DO HEALTH CARE PROVIDERS QUALITY DISCRIMINATE?

EMPIRICAL EVIDENCE FROM PRIMARY CARE OUTPATIENT CLINICS

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INTRODUCTION

In most segments of the economy there can be found differences in the quality of goods that different groups of people buy or receive. Usually there is little, if any, concern over such quality differentiation. Health care is an exception, since public policy and provider ethics promote the idea that all consumers have an entitlement to the highest quality of care available. Thus, finding deliberate quality discrimination and how it occurs would be an important issue for policy makers who wish to discourage and prevent such behavior.

The basis for such concerns is not without merit. Despite moral and legal controls, problems of moral hazard and asymmetric information, combined with payment systems designed to control costs, offer ample incentives for quality discrimination in health care. Moreover, quality discrimination in health care may be difficult to substantiate due to the lack of a consensus in defining exactly what is meant by "quality" [Feldstein, 1967].

Quality responses to cost controls are known as "cost-adjustment" in the literature. Although well documented theoretically, there have been few empirical studies to date. Dranove and White [1998], using service intensity as a proxy for quality, examined a sample of California hospitals to determine whether changes in Medicare or Medicaid reimbursement had a significant impact on the service intensity provided to different groups of patients. While they found overall cost adjusting, there

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was no significant evidence to suggest quality discrimination – the change in service intensity was uniform across patient groups.[1] Friesner [2003] and Rosenman and Friesner [2002] also found evidence of cost adjusting, but did so with a model that assumed quality discrimination. Gertler [1988; 1989] and Gertler and Waldman [1992] examined whether nursing homes cost adjust, assuming away quality discrimination. Dor and Farley [1996] investigated whether general hospitals cost adjusted, but also assumed no quality discrimination.

Thus, there is not yet a general analysis in the literature about whether or not health care providers practice quality discrimination, most notably based on the type of insurance a patient carries. Most empirical studies simply assume that a provider either does or does not quality discriminate. The goal of this paper is to test whether health providers use quality/service intensity to practice market segmentation/discrimination based on the type of insurance a person carries in a more general environment of excess capacity.

The remainder of this paper proceeds in four steps. First, we discuss a (nested) theoretical model that provides the basis for testable hypotheses about whether health care providers quality discriminate. We then formalize the hypotheses and discuss some issues in measuring quality. In following sections we discuss the data, which consist of a cross-section of California primary care, outpatient clinics, present our econometric methodology and discuss our empirical results. The paper concludes by summarizing the implications of our findings and providing some suggestions for future research.

MODELING PROVIDER BEHAVIOR WITH AND WITHOUT QUALITY DISCRIMINATION

Consider a health care provider that services two distinct types of patients: those carrying government-sponsored insurance (such as Medicare or Medicaid) and those carrying privately-funded health insurance. It is conventional in the literature to consider this a multiple-output producer in the health care market, whose output can be measured as the number of patient encounters for each patient group[2]. For simplicity, we assume that the government insurer reimburses the provider a fixed fee for each service provided to a government patient, while the private insurer pays the price for services set by the provider.[3] Thus, the price the provider receives for treating government patients is exogenous, while the price charged to private patients is under the control of the provider.

Following Newhouse [1970], the objective of a health care provider is to maximize its prestige. 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 patient encounters for each group (which may be above the profit maximizing level of output, and so may contain excess "marketed non-pecuniary goods"), quality for each patient group, profitability, purchasing/producing non-marketed non-pecuniary goods[4], and obtaining grants/donations.

Of primary importance in this paper is how we incorporate quality. We assume that firms use quality to create or exploit market power, thus shifting the demand curve for each patient group that it serves. What is unclear is whether providers do not practice quality discrimination (so all patient groups receive the same level of quality) or whether they offer different patient groups different levels of quality based on the patient's insurer. While standard (profit or utility maximizing) economic theory predicts quality discrimination likely will occur if reimbursement differs across patient groups, ethical or legal restrictions (including, for example, JCAHO minimum quality standards) might prevent providers from doing so.

We assume that the provider has decided *a priori* whether or not to practice quality discrimination, and that all quality levels meet or exceed the minimum standards established in the industry. In the event that the provider does practice quality discrimination, there is no substantial legal penalty for doing so, or, if there is a substantial penalty, the odds of being caught and punished by the government are negligible[5]. While our model is sufficiently general to encompass both for-profit and not-for-profit operating status, we assume that choice is predetermined.

Assuming that decisions to quality discriminate (or not to quality discriminate) are *a priori* allows us to postulate two different models – one in which the provider does not practice quality discrimination, and another in which the provider quality discriminates. We can then compare the implications of each model, both jointly and separately. We subsequently use this comparison to develop a set of empirically testable hypotheses that distinguishes the two practices.

Using the prestige configuration of Newhouse, we assume that the provider's objective function takes the following form:

$$(1)\quad \max_{q_1,q_2,p_1,N} U\left\{q_1X_1, q_2X_2, N, G[\bullet], \Pi\right\},\text{ where } \Pi = p_1X_1 + p_2X_2 + G[\bullet] - C[\bullet] - T$$

where

$X_1[p_1,q_1]$ is the quantity of privately insured patient encounters.
$X_2[q_2]$ 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 recovers for treating a government patient.
q_1 is the quality that a privately insured patient receives from the provider.
q_2 is the quality that a government patient receives from the provider.
N is an excess, non-marketed non-pecuniary good (note that having multiple N will give analogous results, so we use a single N for simplicity).
T is the firm's tax obligation, which is set exogenously by the government and may vary depending on the firm's operating status.
$C[q_1X_1, q_2X_2, N]$ is the provider's total (variable) cost function.
$G[q_1X_1, q_2X_2, N, T]$ is the provider's total grant/donation function.
P is the firm's (after tax) observed level of profit.

Notice that quality discrimination occurs when q_1 differs from q_2. Without quality discrimination q_1=q_2 (which we can denote simply as q) and so the objective function becomes

(1a)
$$\max_{q_1,q_2,p_1,N} U\{qX_1, qX_2, N, G[\bullet], \Pi\}$$
$$\text{where } \Pi = p_1X_1 + p_2X_2 + G[\bullet] - C[\bullet] - T$$

With or without quality discrimination, a higher price for private patients lowers their demand, and higher quality for those patients increases their demand for services. Thus, we assume providers enjoy some degree of market power in the private market place, exercising that power by choosing price, quality or both. Providers also enjoy market power in the demand by government-funded patients. However, the ability to exercise that market power is limited to quality. Since the government sets the price per unit, the only way a provider can influence the demand for its services by government-funded patients is to adjust the level of quality offered those patients.[6] Quality is used as a weighting index, and we derive a "quality-adjusted" output by multiplying a firm's output by its quality. The value of this approach is that it shows that a change in the level of quality will have a direct effect on a 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 quality-adjusted output (instead of a firm's number of patient encounters), the dual effects of quality on a firm's cost structure can be accounted for. The presence of taxes in the grant/donation function is consistent with the fact that non-profit firms (which have a different value for T than for-profit firms) are more likely to receive external funding, particularly from government sources.

