35	0.37	-2.65	-0.63
30	9.36	1.27	-21.06	-5.11 **	-1.74	-0.25	-4.88	-1.04
31	13.66	1.61	-23.06	-4.87 **	-0.805927	-0.10	-4.60	-0.85
32	11.18	1.37	-22.32	-4.89 **	-2.58	-0.33	-4.45	-0.86
33	10.43	1.31	-22.19	-4.98 **	-2.86	-0.38	-4.23	-0.84
34	10.16	1.80 *	-12.38	-3.93 **	-2.91	-0.55	-0.020008	-0.01
R-Square		0.8640		0.9577		0.8792		0.9453
Adjusted R-Square		0.8035		0.9309		0.8254		0.9210
F-Statistic		14.27 **		50.83 **		16.34 **		38.81 **

** statistically significant at 0.05 or better
* statistically significant at 0.10 or better

TABLE4: Government Firms

Dependent Variable	XSSPENDING		XSCHARITY		XSPLABOR		XSLTDEBT	
Regressor	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**
CONSTANT	-1.34	-0.24	7.35	1.13	-3.61	-0.90	-2.37	-1.02
PGOV	-0.002656	-2.47 **	0.000478	0.37	-0.000408	-0.52	0.000294	0.64
GOVALOS	-0.672266	-2.53 **	0.246055	0.78	-0.397044	-2.05 **	0.067676	0.60
OTHALOS	-0.064173	-0.48	-0.463980	-2.91 **	-0.184545	-1.89 *	0.066449	1.17
CASEMIX	7.24	2.17 **	15.34	3.87 **	5.85	2.41 **	0.066290	0.05
RWAGE	0.000122	0.64	0.000365	1.62	0.000068	0.50	0.000103	1.28
PSUPP	-0.000008	-1.75 *	0.000019	3.61 **	-0.000004	-1.34	0.000002	1.09
PCAPITAL	0.000977	0.05	-0.057446	-2.45 **	0.000506	0.04	0.017315	2.07 **
COMP	-0.000064	-1.82 *	-0.000074	-1.77 *	-0.000067	-2.61 **	-0.000016	-1.09
LICBEDS	0.045269	2.09 **	-0.012533	-0.48	-0.028794	-1.82 *	0.007096	0.77
PAA	-171.97	-0.82	-585.91	-2.35 **	-88.60	-0.58	-129.81	-1.46
PHISP	9.55	0.45	-71.98	-2.86 **	3.97	0.26	13.50	1.50
PELDER	-28.24	-0.81	-119.90	-2.88 **	5.28	0.21	-6.95	-0.47
Time Specific Effects								
1999	0.582850	1.41	1.54	3.13 **	1.61	5.34 **	-0.195974	-1.12
1998	0.526859	1.55	1.48	3.66 **	1.05	4.22 **	-0.169723	-1.17
1997	0.477966	1.49	1.30	3.40 **	0.795641	3.40 **	-0.157205	-1.15
1996	0.273357	1.39	0.623794	2.67 **	0.375767	2.63 **	-0.064131	-0.77
Firm Specific Effects								
(Firm Number)								
2	0.409227	0.38	3.78	2.93 **	-0.215819	-0.27	-0.270635	-0.59
3	-4.90	-0.40	26.30	1.79 *	21.16	2.35 **	5.05	0.96
4	2.33	1.04	5.58	2.09 **	5.48	3.37 **	0.585553	0.62
5	4.10	1.55	8.32	2.63 **	0.512343	0.26	1.44	1.27
6	-4.15	-0.92	5.27	0.98	8.28	2.52 **	0.214219	0.11
7	2.14	0.44	18.31	3.18 **	2.71	0.77	-0.115343	-0.06
8	3.41	1.37	6.66	2.25 **	-0.318578	-0.18	1.40	1.33

Table 4 continued

9	5.08	1.96 **	8.35	2.70 **	2.37	1.26	2.69	2.44 **
10	0.239203	0.57	1.28	2.55 **	0.207920	0.68	-0.092169	-0.52
11	6.11	1.77 *	6.44	1.56	11.03	4.38 **	3.02	2.05 **
12	7.85	2.40 **	2.36	0.60	9.40	3.94 **	2.90	2.08 **
13	-3.63	-0.28	22.65	1.48	21.58	2.30 **	6.77	1.24
14	3.01	2.55 **	1.36	0.97	2.91	3.39 **	0.640402	1.28
15	-0.158017	-0.03	4.45	0.79	15.27	4.44 **	3.21	1.60
16	2.82	1.93 *	0.475649	0.27	3.48	3.27 **	1.24	1.99 **
17	1.89	0.66	10.90	3.17 **	-0.954796	-0.45	-0.878864	-0.72
18	0.174242	0.17	3.36	2.69 **	0.519538	0.68	-0.351856	-0.79
19	4.64	1.93 *	7.03	2.45 **	5.34	3.04 **	2.73	2.66 **
20	1.23	0.46	-1.05	-0.33	1.55	0.80	2.07	1.83 *
21	3.08	0.26	33.54	2.35 **	20.12	2.31 **	9.51	1.87 *
22	9.04	2.02 **	13.28	2.49 **	7.22	2.21 **	4.12	2.16 **
23	0.144269	0.09	-5.51	-3.02 **	0.295700	0.27	-1.50	-2.30 **
24	11.49	1.05	32.27	2.46 **	15.63	1.95 *	8.64	1.85 *
25	1.30	0.99	4.61	2.96 **	2.19	2.30 **	-0.837401	-1.51
26	3.02	1.11	0.065338	0.02	3.48	1.76 *	2.12	1.84 *
27	1.63	1.59	-1.40	-1.15	1.11	1.48	1.07	2.46 **
R-Square		0.7894		0.7010		0.8883		0.9619
Adjusted R-Square		0.6866		0.5550		0.8337		0.9433
F-Statistic		7.68 **		4.80 **		16.28 **		51.73 **

** statistically significant at 0.05 or better

* statistically significant at 0.10 or better

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