Organizational form and output quality

Mati Dubrovinsky *C.D. Howe Institute, University of Winnipeg*
Ralph A. Winter *Sauder School of Business, University of British Columbia*

Abstract. This paper re-examines the relationship between a firm's organizational form, not-for-profit versus for-profit, and its output quality. The Arrow-Hansmann theory of hidden action on the part of providers predicts higher quality for not-for-profit suppliers. This prediction has a puzzling lack of support in the empirical literature. We propose a theory that resolves the empirical puzzle and generates additional testable implications. The theory starts with the traditional assumptions of hidden action and supplier altruism. It then incorporates two additional features of real-world markets: hidden information on supplier ability to provide high quality and a variation across buyers in the degree of informational asymmetry. The central prediction of the theory is that quality has a higher variance across for-profits than across not-for-profits. Preliminary evidence from the US market for hospital care is consistent with this prediction.

Résumé. *Forme organisationnelle et qualité de l'extrant*. Ce texte réexamine la relation entre la forme organisationnelle de la firme (à but lucratif versus à but non lucratif) et la qualité de son extrant. La théorie Arrow-Hansmann de l'action cachée de la part des fournisseurs prédit une qualité plus grande pour l'extrant des offreurs sans but lucratif. Cette conjecture a reçu un manque déconcertant de support dans la littérature empirique. Les auteurs proposent une théorie qui à la fois résout l'énigme et engendre des implications qu'on peut mettre à l'épreuve. La théorie part des postulats traditionnels d'action cachée et d'altruisme de l'offreur. On incorpore deux éléments supplémentaires des marchés dans le monde réel : d'une part, l'information cachée à propos de la capacité de l'offreur à fournir un extrant de haute qualité, et, d'autre part, une variation dans l'éventail des acheteurs du degré d'asymétrie informationnelle. La prédiction centrale de la théorie est que la variation de la qualité est plus grande pour les firmes à but lucratif que pour les firmes à but non lucratif. Des résultats préliminaires pour les marchés américains de soins hospitaliers supportent cette conjecture.

JEL classification: L33, I11

The views expressed in this paper are those of the authors. No responsibility for them should be attributed to the C.D. Howe Institute or any other organization. We thank Ambarish Chandra, Leemore Dafny, Robert Evans, Patrick Francois, Isaac Holloway, Jill Horwitz, Kim P. Huynh, Xavier Martinez-Giralt, Pablo Moran, Linda Peritz, Alberto Romero, Nathan Schiff, Mariano Tappata, Veikko Thiele, James Townsend, Kyle Vincent, Charles Weinberg and seminar participants at the Sauder School of Business, the University of Winnipeg, the 8th Annual IIOC and the University of Manitoba for very helpful comments and suggestions. We are also grateful to the Social Sciences and Humanities Research Council for financial support. Part of this research was completed while Dubrovinsky was at the Bank of Canada.
Corresponding author: Ralph A. Winter, ralph.winter@sauder.ubc.ca

Canadian Journal of Economics / Revue canadienne d'économique, Vol. 48, No. 1
February 2015. Printed in Canada / Février 2015. Imprimé au Canada

0008–4085 / 15 / 189–206 /

1. Introduction

The efficiencies of the corporate, for-profit, form of organization have been well understood since Alchian and Demsetz (1972). Yet in many markets, such as health care, education, legal services and charity activities, we see a considerable number of not-for-profit firms. In some of these markets we even observe not-for-profit firms operating along side for-profit firms. The existence of not-for-profit entities has long puzzled economists. Why would a firm forgo the efficiencies of the corporate form, adopting the not-for-profit form instead?

Glaeser and Shleifer (2001), in a model incorporating the insights of Arrow (1963) and Hansmann (1980), suggest that not-for-profits are a response to asymmetric information. Consumers cannot observe suppliers' quality choices. Not-for-profit organizational form provides a lower incentive than the for-profit one to shirk on quality of output, because not-for-profits are restricted in the distribution of operating surpluses.[1] This theory predicts that not-for-profits provide a higher quality of output than for-profits.[2] An extensive empirical literature has tested this prediction. More than 80 empirical studies offer mixed evidence on the relationship between organizational form and quality.[3] The failure of the evidence to support existing theory leaves us with a puzzle.