As noted above, we assume that quality discrimination is an a priori decision. It is not endogenous because the decision is whether or not to violate legal, professional and ethical standards. With the quality discrimination decision being made before optimization, we can infer nested models – one where the quality offered the two groups is the same and one where the quality differs.

The first step in deriving testable hypotheses about quality discrimination involves finding the optimal decision rules by providers if they do or don't discriminate on quality. We assume that the demand, cost and utility functions all have normal characteristics such that second-order necessary and sufficient conditions hold. More precisely, the structure of the cost function is that employed by Dor and Farley [1996] and Friesner [2003]. It is nonlinear and implicitly contains the possibility of both economies of scale and economies of scope, without requiring the presence or absence of either. Similarly, the complementarity and/or substitutability of utility across different quality-adjusted outputs are implicit, but not limited, by U{·}. Our results require one explicit behavioral assumption – that the marginal utility of grants differs from the marginal disutility of cost. What this means is that grants in themselves bring prestige, and serve a purpose beyond extending the productive capacities of the provider. The effect of this assumption is that when the provider discriminates on quality it acts as a revenue maximizer, reducing p_1 and increasing q_1 and q_2 until marginal revenue from each source equals zero.[7] Thus the model implies

(2)
$$X_1 + p_1X_{1_{p_1}} = 0$$

(3) $$p_1 X_{1q_1} = 0$$

(4) $$p_2 X_{2q_2} = 0$$

We can totally differentiate (2) – (4) to create comparative statics that describe the firm's cost shifting and cost adjusting incentives[8]:

(5) $$\frac{dp_1}{dp_2} = 0$$

(6) $$\frac{dq_1}{dp_2} = 0$$

(7) $$\frac{dq_2}{dp_2} = 0$$

Clearly, the quality discriminating firm does not cost shift or cost adjust.

When the provider does not quality discriminate the objective function is identical to the previous model except that now the firm provides only one quality level to all patient groups so $q_1 = q_2 = q$. Using the same assumptions, we once again find that the firm is a revenue maximizer with respect to p_1 and quality, but this time it does not differentiate between the quality offered government-insured patients and patients insured privately. The difference becomes that the choice of (a single) quality now affects both X_1 and X_2 resulting in what is essentially summing (3) and (4) so we have

(8) $$X_1 + p_1 X_{1p_1} = 0$$

(9) $$p_1 X_{1q} + p_2 X_{2q} = 0$$

The key difference between the two models is given by a comparison of (9) to (3) and (4). Instead of maximizing revenue separately (under quality discrimination), the firm now maximizes revenue *jointly*. As a result, it is not necessarily the case that each partial of demand is zero. Instead, the firm may go beyond revenue maximizing levels for one group (so that one of the partials is actually negative) in order to maximize revenue for both groups.

Totally differentiate (8) and (9) to create comparative statics that describe the firm's cost shifting and cost adjusting incentives[9]

(10) $$\frac{dp_1}{dp_2} = \frac{X_{2q}\left(X_{1q} + p_1 X_{1qp_1}\right)}{\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)\left(p_1 X_{1qq} + p_2 X_{2qq}\right) - \left(X_{1q} + p_1 X_{1qp_1}\right)^2} \gtrless 0$$

(11) $$\frac{dq}{dp_2} = \frac{-X_{2q}\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)}{\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)\left(p_1 X_{1qq} + p_2 X_{2qq}\right) - \left(X_{1q} + p_1 X_{1qp_1}\right)^2} \geq 0.$$

Only in rare cases would these comparative statics both be zero.[10] Thus, when the firm does not quality discriminate, it likely will cost shift and/or cost adjust. In both equations, the denominators are positive (to ensure a maximum of the objective function). The sign of (10) is ambiguous because we do not know the sign of X_{1qp_1}. If this cross-partial is positive, or is sufficiently small and negative, then the sign of (10) becomes non-negative, and the provider does not cost shift. Alternatively, a sufficiently large (in magnitude) and negative value for this cross partial makes (10) negative, and the provider does practice cost shifting. The sign of (11) is unambiguously nonnegative, and is zero only if demand by private pay patients is not affected by price or quality does not affect demand for government paid patients – so we would expect it to be positive, and thus expect that the provider cost adjusts.

Our findings, particularly (11), have important implications for policy as well as for the cost adjusting literature, which has heretofore assumed that a firm's decision not to quality discriminate reduces (or possibly mitigates) its incentive to cost adjust. Our findings present the opposite inference: failure to quality discriminate may actually *encourage* cost adjusting behavior, and not only for government patients. Private pay patients are also affected.

TESTABLE HYPOTHESES AND MEASURING QUALITY

A comparison of (5) – (7) to (10) and (11) provide a pair of testable hypotheses concerning a firm's quality discrimination activities. First, under the null hypothesis that a firm does quality discriminate, one can regress the government price (as well as other important exogenous factors) on private price, private quality and government quality (where each quality measure is constructed solely based on data for that group). If the null hypothesis is correct, then the coefficient estimates for the government price (in each and all regressions) should not differ from zero with any reasonable degree of statistical significance. Concomitantly, finding that the coefficient estimate is different from zero with the chosen level of statistical significance leads us to reject this hypothesis. Note that to be consistent with our model the cost adjusting equations (those dealing with quality) need to find a *positive* coefficient estimate for government price, while the private price equation need only find a non-zero coefficient estimate.

If we reject the null hypothesis (of quality discrimination), we can provide additional evidence of cost adjusting when firms do not quality discriminate by combining all government and privately-insured patients to create a single measure of quality offered by the firm. Then one can re-run the quality regressions with the "correct" quality measure. If the regression produces a positive and significant coefficient estimate, this would provide additional evidence of cost adjusting.

An issue always faced in empirical analyses of quality in health care is how to measure quality. Since we have no direct measures of quality, we rely on the same proxy as Dranove and White [1998] and Gertler [1989] — service intensity. We follow Friesner [2003] and calculate a measure of service intensity based on a Lerner type index

$$SI_i = \frac{Enc_i - Pat_i}{Enc_i},$$

where i indicates each (non-charity) patient group, Enc represents patient encounters and Pat represents the number of patients for each group. This measures service intensity as a type of contact ratio. A higher value indicates that a fewer number of patients are visiting the clinic more often, and thus utilizing a greater share of the clinic's resources. A value of zero means that each patient is receiving the minimum service intensity (1 visit) while as the index approaches 1, only a few patients are utilizing the clinic's services, indicating a high degree of service intensity.[11]

This measure, of course, may be skewed for clinics serving sicker populations, or those with different demographics that might warrant more care – for example, a higher proportion of pregnant patients may require more prenatal care, raising the encounters per patient. Ideally, a case mix variable would be available for each clinic; however, this was not so. We do control for the percentage of patients who are elderly, and some racial characteristics, which helps control for case mix differences correlated with those factors. But we are forced to (implicitly) assume that the average practice styles and "error rates" across clinics are sufficiently close that service intensity is at least correlated with quality.

