

Discussion: "Involuntary Benchmarking and Quality Improvement: The Effect of Mandated Public Disclosure on Hospitals"

RAJIV D. BANKER*

This paper addresses an important empirical question: Does the mandated public disclosure of quality information cause predictable changes in managerial behavior? Evans et al. find that a new requirement for the disclosure of relative performance measures for Pennsylvania hospitals results in hospitals with higher quality (lower mortality rates) gaining market share. Anticipating this customer reaction, those hospitals with poorer quality levels, those facing more intense competition, and those small in size exhibit a greater improvement in their quality performance. However, the hospitals with higher mortality rates also exhibit the least improvement in productivity (as measured by length of stay).¹

The contribution of this paper is best appreciated in the context of the considerable prior research in accounting and finance that has documented a shift in managerial behavior resulting in an improvement in a performance measure when a manager's incentive compensation contract is modified to include that measure (Baker, Jensen and Murphy [1988]). Similar empirical results are reported by Banker, Lee and Potter (1996) and Banker, Lee, Potter and Srinivasan (1996) for the performance impact of incentive contracts at lower levels of an organization.

In contrast to the above, managers at the Pennsylvania hospitals examined by Evans et al. did not experience systematic or common changes in their incentive compensation contracts. Why should the mandating of external reporting of hospitals' performance change managerial behavior? This question is important considering the findings of a recent research study by Scapens et al. (1996) suggesting that external financial reporting procedures are remote from the day-to-day operations of businesses, and that business managers in the U.K. do not exhibit a preoccupation with financial accounting criteria.

A key assumption implicit in the analysis of Evans et al. is that the incentives of Pennsylvania hospital managers are linked to hospital profitability. While the authors do not present direct evidence to support this assumption, it is plausible considering the emphasis on profitability in the health care industry in recent years. To the extent that published hospital quality performance data inform and influence

*The University of Texas at Dallas

1. This result documenting opposite effects in quality and productivity performance is similar to that reported by Banker et al. (1996) in the context of internal reporting of direct labor variances.

customer choices, hospital market shares and consequently profitability are likely to be affected by such disclosure. This provides the desired conceptual link between mandated external reporting and managerial behavior. If hospital managers seek to maximize profit, they will focus more effort and resources toward improving quality if external disclosure of quality information is likely to influence customers, although such refocusing may shift resources away from other endeavors such as productivity improvements that also influence profitability.

Managers in any industry must consider such tradeoffs when faced with mandated external reporting. These tradeoffs can be formalized in terms of the following optimization model:

$$\text{Maximize } \pi = E(pY - vX - F) - k(a^2 + tab + b^2)$$

a,b

$$\text{where } a, b \geq 0$$

$$Y = \lambda + \lambda(a - a') + e_Y$$

$$X = Y - \mu b + e_X$$

Also, $p > v$, $-2 < t < 2$, and $\mu, \lambda \geq 0$, while e_Y and e_X are random variables.

Here, a and b are two dimensions of managerial effort; the first directed toward improving quality and the second directed toward improving productivity. The expected values of actual quality and productivity levels are directly proportional to these variables a and b , respectively. The parameter k translates a convex function of effort levels into the cost incurred or experienced by the manager to exert this effort, while the parameter t reflects the interaction between the two different effort dimensions. A negative value for t represents synergistic interaction between quality and productivity improvement effort, while a positive value of t reflects the contrary situation where the marginal cost of each effort dimension increases with the level of the other. The stochastic sales output variable is affected positively by the quality effort a (relative to the quality effect a' exerted by competing firms). The stochastic input variable X increases with the output level Y , and decreases with the productivity effort b . The parameters p , v , and F (all > 0) represent the sales price, variable cost and fixed cost respectively.

The mandated public disclosure of relative quality performance information is expected to make it more salient in customer choice, and consequently increase the marginal impact of the relative quality level ($a - a'$) on the output Y . In other words, we expect the value of the quality impact parameter λ to increase from $\lambda_1 \geq 0$ before the mandated disclosure to $\lambda_2 (> \lambda_1)$ after the disclosure. Our interest is in analyzing the effect that this parameter change has on the manager's optimal choice of effort levels a and b . Therefore, we consider the following two first order conditions for the manager's optimization problem:

$$\partial \pi / \partial a = p\lambda - v\lambda - 2ka - ktb = 0 \text{ and}$$

$$\partial \pi / \partial b = v\mu - 2kb - kta = 0.$$

Given the boundary constraints $a, b, \geq 0$, we have three cases with different expressions for optimal levels a^* and b^* .