This paper reconciles existing evidence on quality and organizational form with economic theory. Our model incorporates two key assumptions common in the literature: 1) informational asymmetry in the form of hidden action in quality decisions[4] and 2) supplier altruism. The theory adds to these assumptions a recognition of two additional features of markets where not-for-profits are active: 3) *hidden information* on supplier ability to set higher quality and 4) a *variation* across consumers in the extent of informational asymmetry (in both the hidden action and hidden information dimensions). Some consumers are perfectly informed and can enforce contracts on quality; other consumers are not informed and cannot enforce contracts on quality.[5]

1 Section 501(c)(3) of the US *Internal Revenue Code* prohibits outside parties from sharing in operating surpluses of not-for-profits.
2 Other strands of literature come to the same conclusion. For example, Francois and Vlassopoulos (2008) show that altruistically motivated employees put more effort into their jobs when the entrepreneur has a lower incentive to reduce other inputs, and save costs. This occurs under the not-for-profit form, again due to the restriction on distribution of operating surpluses. Francois (2007), while focused on a different issue, offers a model that also yields the implication of a higher quality at not-for-profits, as a consequence of heterogeneity in the degree of altruism among employees choosing their place of work between not-for-profits and for-profits. Easley and O'Hara (1983), in contrast, approach the imperfect contracting on quality problem from a central planner perspective and offer a truthful revelation mechanism, which mitigates moral hazard of managers under the not-for-profit form, but not under the for-profit form.
3 See Rosenau and Linder (2003) and Schlesinger and Gray (2006). Dubrovinsky (2009) offers additional evidence on cases where for-profit firms dominate not-for-profit ones in quality of output.
4 See Glaeser and Shleifer (2001), Arrow (1963), Hansmann (1980) and Hirth (1999).
5 Since the classic article by Salop and Stiglitz (1977), it has been standard to represent a variation in consumer information in a market in this way.

A theory incorporating all four features might seem overly complex. In fact, our model yields a clear explanation of the inconsistency between existing evidence and theories, as well as a set of additional implications. Our central prediction is that the *average* quality may be higher or lower for for-profits than for not-for-profits, but the *variance* of quality is higher across for-profits. The implication of our basic model is in fact stronger than this. The range of qualities offered in equilibrium is partitioned into three sets. For-profit firms supply the lowest and the highest sets, and the not-for-profits supply the middle set of qualities. In terms of bringing the theory to data, however, the prediction on the relative variance in quality across organizational forms is more robust to simple extensions of the basic model than the stronger implication.

The highest ability entrepreneurs in the market self-select into for-profit contracts, which they write with informed consumers, because this match generates the highest total surplus from a transaction. Remaining firms must serve uninformed consumers in contracts that cannot specify quality. Entrepreneurs adopting the not-for-profit organizational form in serving these uninformed consumers have a greater commitment to quality because a constraint on the distribution of profits leaves them with a lower incentive to cut costs by reducing quality, as in Glaeser and Shleifer (2001). The payoff to entrepreneurs adopting the not-for-profit forms comes from altruistic enjoyment of the high consumer surplus that they provide.[6] This payoff is higher for more able suppliers, with the result that middle ability entrepreneurs (that is, the highest ability entrepreneurs among those supplying to uninformed consumers) select into the not-for-profit organizational form. The lowest ability providers, which generate the lowest consumer surplus, pool into a common for-profit contract, under which they benefit from the freedom to distribute profits.

In short, our model resolves the puzzling lack of support of the dominant existing theory of organizational forms in markets with unobservable quality, and yields a prediction about the positions in the distribution of quality of not-for-profit and for-profit organizational forms. In contrast to the literature's prediction about relative *first* moments of this distribution, our prediction is about the relative *second* moments. A second implication of our model is excess demand (higher degree of rationing) for not-for-profit providers. Uninformed consumers would prefer to buy from the (middle-quality) not-for-profit suppliers given the commitment to quality and low fees by these suppliers, but are rationed. This article offers some preliminary empirical evidence supporting the first prediction of our model.

Previous literature has examined self-selection of individuals into different sectors. For example, Glaeser and Shleifer (2001) consider self-selection based on reputational concerns between not-for-profit and for-profit sectors. Prendergast (2007), Biglaiser and Ma (2007), Francois (2007) and Brekke and Nyborg (2010), on the other hand, examine self-selection between public and private sectors based on the degree of altruism. Delfgaauw and Dur (2010) treat self-selection

6 Altruism on the part of the suppliers is modelled in the spirit of Biglaiser and Ma (2007).

between public and private sectors based on public service motivation and managerial ability. Finally, Besley and Ghatak (2005) study self-selection based on preferences for the organizational mission.