An additional drawback to this measure of service intensity is that it is bounded between 0 and 1, and so is not directly employable as a dependent variable in standard (OLS) regression techniques. To avoid this difficulty, we transform our service intensity measures by taking the z-scores. This newly transformed variable is approximately normally distributed (with a mean of 0 and a standard deviation of 1), and thus conducive to standard regression techniques.

DATA

The data used in this study are taken from the 2000 annual report of primary care clinics provided by the California Office of Statewide Health Planning and Development. There are 744 primary care clinics in the state. Of these 744 clinics, 715 are licensed as community clinics, while the remaining 29 are licensed as free clinics.[12] The data contain information on the number of patients and patient encounters for each of these clinics, further broken down by sources of payment, as well as total charges and collections for each of these patient groups. In addition, the data contain demographic information on each clinic's clientele, including race, gender, age and income. The data provide sufficient information to allow us to construct a Herfindahl index of market power for each clinic (where the market is defined at the county level).[13]

The data do not provide information on the input prices facing each clinic. For instruments, we collected information on the average wage per job in each county from the Bureau of Economic Analysis' web site as a proxy for the price of labor. We utilized the average valuation per unit on new, single unit home construction (per county) as a proxy for the price of capital (collected from the California Department of Finance homepage). After eliminating observations due to missing or mis-measured data, we were left with a sample of 355 observations.[14]

Consistent with our models, we divided patients into one of three groups. Medicare and MediCal (California's Medicaid program) patients, both of whom reimburse on a fixed fee for service (and/or capitation basis), comprise our "government" patient group. Similarly, all other (paying) patients besides those on Medicare and MediCal comprise our non-government, or "privately-insured" group. Because our model distinguishes charity care (or non-paying) patients from those in the government and privately-insured groups, we place all non-paying patients in a third group. These patients, while not used in our empirical analysis, may be thought of as encompassing (a portion of) the non-marketed non-pecuniary good viewed as valuable to the organization. In any case, it is important to exclude these patients from our non-government patient group, since including them may artificially reduce the net non-government price, thereby biasing the regression estimates [Zwanziger et al 2000].

The net price for government patients was calculated as total collections for those patients, divided by the number of patient encounters. The net price for non-government patients was calculated analogously.

Table 1 contains the names and definitions of the variables used in the study and the mean and standard deviation for each of these variables. On average, the clinics have approximately 50 percent more non-government encounters, although they have more than twice as many (on average) non-government patients. This provides some initial insights about whether the firms in our sample are quality discriminating. Since it is based on these two values, the base measure of service intensity for government patients is much higher than for non-government patients, indicating that the former group receives higher quality. The Wilcoxon Signed Rank Test (a non-parametric equivalent to the matched t-test) indicates that these average values are significantly different at better than a 95% level of confidence.[15] It remains to be seen from the coming regression analyses whether this difference remains significant when controlling for other exogenous determinants of price and quality.

An interesting difference is in the net price variables. The average net government price exceeds the average net non-government price by almost 23 percent. It is often thought that government prices are lower than non-government prices. However, these community and free clinics charge private pay patients according to a sliding scale of ability to pay. An initial reaction is that this may cause some difficulty in empirically assessing quality discrimination. If net private price were the only dependent variable in our model it potentially would. However, two factors mitigate this hazard; our test depends on quality measures as well as price measures, and the clinics set the sliding scale, so can still cost adjust. Thus, the sliding scale of private pay patients should not be a problem, particularly as we control for poverty levels in each clinic's service area. In that respect, although the average wage in the counties being served exceeds $35,000 and the average house price exceeds $200,000, on average the clinics serve low income populations. Over 60 percent of the patients, on average, have incomes below 100% of the poverty level, while less than 13 percent enjoy incomes greater than 200% of the poverty level. Patients are predominantly Hispanic (46%), while 8 percent are black and 4 percent are Asian. Clinics average

TABLE 1
Variable Names, Definitions, Means and Standard Deviations

Variable	Definition	Mean	Std.Dev.
Output Variables			
NGOVENC	Non-government, non-charity care patient encounters	7922.02	10526.70
GOVENC	Government (Medicare and MediCal) patient encounters	5250.83	6820.92
NONENC	Charity care patient encounters	752.67	2348.90
NGOVPAT	Non-government, non-charity care patients	2954.99	3652.75
GOVPAT	Government (Medicare and MediCal) patients	1482.59	1926.55
NONPAT	Charity care patients	227.36	746.27
Net Price Variables			
NGPRICE	Net price collected for treating non-government, non-charity care patient encounters	63.98	49.73
GPRICE	Net price collected for treating government patient encounters	78.43	45.43
Service Intensity Variables			
SIGOV	Service intensity provided to government patients under the hypothesis of quality discrimination	0.6573	0.1958
SINGOV	Service intensity provided to non-government, non-charity care patients under the hypothesis of quality discrimination	0.5860	0.1905
SIBOTH	Service intensity provided to government and non-government patients under the hypothesis of no quality discrimination	0.6267	0.1748
QGOV	Measure of government quality - equal to the z-score of SIGOV	0.0000	1.00
QNGOV	Measure of non-government quality - equal to the z-score of SINGOV	0.0000	1.00
QBOTH	Measure of quality under the hypothesis of no quality discrimination - equal to the z-score of SIBOTH	0.0000	1.00
Input Price and Market Characteristics			
PCAPITAL	Average price of capital in each county	203900.00	59245.70
WAGE	Average wage in each county	35243.90	10162.90
PHERF	Herfindahl index of market power	0.1499	0.1836
PBLACK	Proportion of a clinic's patients that are African-American	0.0832	0.1403
PHISP	Proportion of a clinic's patients that are Hispanic	0.4647	0.3184
PASIAN	Proportion of a clinic's patients that are Asian	0.0412	0.1121
PELDER	Proportion of a clinic's patients that are 65 or older	0.0574	0.1217
PLOWPOV	Proportion of a clinic's patients whose income is below 100% of the poverty level	0.6081	0.2753
PUPPOV	Proportion of a clinic's patients whose income is above 200% of the poverty level	0.1279	0.1740
PFMALE	Proportion of a clinic's patients who are female	0.6654	0.1927
Firm-Specific Dummy Variables			
LICTYPE	Dummy variable that gives a value of 1 if a clinic is a free primary care clinic	0.0197	0.1392
HOMEDV	Dummy variable that gives a value of 1 if a clinic provides services to the homeless	0.1183	0.3234
LEGALDV	Dummy variable that gives a value of 1 if a clinic provides legal services	0.0282	0.1657
COMMEDDV	Dummy variable that gives a value of 1 if a clinic provides community education services	0.4761	0.5001
BILING	Dummy variable that gives a value of 1 if a clinic provides bilingual services	0.9239	0.2655
IMMUNDV	Dummy variable that gives a value of 1 if a clinic provides immunization services	0.6056	0.4894
	Number of Observations	355	

little market power (*PHERF* averages 0.15). The elderly comprise, on average, just under 6 percent of the patient base, while over 66 percent of patients are female. Most clinics provide immunization and bilingual services, about half do some community education, but less than 12 percent provide services to the homeless.