Case 1: $\lambda \leq tv\mu/2(p - v)$.

Here, $a^* = 0$ and $b^* = v\mu/2k$

Case 2: $\lambda > tv\mu/2(p - v)$,

and $\lambda > 2v\mu / t(p - v)$ when $t > 0$.

Here, $a^* = \frac{2\lambda(p - v) - tv\mu}{k(4 - t^2)} > 0$.

and $b^* = \frac{2v\mu - \lambda t(p - v)}{k(4 - t^2)} > 0$.

Case 3: $\lambda > 2v\mu/t(p - v)$ when $t > 0$.

Here, $a^* = \lambda(p - v)/2k$ and $b^* = 0$.

Since the insights are similar for the boundary solutions represented by cases 1 and 3, we shall focus here only on case 2, assuming that the conditions of case 2 hold. Observe that if $t < 0$, then case 2 conditions are always satisfied because $\lambda \geq 0$. As the value of the parameter λ increases from λ_1 before the mandated disclosure to λ_2 after the mandated disclosure, the change in the optimal effort levels from a_1^* and b_1^* to a_2^* and b_2^* is as follows:

$$a_2^* - a_1^* = 2(\lambda_2 - \lambda_1)(p - v)/k(4 - t^2) > 0,$$

and

$$b_2^* - b_1^* = -t(\lambda_2 - \lambda_1)(p - v)/k(4 - t^2).$$

Thus, we expect the quality level to improve as λ increases from λ_1 to λ_2 . The change in the productivity level, however, depends on the sign of t . When the quality and productivity dimensions are synergistic and $t < 0$, productivity level will also improve. On the other hand, if focusing more effort on quality increases the marginal cost of maintaining the productivity level, then we expect the productivity level to decline.

Evans et al. do not report whether quality (lower mortality rates) and productivity (lower length of stay) improved or declined on average for their sample of hospitals after the mandated disclosure, nor do they report the proportion of hospitals for which the changes in quality or productivity were positive. However, such statistics would be of interest in evaluating the above theoretical predictions, and inferring whether quality and productivity are synergistic.

The theoretical analysis also provides insights into explaining cross-sectional differences in the extent of improvement in quality exhibited by different hospitals. The change in the quality level is proportional to the increase $(\lambda_2 - \lambda_1)$ in the value of the quality impact λ on the sales output Y . Hospital DRGs facing greater

competition are expected to present conditions when hospital market shares are more sensitive to their reported relative quality levels. Also, small hospitals that are not subject to as close a scrutiny as large hospitals are likely to find their market shares change more when relative quality information is disclosed publicly. Thus, we expect the quality level to increase more for smaller hospitals and those facing greater competition. The empirical findings reported by Evans et al. appear to be consistent with these theoretical predictions.

Evans et al. report estimation results for three types of models: (1) Models to evaluate factors explaining the change in the quality levels; (2) models to evaluate factors explaining the change in the productivity levels; and (3) models to evaluate factors explaining the change in market share.

The model to explain the change in market share is important as it helps validate a critical assumption that helps link the mandated disclosure requirement to a change in quality and productivity performance. The authors find that the quality (lower mortality rate) ranking for a hospital is positively and significantly related to the change in its market share, consistent with the required assumption. However, their estimation model that relates the change in the market share of a hospital only to its own characteristics may be misspecified. The market share for a hospital depends not only on the characteristics of the hospital that its potential customers find attractive, but also on the characteristics of other hospitals in the local region that compete for the same customers.