The next section offers a brief summary of existing theory and empirical evidence on the patterns of organizational form and output quality. Section 3 sets up the model, derives the equilibrium and empirical implications. Section 4 offers evidence on the main testable implication of the model, and Section 5 concludes the paper.

2. Existing theories and evidence

The central prediction of existing economic theory on the relationship between organization form and quality of output is that not-for-profits provide higher quality than for-profits. The Arrow-Hansmann theory, elegantly formalized by Glaeser and Shleifer (2001), assumes that certain aspects of output quality chosen by the producer are unobservable (or non-contractable) to the consumer. The not-for-profit organizational form involves constraints on the distribution of operating surpluses, compared to the for-profit form.[7] Not-for-profit suppliers therefore have a lower incentive to raise operating surpluses by shirking on unobservable quality. Other researchers reach similar conclusions when examining employee incentives to join organizations (not-for-profit versus for-profit) and to exert effort under these organizational forms (Francois and Vlassopoulos 2008; Francois 2007).

Most researchers turn to the health care sector to test the implications of not-for-profit theories, because of the abundance of data and direct comparability of for-profit and not-for-profit providers in these markets. Following the prediction of not-for-profit theories, the vast majority of empirical studies of output quality and organizational form test the implication that (controlling for other factors) the average quality of not-for-profit providers is higher than that of for-profit providers. A typical study (see, for example, Shen 2002) regresses the mortality rate for a certain procedure at a hospital, as a measure of hospital quality, on a set of hospital characteristics including an dummy variable for hospital's organizational form: not-for-profit, for-profit or government-owned.

Rosenau and Linder (2003) offer an extensive review of studies on the relative quality of output between not-for-profit and for-profit providers. Studies based on data from the 1960s and 1970s generally fail to find any statistical difference in (average) quality between not-for-profit and for-profit providers. Studies based on data from the 1980s fall into the following three categories: 59% of these studies report that not-for-profits (on average) have higher quality than for-profits, consistent with the Arrow-Hansmann hypothesis; 12% show higher (average) for-

7 Operating surpluses at for-profits can be collected through dividends, while at not-for-profits mainly through perquisites. Perquisites are, usually, valued less than cash; see Glaeser and Shleifer (2001).

profit quality while the remaining 29% are unable to find a statistically significant difference in quality between the two organizational forms.

Schlesinger and Gray (2006) list 38 empirical studies comparing quality of health care services provided by not-for-profit and for-profit institutions (21 of which overlap with Rosenau and Linder 2003). Only 14 of these studies (36. 84%) confirm the prediction of the Arrow-Hansmann hypothesis that not-for-profits provide higher quality than for-profits. 20 studies (52. 63%) find no statistically significant difference in quality of output between not-for-profits and for-profits. Four of these studies (10. 53%) report higher for-profit quality. In short, the overall empirical evidence on the central prediction of the existing economic theory about the relationship between organizational form and quality is mixed.

3. The model

We set out the assumptions of our model and then turn to a characterization of the equilibrium.

3.1. Assumptions

Demand side

We consider a market in which buyers purchase 0 or 1 unit. A buyer paying F for a unit of output of quality q gains surplus $q - F$.

Supply side

Suppliers (entrepreneurs) each provide one unit of output. Entrepreneurs vary in their ability θ, which determines the cost of providing quality of output according to a quadratic cost function $c(q;\theta) = q^2/4\theta$. Higher abilities incur lower total cost, and lower marginal cost, of producing higher quality: $c_\theta < 0$ and $c_{q\theta} < 0$. Ability θ is uniformly distributed on $\Theta \equiv [\underline{\theta}, \bar{\theta}] \subset \mathbb{R}_+$. An entrepreneur values profit, $F - c(q;\theta)$, but also cares about the surplus provided to the purchaser of the product. Each entrepreneur places weight 1 on profits and weight $\alpha \in (0,1)$ on the buyer's surplus, $q - F$. (While θ varies across entrepreneurs, α does not.) The entrepreneur's payoff is thus:

$$u(q, F;\theta) = F - q^2/4\theta + \alpha(q - F). \tag{1}$$

Profits are given by:

$$\pi(q, F;\theta) = F - q^2/4\theta. \tag{2}$$

Entry into any sector requires that the flow of profits generated by the firm be non-negative. The entrepreneur cannot access capital that is promised a negative rate of return simply so that she can realize altruistic benefits.