ECONOMETRIC METHODOLOGY AND RESULTS

We estimate a reduced form system of equations consistent with our theoretical models and testable hypotheses. Our first test operates under the null hypothesis that firms, on average, practice quality discrimination. As such, we create separate service intensity measures and specify the following regression equations to test that hypothesis:

(12) $$NGPRICE_i = \alpha_0 + \alpha_1 GPRICE_i + \sum_{j=2}^{17} \alpha_j X_i^j + \varepsilon_i$$

(13) $$QGOV_i = \beta_0 + \beta_1 GPRICE_i + \sum_{j=2}^{17} \beta_j X_i^j + \upsilon_i$$

(14) $$QNGOV_i = \gamma_0 + \gamma_1 GPRICE_i + \sum_{j=2}^{17} \gamma_j X_i^j + \omega_i ,$$

where i indexes each observation, *NGPRICE* is the average net non-government price, *QGOV* is our government quality proxy, *QNGOV* is our non-government quality proxy, *GPRICE* is the average net government price per encounter, the X^js are exogenous control variables, the αs, *β*s and *γ*s are parameters to be estimated, while the εs, νs and ωs are stochastic error terms with the usual assumptions. Statistically significant estimates different from zero for α_1, β_1 and/or γ_1 would cause us to reject this null hypothesis, while estimates not significantly different from zero for all three of these coefficients would lead us to fail to reject this null hypothesis.

If we reject the first hypothesis, we can go further by examining the direct consequence of not quality discriminating with regard to cost adjusting. To do so, we create a new proxy for quality that is inclusive of both government and non-government patients (which we define as *QBOTH*). We then estimate another reduced form equation of the following form:

(15) $$QBOTH_i = \theta_0 + \theta_1 GPRICE_i + \sum_{j=2}^{17} \theta_j X_i^j + \tau_i ,$$

where the *θ*s are parameters, the *τ*s are stochastic error terms, and the remaining terms are defined analogously to (12) – (14). If θ_1 is positive and significant, then firms, on average, are cost adjusting. If this coefficient estimate is insignificant from zero, it indicates that firms are not cost adjusting, even if they do discriminate across patient groups on quality.

Table 2 presents our regression results. The first three columns in this table can be used to test our first hypothesis. Clearly, all three coefficient estimates for the government price variable are positive and statistically significant at 95% or better. Thus, we reject the null hypothesis of quality discrimination. Additionally, the positive and significant estimate for *GPRICE* in the non-government price equation also indicates that these firms are not cost shifting.[16]

TABLE 2
Cost Shifting and Cost Adjusting Regression Results

Dependent Variable:	**NGPRICE**		**QGOV**		**QNGOV**		**QBOTH**	
Variable	**Coeff.**	**T-ratio**	**Coeff.**	**T-ratio**	**Coeff.**	**T-ratio**	**Coeff.**	**T-ratio**
Constant	-10.8444	-0.54	0.0798	0.19	0.7081	1.66*	0.6279	1.50
Net Price Variable								
GPRICE	0.2300	4.14 **	0.0032	2.73**	0.0028	2.42**	0.0030	2.57 **
Input Price and Market Characteristics								
PCAPITAL	0.0001	2.48 **	-0.000001	-0.97	-0.000001	-1.11	-0.000002	-1.48
WAGE	-0.0006	-1.88 *	0.00001	1.96**	0.000007	1.02	0.000009	1.28
PHERF	-18.7067	-1.28	0.4223	1.37	0.4431	1.44	0.4016	1.33
PBLACK	-21.2510	-1.09	0.1738	0.42	0.8277	2.02**	0.9415	2.33 **
PHISP	-11.3880	-1.24	-0.4168	-2.16**	-0.4354	-2.25**	-0.3116	-1.64
PASIAN	31.1626	1.35	-0.4118	-0.84	-1.1461	-2.35**	-0.0433	-0.09
PELDER	26.7663	1.22	-1.4430	-3.12**	-1.1521	-2.50**	-1.2519	-2.76 **
PLOWPOV	4.2221	0.36	-0.1316	-0.52	-0.2025	-0.81	-0.0865	-0.35
PUPPOV	14.9161	0.81	-0.6887	-1.77*	-0.7451	-1.92*	-0.7295	-1.91 *
PFMALE	102.1900	7.37 **	-1.0762	-3.67**	-1.4313	-4.89**	-1.5824	-5.51 **
Firm-Specific Dummy Variables								
LICTYPE	-4.4814	-0.26	-0.2848	-0.78	-0.1908	-0.53	-0.3321	-0.93
HOMEDV	-1.3507	-0.16	-0.3441	-1.98**	-0.1979	-1.14	-0.2562	-1.51
LEGALDV	6.0613	0.37	1.0666	3.07**	0.9544	2.76**	1.1035	3.24 **
COMMEDDV	-10.6521	-2.08 **	0.1908	1.76*	0.1317	1.22	0.0812	0.76
BILING	-7.7704	-0.78	0.2784	1.33	0.4270	2.04**	0.3748	1.83 *
IMMUNDV	-6.1666	-1.16	0.3182	2.83**	-0.0185	-0.16	0.1492	1.35
R-Square		0.2624		0.1860		0.1884		0.2116
Adjusted R-Square		0.2252		0.1450		0.1474		0.1770
F[17, 337] Statistic		7.05 **		4.53**		4.60**		5.48 **

* indicates significance at the 10% level
** indicates significance at the 5% level

Having found evidence that these primary care clinics are not practicing quality discrimination, we can go further to test whether and how these firms may be practicing cost adjusting. The final column in Table 2 presents these results. Of primary interest is the sign and significance of the coefficient estimate for the government price variable. It is clearly positive and significant at better than a 95% level of confidence, indicating cost adjusting behavior.[17] Not surprisingly, the impact of price changes on quality is about the average of the individual impacts estimated under the possibility that quality discrimination is practiced. It is comforting, and further evidence of non-quality discrimination, that the coefficient on the combined data is not significantly different from either of the estimates that come out of the regressions when government and non-government patients are separated.

While not central to our analysis, the other control variables offer a few interesting insights into the behavior of community clinics in California. Clinics with a larger proportion of female patients set higher prices and offer lower service intensity than do clinics with smaller proportions of female patients, holding the other regressors constant. Service intensity is also lower in clinics with a higher proportion of its population exceeding 200 percent of the poverty line, and with larger proportion of the population being elderly. These findings are somewhat counterintuitive for several reasons. If females use the clinics for prenatal care, we would expect more frequent visits (service intensity). This could be countered by females coming to the clinics for birth control services (which may explain the lower service intensity). That elderly have lower service intensity is also difficult to explain, since they are more likely to be covered by a government plan (in this case Medicare), and are more likely to have chronic illnesses requiring periodic checking. One possible explanation is that they are more likely than others to come for services like flu-immunizations (once a year).[18]

Service intensity for non-government patients is higher when the clinic has a larger proportion of black patients and lower when the proportion of Asian patients increases. Clinics with higher proportions of Hispanic patients give lower service intensity no matter what insurance coverage. This last finding may be a result of language differences that may impede communication between the patients and providers. The statistically significant positive coefficient on bilingual services in the non-government and total quality equations supports this conjecture. Finally, the result that clinics that provide legal services have higher levels of quality might say something about the clinic management. A willingness to extend beyond medical care may be an indicator of greater sensitivity to the needs of the community, which extends to the quality of care offered to patients.