An empirical model that is commonly employed in research published in the marketing literature is the Multiplicative Competitive Interaction (MCI) model, also known as the "gravitational" model that relates market share to the relative attractiveness of different firms or products. This model specifies the market share (s_j) of a firm j as a ratio function of its characteristics (say x_{ij}) relative to the characteristics of all its competitors k (say x_{ik}) in the following multiplicative form:

$$S_j = \frac{\prod_i x_{ij}^{b_j}}{\sum_k \prod_i x_{ik}^{b_i}}$$

Thus, the market share of a hospital may decline even if there is no change in its characteristics but if the attractiveness of its competitors increases. Banker and Johnston (1995) extend this MCI model to evaluate factors affecting changes in the market shares and provide an equivalent estimable model that is linear in the parameters b_i . An additional aspect that is evident in their market share change model is that the explanatory variables measure the change in the characteristics x_{ik} of all hospitals. Thus, for instance, an explanatory variable should be the change in a hospital's mean charge (price) relative to the regional average rather than the level of the mean charge.

The models to evaluate factors affecting changes in quality are of the form:

$$\text{CHMTRES} = a_0 + a_1 \text{MTRES} + a_2 \text{POORMT} + \dots + a_5 \text{HERF} + \dots$$

where CHMTRES measures the 1992 mortality residual less the 1990 mortality residual, MTRES measures the 1990 mortality residual, POORMT = 1 for hospitals with mortality residual worse than the median and = 0 otherwise, and HERF is the competition index. This model can be restated in the following equivalent form:

$$\text{MTRES92} = a_0 + (a_1 + 1) \text{MTRES90} + a_2 \text{POORMT} + \dots + a_5 \text{HERF} + \dots$$

where MTRES92 and MTRES90 correspond to the mortality residuals in the years 1992 and 1990 respectively. To the extent a_1 is close to -1 , it is apparent that explanatory variables such as HERF explain the 1992 quality level rather than the change in the quality level. The authors report estimated values of $a_1 = -0.8518$ and -0.9452 for the mortality and the morbidity models, respectively. While both these values appear close to -1 , they are significantly greater than -1 ; that is, $a_1 + 1$ is significantly greater than zero for both models. The authors include the MTRES90 variable to control for the regression-to-the-mean effect and the dummy variable POORMT to test the hypothesis that the worst performing hospitals in 1990 show the most improvement. However, one wonders whether the opposite signs for the coefficients $(a_1 + 1)$ and a_2 for these two related variables result only from the collinearity between them, when in fact the true value of a_2 is zero or positive. Furthermore, if the regression-to-the-mean effect is important for the quality models, then it is likely to be important also for the productivity models. However, the 1990 productivity level for a hospital is not included as a control for the regression-to-the-mean effect in those models. Thus, there appears to be a different set of assumptions about the stochastic processes underlying the productivity change than those for the quality change.

In summary, Evans et al. make an important contribution to an area of accounting research that is at the confluence of managerial and financial accounting. Empirical research in managerial accounting has sought to investigate whether and how linking managerial incentives to specific performance measures influences managerial behavior and future performance. Empirical research in financial accounting has sought to investigate whether mandated public disclosure of specific accounting information results in a change in the valuation of the firm and in managerial choices of accounting policies. Evans et al. have investigated a particularly interesting setting where mandated public disclosure of non-financial performance measures affects managerial behavior and future performance.

REFERENCES

- Baker, G. P., M. C. Jensen and K. J. Murphy. 1988. "Compensation and Incentives: Practice vs. Theory." *Journal of Finance* 43 (July): 593-616.
- Banker, R. D., S. Devaraj, R. G. Schroeder and K. K. Sinha. 1996. "Performance Impact of Elimination of Direct Labor Variance Reporting." Mimeo.
- Banker, R. D. and H. Johnston. 1995. "Value of Computerized Reservations Systems in the Airline Industry: An Empirical Study." *Journal of Organizational Computing*.

- Banker, R. D., S. Y. Lee and G. Potter. 1996. "A Field Study of the Impact of a Performance-Based Incentive Plan." *Journal of Accounting and Economics* 21 (April): 195-226.
- Banker, R. D., S. Y. Lee, G. Potter and D. Srinivasan. 1996. "Contextual Analysis of Performance Impacts of Incentive Compensation." *Academy of Management Journal* 93 (August): 920-948.
- Scapens, R., S. Turley, J. Burns, L. Lewis and A. Southwork. 1996. *External Reporting and Management Decisions*. London: Chartered Institute of Management Accountants.

Copyright of *Journal of Accounting, Auditing & Finance* is the property of Greenwood Publishing Group Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.