The measure of buyers, N, satisfies $N \leqslant \bar{\theta} - \underline{\theta}$, which is the measure of potential suppliers.

Contracts

Sellers can offer contracts of the following types:

- "Not-for-profit contract," denoted *NP*: a contract that specifies only the fee, F, that the buyer pays. The contract includes a requirement (monitored by an implicit regulator) to set the quality such that profit is zero, i.e., that $F = c(q;\theta)$.[8] We denote a contract of this type as $[q, F; NP]$. In setting up an *NP* firm the entrepreneur is assumed to incur a cost k, in the form of forgone future career opportunities (or income). The cost k is not recoverable in the regulatory determination of F.
- "Incomplete for-profit contract," denoted *FP*: a contract that specifies only the fee F and leaves the quality q to be chosen by the entrepreneur. As usual in contract theory, we write the contract as including quality, $[q, F; FP]$, but recognize that q must satisfy an incentive compatibility constraint.
- "Complete for-profit contract," denoted $\overline{FP}$: a contract that specifies both fee F and quality q: $[q, F; \overline{FP}]$.

Information structure

Buyers are of two types. A measure I of informed buyers can observe quality and can enforce any contract on quality. A measure U of uninformed buyers cannot observe quality, but can observe both the type of contract being offered and the fee, F. We have $N = I + U$. Uninformed buyers cannot enter a complete for-profit contract $\overline{FP}$, since they cannot enforce quality, and hence are offered only *NP* or *FP* contracts. If an uninformed buyer enters an *NP* contract, she knows that the quality chosen by the supplier of the contract will solve the regulatory zero profit constraint, $F - q^2/4\theta = 0$, but does not observe the type θ and therefore cannot identify *directly* which quality will be provided. If the buyer enters an incomplete for-profit contract, *FP*, she knows that the quality q chosen will maximize (1), but since she does not observe the type θ, she does not know which q will be offered by the seller whose offer she accepts.[9]

8 The regulator is able to determine ex-post whether an *NP* firm has violated the regulatory constraint by making positive profits but cannot observe the firm's type θ. We assume that the fine in case of positive profits is high enough such that the firm's owner never violates the constraint. An alternative interpretation is that since an entrepreneur is not allowed to distribute profit under the *NP* contract, she places zero value to profit and therefore chooses the contract that maximizes buyer surplus subject to earning non-negative profit. The *NP* firm exists only to serve buyers. Note that under this interpretation our approach simply takes to the extreme the Glaeser-Shleifer assumption that profits earned by an *NP* firm have a weight less than 1 in the entrepreneur's utility function. (In Glaeser-Shleifer (2001), the weight is positive because of the not-for-profit entrepreneur's opportunity to consume perquisites. We set aside the possibility of perquisite consumption.)

9 The fully rational buyer knows, however, *which* firm types will offer *NP* contracts in equilibrium, *which* firms will offer the *FP* contract and which fee F_θ^{NP} will be offered by each type θ offering an *NP* contract. Having observed the type and fee of the contract that she enters, the buyer infers the distribution of quality from the type of contract and knowledge of the equilibrium set of firms offering each type of contract.

Timing and strategies

At the first stage of the game, the entrepreneur of each type θ offers a contract of type NP, FP or $\overline{FP}$, with a specified fee, F, and (if the contract is of type $\overline{FP}$) a specified quality level, q. Then each buyer chooses to accept an offer from a particular firm, or to accept no offers. If more than one buyer accept an offer from the same firm, an informed buyer will always get the contract (if at least one of the buyers accepting is informed). If a measure n of the same type accepts, a proportional rationing scheme applies: each buyer obtains the contract with probability $1/n$. Informed buyers can accept an offer of any of the three contract types; uninformed buyers can accept only NP or FP. The entrepreneur then chooses quality: to meet the contract if the contract type is $\overline{FP}$; to solve the zero profit constraint $F - q^2/4\theta = 0$ if the contract type is NP; or to maximize its payoff (1) if the contract type is FP. The payoff to the entrepreneur is $F - q^2/4\theta + \alpha(q - F)$ (minus k if the contract type is NP), and the payoff to a buyer is $q - F$.