CONCLUSIONS AND IMPLICATIONS

Using what is essentially a nested model, we use service intensity to test for quality differences among Community Clinics in California. Our empirical analysis reveals no evidence of quality discrimination within this group of providers. To the extent that an ethic calls for equal quality in health care regardless of the ability to pay, this finding is comforting. From an economic perspective, however, it is not necessarily efficient. Implicit in our model is an additional constraint on behavior (that quality be equal across patients), which by its nature lowers the achievable optimum.

One disturbing finding in our study is that there is strong evidence that these clinics practice cost adjusting. When payments by government agencies for care decreases, so does the quality or service intensity offered patients. Moreover, the cost adjusting extends not just to patients supported by government programs like Medicare and Medicaid, but to private pay patients as well. Although it may be a result of not discriminating on quality grounds, private pay patients should be concerned. Policies designed to control the cost of government programs and instill efficiency among providers may have adverse impacts on all patients. Thus, private pay patients who think lowering government payments for health care would have no effect on them may, in fact, be mistaken. What is taken away from government-supported patients is also taken away from them.

Our findings also present some recommendations for future research. One limitation of our empirical analysis is that it utilizes only a single, service intensity-based measure of quality. While using service intensity as a proxy for quality has its precedent in the literature, it would be beneficial for future research to determine whether these results are robust to alternative and/or multiple measures of quality; most notably the process, structural and outcome-based quality measures proposed by Donabedian (1980; 1988). Since health care quality is a multi-faceted variable, it may be the case that firms are actually quality discriminating in the provision of certain aspects of quality, but not others. Further research that identifies whether or not such *partial quality discrimination* is occurring would provide a valuable contribution to our knowledge of this phenomenon.

Another suggestion for research is to determine whether or not our findings are robust to the choice of health care provider. It remains to be seen whether other types of providers, such as hospitals and nursing homes, practice quality discrimination. Hospitals, in particular, provide such a wide variety of medical services (and treat a variety of different illness severities for each medical condition) that quality discrimination becomes a much more viable possibility. For a policy perspective, then, an extension of our work that studies these types of providers is of paramount concern.

APPENDIX A

Deriving the Cost Adjusting/Cost Shifting Rules

We assume that the provider's objective function takes the following form

$$\text{(A1)} \quad \max_{q_1,q_2,p_1,N} U\{q_1X_1, q_2X_2, N, G[\bullet], \Pi\}, \text{ where } \Pi = p_1X_1 + p_2X_2 + G[\bullet] - C[\bullet] - T$$

where the variables are as defined in the paper.

Quality discrimination occurs when q_1 differs from q_2. With or without quality discrimination, the provider's choice of private price and private quality influences the private demand for its services. However, the only way the provider is able to influence government demand is to adjust the level of quality offered those patients.

Differentiate the model by the *a priori* choice to quality discriminate (so $q_1 \neq q_2$). To simplify the optimization process, we substitute the expression for P into the utility function and define the result as the function $L(\cdot)$. Taking partial derivatives, the first order necessary conditions can be expressed as

$$\text{(A2)} \quad \begin{aligned} \frac{\partial L}{\partial p_1} = {} & \frac{\partial U}{\partial q_1 X_1}\left[q_1 \frac{\partial X_1}{\partial p_1}\right] + \frac{\partial U}{\partial \Pi}\left[X_1 + p_1 \frac{\partial X_1}{\partial p_1} + \frac{\partial G}{\partial q_1 X_1} q_1 \frac{\partial X_1}{\partial p_1} - \frac{\partial C}{\partial q_1 X_1} q_1 \frac{\partial X_1}{\partial p_1}\right] \\ & + \frac{\partial U}{\partial G}\frac{\partial G}{\partial q_1 X}\left[q_1 \frac{\partial X_1}{\partial p_1}\right] = 0 \end{aligned}$$

Appendix A — Continued

(A3)
$$\begin{aligned}\frac{\partial L}{\partial q_1} &= \frac{\partial U}{\partial q_1 X_1}\left[X_1 + q_1\frac{\partial X_1}{\partial q_1}\right] + \\ &\frac{\partial U}{\partial \Pi}\left[p_1\frac{\partial X_1}{\partial q_1} + \frac{\partial G}{\partial q_1 X_1}\left(X_1 + q_1\frac{\partial X_1}{\partial q_1}\right) - \frac{\partial C}{\partial q_1 X_1}\left(X_1 + q_1\frac{\partial X_1}{\partial q_1}\right)\right] + \\ &\frac{\partial U}{\partial G}\frac{\partial G}{\partial q_1 X_1}\left[X_1 + q_1\frac{\partial X_1}{\partial q_1}\right] = 0\end{aligned}$$

(A4)
$$\begin{aligned}\frac{\partial L}{\partial q_2} &= \frac{\partial U}{\partial q_2 X_2}\left[X_2 + q_2\frac{\partial X_2}{\partial q_2}\right] + \\ &\frac{\partial U}{\partial \Pi}\left[p_2\frac{\partial X_2}{\partial q_2} + \frac{\partial G}{\partial q_2 X_2}\left(X_2 + q_2\frac{\partial X_2}{\partial q_2}\right) - \frac{\partial C}{\partial q_2 X_2}\left(X_2 + q_2\frac{\partial X_2}{\partial q_2}\right)\right] + \\ &\frac{\partial U}{\partial G}\frac{\partial G}{\partial q_2 X_2}\left[X_2 + q_2\frac{\partial X_2}{\partial q_2}\right] = 0\end{aligned}$$

(A5)
$$\frac{\partial L}{\partial N} = \frac{\partial U}{\partial N} + \frac{\partial U}{\partial \Pi}\left[\frac{\partial G}{\partial N} - \frac{\partial C}{\partial N}\right] + \frac{\partial U}{\partial G}\frac{\partial G}{\partial N} = 0$$

We assume

$$\begin{array}{lll}
X_{1P_1} = \dfrac{\partial X_1[\bullet]}{\partial P_1} \le 0; & X_{1q_1} = \dfrac{\partial X_1[\bullet]}{\partial q_1} \ge 0; & X_{2q_2} = \dfrac{\partial X_2[\bullet]}{\partial q_2} \ge 0; \\
X_{1P_1P_1} = \dfrac{\partial^2 X_1[\bullet]}{\partial (P_1)^2} \le 0; & X_{1q_1q_1} = \dfrac{\partial^2 X_1[\bullet]}{\partial (q_1)^2} \le 0; & X_{2q_2q_2} = \dfrac{\partial^2 X_2[\bullet]}{\partial (q_2)^2} \le 0; \\
X_{1P_1q_1} = \dfrac{\partial^2 X_1[\bullet]}{\partial P_1 \partial q_1} \gtrless 0; & C_1 = \dfrac{\partial C[\bullet]}{\partial (q_1 X_1)} \ge 0; & C_2 = \dfrac{\partial C[\bullet]}{\partial (q_2 X_2)} \ge 0; \\
C_3 = \dfrac{\partial C[\bullet]}{\partial N} \ge 0; & U_1 = \dfrac{\partial U[\bullet]}{\partial (q_1 X_1)} \ge 0; & U_2 = \dfrac{\partial U[\bullet]}{\partial (q_2 X_2)} \ge 0; \\
U_3 = \dfrac{\partial U[\bullet]}{\partial N} \ge 0; & U_4 = \dfrac{\partial U[\bullet]}{\partial G} \ge 0; & U_5 = \dfrac{\partial U[\bullet]}{\partial \Pi} \ge 0; \\
G_1 = \dfrac{\partial G[\bullet]}{\partial (q_1 X_1)} \ge 0; & G_2 = \dfrac{\partial G[\bullet]}{\partial (q_2 X_2)} \ge 0; & G_3 = \dfrac{\partial G[\bullet]}{\partial N} \ge 0.
\end{array}$$

The signs of the partial derivatives apply standard economic assumptions. For example, costs and utility are increasing in service intensity-adjusted output. Any economies of

Appendix A — Continued

of scale and scope are implicitly included in C_1 and C_2. Similarly, complementarity and/or substitutability in utility across different service intensity-adjusted outputs are contained in U_1 and U_2. The sign of G_3 is based on the assumption that N is defined as community enhancing activities that are not distributed through a market, such as charity care.

A change of variables facilitates deriving our testable hypotheses. Define $V = G[\cdot] - C[\cdot]$. Then it follows that $\frac{\partial V}{\partial N} = \frac{\partial G}{\partial N} - \frac{\partial C}{\partial N}$, and similarly for the remaining choice variables. Solve (A5) for $\frac{\partial U}{\partial \Pi}$, and use the result in (A2), (A3) and (A4), respectively. Assuming that $\frac{\partial U}{\partial V} \neq 0$ (which means that grants increase prestige – ie, have value in their own right and are not just used to increase the budget – yields

(A6) $$-2\frac{\partial U}{\partial V}\left(X_1 + p_1 X_{1p_1}\right) = 0 \qquad \Rightarrow \qquad X_1 + p_1 X_{1p_1} = 0$$

(A7) $$-2\frac{\partial U}{\partial V} p_1 X_{1q_1} = 0 \qquad \Rightarrow \qquad p_1 X_{1q_1} = 0$$

(A8) $$-2\frac{\partial U}{\partial V} p_2 X_{2q_2} = 0 \qquad \Rightarrow \qquad p_2 X_{2q_2} = 0$$

Totally differentiate (A6) – (A8) to create comparative statics that describe the firm's cost shifting and cost adjusting incentives.

When the provider does not quality discriminate the objective function is identical to the previous model except that now the firm provides only one quality level to all patient groups so $q_1 = q_2 = q$. We retain the same assumptions concerning the signs of demand partials (particularly with respect to private price, as well as the second order partials), marginal costs and marginal utilities. In addition, for each demand function, higher quality still increases the quantity demanded. The problem now is

(A9) $$\max_{q,p_1,N} U\{qX_1, qX_2, N, G[\bullet], \Pi\} \qquad \text{where} \quad \Pi = p_1 X_1 + p_2 X_2 + G[\bullet] - C[\bullet] - T$$

Since reimbursement differs across patient groups, the firm is still operating off of two distinct demand curves. Substituting the expression for P into the utility function and re-defining this new function as L, the first order necessary conditions can be expressed as

(A10) $$\frac{\partial L}{\partial p_1} = \frac{\partial U}{\partial qX_1}\left[q\frac{\partial X_1}{\partial p_1}\right] + \frac{\partial U}{\partial \Pi}\left[X_1 + p_1\frac{\partial X_1}{\partial p_1} + \frac{\partial G}{\partial qX_1} q \frac{\partial X_1}{\partial p_1} - \frac{\partial C}{\partial qX_1} q \frac{\partial X_1}{\partial p_1}\right] + \frac{\partial U}{\partial G}\frac{\partial G}{\partial qX}\left[q\frac{\partial X_1}{\partial p_1}\right] = 0$$

Appendix A — Continued

(A11)
$$\begin{aligned}\frac{\partial L}{\partial q} = {} & \frac{\partial U}{\partial qX_1}\left[X_1 + q\frac{\partial X_1}{\partial q}\right] + \frac{\partial U}{\partial \Pi}\left[p_1\frac{\partial X_1}{\partial q} + \frac{\partial G}{\partial qX_1}\left(X_1 + q\frac{\partial X_1}{\partial q}\right) - \frac{\partial C}{\partial qX_1}\left(X_1 + q\frac{\partial X_1}{\partial q}\right)\right] \\ & + \frac{\partial U}{\partial G}\frac{\partial G}{\partial qX_1}\left[X_1 + q\frac{\partial X_1}{\partial q_1}\right] + \frac{\partial U}{\partial qX_2}\left[X_2 + q\frac{\partial X_2}{\partial q}\right] \\ & + \frac{\partial U}{\partial \Pi}\left[p_2\frac{\partial X_2}{\partial q} + \frac{\partial G}{\partial qX_2}\left(X_2 + q\frac{\partial X_2}{\partial q}\right) - \frac{\partial C}{\partial qX_2}\left(X_2 + q\frac{\partial X_2}{\partial q}\right)\right] \\ & + \frac{\partial U}{\partial G}\frac{\partial G}{\partial qX_2}\left[X_2 + q\frac{\partial X_2}{\partial q}\right] = 0\end{aligned}$$

(A12)
$$\frac{\partial L}{\partial N} = \frac{\partial U}{\partial N} + \frac{\partial U}{\partial \Pi}\left[\frac{\partial G}{\partial N} - \frac{\partial C}{\partial N}\right] + \frac{\partial U}{\partial G}\frac{\partial G}{\partial N} = 0$$

As before, we define $V = G[\cdot] - C[\cdot]$, so that $\frac{\partial V}{\partial N} = \frac{\partial G}{\partial N} - \frac{\partial C}{\partial N}$, and similarly for the remaining choice variables. Now solve (A12) for $\frac{\partial U}{\partial \Pi}$, and use the result in (A10) and (A11), respectively. Simplify these expressions (again, assuming that $\frac{\partial U}{\partial V} \neq 0$) to find

(A13)
$$-2\frac{\partial U}{\partial V}\left(X_1 + p_1 X_{1p_1}\right) = 0 \quad \Rightarrow \quad X_1 + p_1 X_{1p_1} = 0$$

(A14)
$$-2\frac{\partial U}{\partial V}\left(p_1 X_{1q} + p_2 X_{2q}\right) = 0 \quad \Rightarrow \quad p_1 X_{1q} + p_2 X_{2q} = 0$$

The key difference between the two models is given by a comparison of (A14) to (A7) and (A8). Instead of maximizing revenue separately (under quality discrimination), the firm now maximizes revenue *jointly*. As a result, it is not necessarily the case that each partial of demand is zero. Instead, the firm may go beyond revenue maximizing levels for one group (so that one of the partials is actually negative) in order to maximize revenue for both groups.