Discussion of assumptions

Our model abstracts from all aspects of real world markets except those necessary for the basic logic of our propositions. We are adopting the conventional assumptions from the literature of hidden action (setting quality) and altruism.[10] Since we are adding to existing theory both hidden information (on θ) and a *variation* in the extent of the informational asymmetry across consumers, tractability of the model demands a higher level of abstraction than usual. First, in making the assumption that each supplier is a one-person firm we abstract from all incentive issues *within* the firm. (These are the focus of Francois and Vlassopoulos (2008).)

Second, in reality not-for-profit firms earn positive surplus, surplus that cannot be distributed to any residual claimants (but can be appropriated as perquisites by managers). In our static model, as in other static models of not-for-profits (Newhouse 1970; Weinberg 1980; Liu and Weinberg 2009), the non-distribution requirement is captured in an extreme assumption: not-for-profit firms are constrained to earn zero profit. An alternative interpretation is that the entrepreneur chooses to lower the fee until profits are zero because doing so provides altruistic benefit, and since profits cannot be distributed, the entrepreneur incurs no cost in terms of forgone personal wealth. This has the implication in our model that buyers can infer the ability of an entrepreneur from the firm's price, and thus know exactly the quality that is provided by a not-for-profit. This assumption captures in the simplest way the idea that buyers at a not-for-profit are more likely to "get what they pay for" because of a tighter link between costs and price.

Third, we capture variation in consumer information in the standard way by assuming consumers are either perfectly informed or not informed at all (Salop and Stiglitz 1977; Hirth 1999). In this static model reputational and word-of-mouth forces play no role. Fourth, we abstract from imperfections in information except in the quality dimension, which is our focus. For example, consumers are

10 We are considering "impure" altruism (Andreoni 1990).

assumed to observe and take into account the organizational form of the provider. Finally, we adopt abstractions common in the economic literature in general: consumers have homogeneous preferences, the market contains a single product and transaction costs are zero apart from the costs introduced explicitly.

3.2. Equilibrium

We employ the concept of Perfect Bayesian equilibrium. An equilibrium consists of seller strategies (contract offers and quality choices), buyer strategies (contract acceptance decisions) and uninformed buyers' expectations of quality conditional upon a contract offer type and fee, such that:

1. Each buyer's acceptance decision maximizes her expected surplus, given her expectations.
2. Each seller's contract offer maximizes the seller's payoff, given buyers' acceptance strategies and other sellers' contract offers.
3. The expectations of uninformed buyers are rational.

Let $\Theta_{NP}, \Theta_{FP}, \Theta_{\overline{FP}}$ and Θ_E be the sets of seller types offering *NP* contracts, *FP* contracts, $\overline{FP}$ contracts and no contract offers (*E* stands for "Empty set"), respectively. The following proposition characterizes the equilibria in this model.

Proposition 1. *For some values of the exogenous parameters α, $\underline{\theta}$, $\overline{\theta}$, I and U, a Perfect Bayesian equilibrium exists. In any such equilibrium, $\Theta_{NP}, \Theta_{FP}, \Theta_{\overline{FP}}$, and Θ_E are ordered intervals: $\Theta_{FP} = [\underline{\theta}, \hat{\theta}_1)$, $\Theta_E = [\hat{\theta}_1, \hat{\theta}_2)$, $\Theta_{NP} = [\hat{\theta}_2, \hat{\theta}_3)$, and $\Theta_{\overline{FP}} = [\hat{\theta}_3, \overline{\theta}]$ for some cutoff values $\hat{\theta}_i$, $i = 1, 2, 3$. An equilibrium involves rationing of consumers at NP contracts, with more than* 1 *buyer accepting each NP contract.*

We prove this proposition in five stages:

1. We derive the equilibrium quality choices conditional upon contract type and seller type.
2. From these quality choices, we characterize entrepreneur equilibrium payoffs by contract type and seller type.
3. We demonstrate single-crossing-type properties of the payoffs, from which it follows that the partition described in the proposition is a necessary property of any equilibrium.
4. For a given F^{FP}, the fee charged by firms offering *FP* contracts, we characterize the equilibrium values of all other endogenous parameters under the assumption that all four sets of the equilibrium partition are non-empty.
5. We demonstrate via computation the existence of an equilibrium value for F^{FP}.

Quality choices by contract type and seller type

NP firms maximize (1) with respect to q and F, subject to the constraint:

$$F - q^2/4\theta = 0. \tag{3}$$

An FP firm maximizes (1) with respect to q (taking F^{FP} as given). An $\overline{FP}$ firm offers a contract that maximizes $u(q, F; \theta)$, with respect to q and F, subject to $q - F \geqslant s^{\overline{FP}}$, where $s^{\overline{FP}}$ is the surplus obtained by an informed buyer accepting the contract. Solving these three maximization problems yields quality choices given by:

$$\begin{aligned} q_\theta^{FP} &= 2\alpha\theta \\ q_\theta^{NP} &= 2\theta \\ q_\theta^{\overline{FP}} &= 2\theta. \end{aligned} \tag{4}$$

Equilibrium payoffs by contract type and seller type

Substituting $q = q_\theta^{NP} = 2\theta$ and the zero profit constraint (3) into $u(q, F; \theta)$, given by (1), and subtracting k, yields as an equilibrium payoff to a firm θ in an NP contract, $u_\theta^{NP} = \alpha\theta - k$. Next, note that FP firms must sell only to U buyers since, given any FP contract and any seller-informed buyer pair, there is an $\overline{FP}$ contract that yields higher surplus to both parties than the FP contract. (The complete contract Pareto dominates the incomplete contract.) Selling only to U buyers, the FP firms must all offer the same fee F^{FP} since these buyers cannot distinguish among the firms. Substituting $q_\theta^{FP} = 2\alpha\theta$ into (1) yields as a payoff in the FP set $u_\theta^{FP} = u(q_\theta^{FP}, F^{FP}; \theta) = (1-\alpha)F^{FP} + \alpha^2\theta$. In the $\overline{FP}$ set of the market, which under our assumptions can serve only informed consumers, the equilibrium level of surplus $s^{\overline{FP}}$ achieved by buyers is common across the contracts (otherwise, any firm offering the highest surplus could raise its fee). Note that $s^{\overline{FP}} = q_\theta^{\overline{FP}} - F_\theta^{\overline{FP}} = 2\theta - F_\theta^{\overline{FP}}$. Solving this for $F_\theta^{\overline{FP}}$ yields $F_\theta^{\overline{FP}} = 2\theta - s^{\overline{FP}}$. Substituting this, and $q_\theta^{\overline{FP}}$ from (4) into (1), we obtain $u_\theta^{\overline{FP}} = \theta - (1-\alpha)s^{\overline{FP}}$. In sum, the equilibrium payoffs to entrepreneurs, expressed in terms of two endogenous variables F^{FP} and $s^{\overline{FP}}$, are as follows:[11]

$$\begin{aligned} u_\theta^{FP} &= (1-\alpha)F^{FP} + \alpha^2\theta \\ u_\theta^{NP} &= \alpha\theta - k \\ u_\theta^{\overline{FP}} &= \theta - (1-\alpha)s^{\overline{FP}}. \end{aligned} \tag{5}$$

Because entry into the market requires non-negative profits, profit is also relevant for the derivation of equilibrium. Substituting (4) into (2) yields as the profit attained by type θ, in each of the three sets of firms in the market, the following:

$$\begin{aligned} \pi_\theta^{FP} &= F^{FP} - \alpha^2\theta \\ \pi_\theta^{NP} &= 0 \\ \pi_\theta^{\overline{FP}} &= \theta - s^{\overline{FP}}. \end{aligned} \tag{6}$$

11 This characterization of payoffs is in terms of two endogenous variables, F^{FP} and $s^{\overline{FP}}$, rather than a solution in terms of exogenous parameters. After proving the partition property, we solve for $s^{\overline{FP}}$, leaving the equilibrium conditional only on F^{FP}.

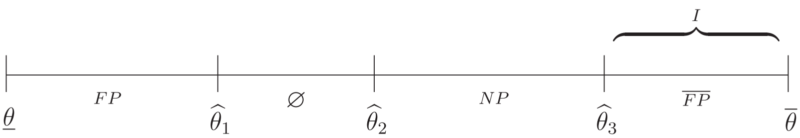

FIGURE 1 Equilibrium partition of entrepreneur-types into organizational forms

The partition property

We prove the partition property set out in the proposition by evaluating the gains to switching from one contract type to another using (5), and showing that these gains are monotonic in θ. From (5), the change in payoff to an entrepreneur of type θ from switching from an $\overline{FP}$ contract to an NP contract is $u_\theta^{NP} - u_\theta^{\overline{FP}} = (1-\alpha)(s^{\overline{FP}} - \theta) - k$ which is decreasing in θ. This implies that $\Theta_{NP} < \Theta_{\overline{FP}}$.[12] Similarly, $u^{FP} - u^{NP} = (1-\alpha)F^{FP} - \alpha(1-\alpha)\theta + k$ which is again decreasing in θ, implying that $\Theta_{FP} < \Theta_{NP}$.