Totally differentiate (A13) and (A14) to create comparative statics that describe the firm's cost shifting and cost adjusting incentives

(A15)
$$\frac{dp_1}{dp_2} = \frac{X_{2q}\left(X_{1q} + p_1 X_{1qp_1}\right)}{\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)\left(p_1 X_{1qq} + p_2 X_{2qq}\right) - \left(X_{1q} + p_1 X_{1qp_1}\right)^2} \gtrless 0$$

Appendix A — Continued

(A16) $$\frac{dq}{dp_2} = \frac{-X_{2q}\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)}{\left(2X_{1p_1} + p_1X_{1p_1p_1}\right)\left(p_1X_{1qq} + p_2X_{2qq}\right) - \left(X_{1q} + p_1X_{1qp_1}\right)^2} \geq 0$$

APPENDIX B

Deriving the Comparative Statics in the Quality Discrimination Model

We begin by totally differentiating (A6) – (A8) and placing the results in matrix form

(B1) $$\begin{bmatrix} 2X_{1p_1} + p_1X_{1p_1p_1} & X_{1q_1} + p_1X_{1p_1q_1} & 0 \\ p_1X_{1p_1q_1} & X_{1q_1} + p_1X_{1q_1q_1} & 0 \\ 0 & 0 & p_2X_{2q_2q_2} \end{bmatrix} \begin{bmatrix} dp_1 \\ dq_1 \\ dq_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -X_{2q_2}dp_2 \end{bmatrix}$$

Define the far left matrix as A. It follows that

(B2) $$\begin{aligned} |\mathrm{A}| = {} & \left(2X_{1p_1} + p_1X_{1p_1p_1}\right)\left(X_{1q_1} + p_1X_{1q_1q_1}\right)\left(p_2X_{2q_2q_2}\right) - \\ & \left(p_1X_{1q_1p_1}\right)\left(X_{1q_1} + p_1X_{1q_1p_1}\right)\left(p_2X_{2q_2q_2}\right) \end{aligned}$$

which must be negative (since A is a 3x3 matrix) in order to guarantee that the function is maximized. Note that, given (A7) and (A8), and assuming that both prices are positive, this value simplifies to

(B2a) $$\begin{aligned} |\mathrm{A}| = {} & \left(2X_{1p_1} + p_1X_{1p_1p_1}\right)\left(p_1X_{1q_1q_1}\right)\left(p_2X_{2q_2q_2}\right) - \\ & \theta\left(p_1X_{1q_1p_1}\right)\left(p_1X_{1q_1p_1}\right)\left(p_2X_{2q_2q_2}\right) \\ = {} & \left(p_2X_{2q_2q_2}\right)\left[p_1X_{1q_1q_1}\left(2X_{1p_1} + p_1X_{1p_1p_1}\right) - \left(p_1X_{1q_1p_1}\right)^2\right] \end{aligned}$$

Equation (B2a) implies that in order for the function to be maximized, the following condition must hold

(B3) $$\left(p_1X_{1q_1p_1}\right)^2 < p_1X_{1q_1q_1}\left(2X_{1p_1} + p_1X_{1p_1p_1}\right)$$

Appendix B — Continued

Applying Cramer's rule, we find

(B4) $$dp_1 = \frac{1}{|A|} * |A_1| = \frac{1}{|A|} * 0 = 0$$

where $|A_1|$ is the determinant of the matrix A, except that the first column in this matrix has been replaced by $\begin{bmatrix} 0 \\ 0 \\ -X_{2q_2} dp_2 \end{bmatrix}$. As a result $\frac{dp_1}{dp_2} = 0$. Similarly,

(B5) $$dq_1 = \frac{1}{|A|} * |A_2| = \frac{1}{|A|} * 0 = 0$$

where $|A_2|$ is the determinant of the matrix A, except that the second column in this matrix has been replaced by $\begin{bmatrix} 0 \\ 0 \\ -X_{2q_2} dp_2 \end{bmatrix}$. Using similar logic, it follows that $\frac{dq_1}{dp_2} = 0$.

Lastly,

(B6) $$\begin{aligned} dq_2 &= \frac{1}{|A|} * |A_3| \\ &= \frac{1}{|A|} * \left[X_{2q_2} dp_2 \right] \\ &\quad \left[p_1 X_{1q_1p_1} X_{1q_1} + \left(p_1 X_{1q_1p_1} \right)^2 - \left(2X_{1p_1} + p_1 X_{1p_1p_1} \right) \left(X_{1q_1} + p_1 X_{1q_1q_1} \right) \right] \end{aligned}$$

where $|A_3|$ is the determinant of the matrix A, except that the third column in this matrix has been replaced by $\begin{bmatrix} 0 \\ 0 \\ -X_{2q_2} dp_2 \end{bmatrix}$. Equation (B6) can be used to identify the final comparative static

(B7) $$\begin{aligned} \frac{dq_2}{dp_2} &= \frac{1}{|A|} * \left[X_{2q_2} \right] \\ &\quad \left[p_1 X_{1q_1p_1} X_{1q_1} + \left(p_1 X_{1q_1p_1} \right)^2 - \left(2X_{1p_1} + p_1 X_{1p_1p_1} \right) \left(X_{1q_1} + p_1 X_{1q_1q_1} \right) \right] \end{aligned}$$

Appendix B — Continued

However, assuming that $p_2 > 0$, (A8) requires that $X_{2q_2} = 0$, making the expression in (B7) also equal to zero.

Deriving the Comparative Statics in the Non-Quality Discrimination Model

We begin by totally differentiating (A13) – (A14) and placing the results in matrix form

(B8) $$\begin{bmatrix} 2X_{1p_1} + p_1X_{1p_1p_1} & X_{1q} + p_1X_{1p_1q} \\ X_{1q} + p_1X_{1qp_1} & p_1X_{1qq} + p_2X_{2qq} \end{bmatrix} \begin{bmatrix} dp_1 \\ dq \end{bmatrix} = \begin{bmatrix} 0 \\ -X_{2q}dp_2 \end{bmatrix}$$

Define the far left matrix as B. It then follows that

(B9) $$|B| = \left(2X_{1p_1} + p_1X_{1p_1p_1}\right)\left(p_1X_{1qq} + p_2X_{2qq}\right) - \left(X_{1q} + p_1X_{1qp_1}\right)^2$$

which must be positive in order to guarantee that the function is maximized. Applying Cramer's rule, we find that

(B10) $$dp_1 = \frac{1}{|B|} * |B_1| = \frac{1}{|B|} * \left(X_{2q}dp_2\right)\left(X_{1q} + p_1X_{1p_1q}\right)$$

where $|B_1|$ is the determinant of the matrix B, except that the first column in this matrix has been replaced by $\begin{bmatrix} 0 \\ 0 \\ -X_{2q_2}dp_2 \end{bmatrix}$. Completing the comparative static gives

(B11) $$\frac{dp_1}{dp_2} = \frac{1}{|B|} * \left(X_{2q}\right)\left(X_{1q} + p_1X_{1p_1q}\right)$$

Similarly, we find that

(B12) $$dq = \frac{1}{|B|} * |B_2| = \frac{1}{|B|} * \left(-X_{2q}dp_2\right)\left(2X_{1p_1} + p_1X_{1p_1p_1}\right).$$

Equation (B12) can subsequently be used to identify the remaining comparative static in the model.

(B13) $$\frac{dq}{dp_2} = \frac{1}{|B|} * |B_2| = \frac{1}{|B|} * \left(-X_{2q}\right)\left(2X_{1p_1} + p_1 X_{1p_1p_1}\right)$$

NOTES

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1. Dranove and White based their theory on the arguments of Gertler (1988; 1989). Gertler's model assumes that the provider always operates at full capacity, thereby allowing the researcher to treat total output (and hence all demand elasticities) as exogenous. While this may be true of nursing homes (which Gertler studied), this is not the case for most other health care producers, including the sample of hospitals employed by Dranove and White.
2. It is assumed that the provider has significant market power over private price as well as any type of quality offered by the firm.
3. We assume that government-insured patients pay a co-pay that is negligible and/or unrelated to the value of services rendered by the provider and that privately insured patients pay a co-pay that is proportional to the charges set by the provider. Private payers may pay a discounted percentage of billed charges (or self-pay patients may pay 100% of billed charges), but that does not change the model or its conclusions. As many private insurers are adopting reimbursement policies that are similar to those of Medicare and/or Medicaid one need only re-define the government group to include these patients, and adapt the empirical analysis accordingly. For ease of exposition, we maintain the government-private nomenclature.
4. Some studies have included charity care as an excess non-marketed, non-pecuniary expenditure (for example, Friesner and Rosenman (2002) and Hassan et al (2000)). In this study, one may also define excess non-marketed non-pecuniary spending in this way. However, since neither the quantity nor the quality of charity care is distributed through a market-based mechanism, we will not distinguish between the quality and quantity of charity care services. As such, our test of quality discrimination will be based solely on those services that are distributed through a market mechanism.
5. Asymmetric information and the fact that quality is a multi-faceted, unobserved variable makes this assumption innocuous.
6. Quality, of course, is difficult to measure. In the empirical section we use service intensity as our (imperfect) measure of quality (Gertler, 1989). We assume, however, in the theoretical analysis, that quality is seen by the patient and affects demand. To ease the exposition, our theoretical analysis assumes that casemix is held constant. It is possible that providers could also discriminate on casemix. If one wishes to examine quality and case-mix simultaneously, one can apply Dor and Farley's (1996) approach to this model with little loss of generality.
7. The mathematics behind this assertion is provided in appendix A.
8. Cost shifting is an alternative to cost adjusting when the provider can raise net prices to patients over whom it exercises price control. The firm's cost shifting incentive is consequently given by equation (5). For a more detailed discussion of cost shifting, see Dranove and White (1998), Zwanziger et al (2000), Rosenman et al (2000) and Rosenman and Friesner (2002). In this paper, our primary emphasis is on the quality incentives of the provider. But since cost shifting and cost adjusting are linked (Dranove and White, 1998; Rosenman and Friesner, 2002) we provide this comparative static for the sake of completeness. A derivation of these comparative statics can be found in appendix B of this paper.
9. A derivation of these comparative statics can also be found in appendix B of this paper.
10. An interesting exception to this finding is when the firm maximizes joint revenue by setting both cross-partials equal to zero. In that case, the signs of (10) and (11) are zero. As such, the pair of

hypothesis tests we are about to present are sufficient (but not necessary) tests of quality discrimination.

11. Since quality is inherently unobservable, our service intensity measures almost certainly measure quality with error. However, since we will be utilizing these measures as dependent variables in regression analyses via OLS, this should not be of significant concern, since measurement error of the dependent variable will not affect the consistency of our regression estimates (Greene, 2000).
12. This data set was chosen primarily because it consists of a group of nonproprietary health care providers that are primarily interested in serving the needs of the public. Thus, at least a priori, these providers should be *least likely* to practice quality discrimination. If we do find evidence of quality discrimination, our findings present a very serious policy issue. Alternatively, if we do not find empirical evidence of quality discrimination, the data will allow us to go further to examine the consequences of not quality discriminating, particularly with regard to cost adjusting. An additional reason for choosing this group of clinics is that they provide a very basic set of services to the public. As a result, differences in patient illness severity across providers may not be a significant concern.
13. One issue to address is whether or not private practice physicians should be included in the Herfindahl index of competition. Community Clinics are operated by tax-exempt nonprofit corporations supported in whole or in part by donations, bequests, gifts, grants, government funds or contributions. Any charges to the patient are based on the patient's ability to pay. Free Clinics are operated by a tax exempt non-profit corporation supported in whole by voluntary donations, bequests, gifts, grants, government funds or contributions. Patients are not charged. These organizations comprise a critical element of the California safety net. They provide health care to about 2.3 million people annually. People use these clinics primarily because they lack insurance or because the clinics provide multilingual and culturally appropriate care (CHHSA, 2002). The nature of these clinics and the populations they serve separates them from the market served by private practice physicians.
14. Of the 744 clinics in the data set, 108 did not report any data for the full year and, thus, could not be included. Of the remaining 636 observations, 281 were excluded because they a) treated only one type of patient group (thus leaving no possibility of quality discrimination) or b) missing or inconsistent data rendered the observation unreliable. We compared the excluded observations to those we used for the mix of patients (government or private), prices charged, demographic characteristics and service intensities. An ANOVA indicated that the only significant differences between the two groups were in the number of government patients seen (the sample used included firms who treated slightly more MediCal patients), in non-government prices (the included sample were paid slightly more), and the percent of low poverty clients and Asians (included sample lower in both).
15. The test (which takes the difference between non-government and government service intensities) gives a test statistic equal to –9.985, which is statistically significant at better than a 99% level of confidence. We also conducted a (nonparametric) sign test for median differences between non-government and government service intensities. The test indicated that, of the 355 firms, 270 had higher government service intensity measures, 83 exhibited higher non-government service intensity measures, and 2 had identical service intensity values. These values were sufficient to reject the null hypothesis of no median difference (with a test statistic of – 9.90) at better than 99% confidence.
16. Rosenman et al (2000) used a sample of California primary care clinics from an earlier year (1995) and found evidence of cost shifting . However, they did not separate charity care patients from non-government patients. As mentioned above, this may bias the results by artificially reducing the net non-government price.
17. Friesner (2003) found a similar result using a sample of California outpatient clinics from an earlier time period (1995).
18. We would like to thank a referee for helping with these possible explanations.

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