The allocation of types into Θ_{FP} and Θ_E depends on the zero profit constraint, $\pi_\theta^{FP} \geqslant 0$. From (6), π_θ^{FP} is *decreasing* in θ. This implies that $\Theta_{FP} < \Theta_E$. The cutoff point $\hat{\theta}_1$ is the value of θ for which $\pi_\theta^{FP} = F^{FP} - \alpha^2\theta = 0$, which implies $\hat{\theta}_1 = F^{FP}/\alpha^2$. The allocation of types into Θ_{NP} and Θ_E depends on the entry cost k into the NP set. From (5), u_θ^{NP} is increasing in θ, hence $\Theta_E < \Theta_{NP}$. The cutoff point $\hat{\theta}_2$ is the value of minimum θ for which $u_\theta^{NP} = \alpha\theta - k$ is non-negative. That is, $\hat{\theta}_2 = k/\alpha$. Finally the allocation of types into $\Theta_{\overline{FP}}$ and Θ_{NP} via the cutoff point $\hat{\theta}_3$ depends only on the measure of informed buyers. In sum, any equilibrium must satisfy the partitioning property illustrated in figure 1, with the following cutoff points:

$$\begin{aligned} \hat{\theta}_1 &= F^{FP}/\alpha^2 \\ \hat{\theta}_2 &= k/\alpha \\ \hat{\theta}_3 &= \bar{\theta} - I. \end{aligned} \tag{7}$$

We have proven that the partition property, necessary for an equilibrium, holds. To show that such an equilibrium exists, we complete the construction of equilibrium parameters conditional upon F^{FP}, and then show that an equilibrium F^{FP} exists.

Equilibrium conditional upon F^{FP}

Given the partition property, the expression for $u_\theta^{\overline{FP}}$ in (5) is reduced further by solving for $s^{\overline{FP}}$. The surplus $s^{\overline{FP}}$ is determined by the condition that an informed buyer must be indifferent between an $\overline{FP}$ contract and her preferred contract among the NP contracts. An informed buyer, if switching to an NP contract, would avoid any rationing at the NP contract because as an informed buyer she has priority over any uninformed buyers. Hence $s^{\overline{FP}} = q_{\hat{\theta}_3}^{NP} - F_{\hat{\theta}_3}^{NP} = 2\hat{\theta}_3 - \hat{\theta}_3 = \hat{\theta}_3$.

12 We use the notation $A < B$ for sets $A, B \subset \mathbb{R}$ if every element of A is less than any element of B.

We have determined sellers' equilibrium actions (conditional upon F^{FP}): a seller offers a contract type according to the partition determined by (7), and a contract quality given by (4). To complete our determination of sellers' actions in any equilibrium, we summarize the value of F in the NP and $\overline{FP}$ sets. F^{NP} is determined by $F^{NP} = c(q_\theta^{NP}, \theta) = c(2\theta, \theta) = (2\theta)^2/4\theta = \theta$. $F^{\overline{FP}} = q_\theta^{FP} - s^{\overline{FP}} = 2\theta - \hat{\theta}_3$. In summary:

$$\begin{aligned} F_\theta^{NP} &= \theta \\ F_\theta^{\overline{FP}} &= 2\theta - \hat{\theta}_3. \end{aligned} \tag{8}$$

This completes the characterization of equilibrium contracts, quality choices and payoffs conditional upon F^{FP}. It remains to characterize the number of consumers accepting each contract offer, given F^{FP}. Only one informed consumer accepts each $\overline{FP}$ contract because if there were rationing in this set, the entrepreneur who attracted more than one consumer would have an incentive to raise her fee. Similarly, only one consumer accepts each FP contract offer: the competitive equilibrium fee in the FP set equates the number of suppliers to the number of buyers.

To characterize the number of buyers accepting each NP contract in equilibrium, we begin by characterizing the *expected* surplus of a buyer in the FP set, across the range of (unobservable) seller types in that set. This expected surplus, under rational expectations that a firm offering the contract is of type $\theta \in [\underline{\theta}, \hat{\theta}_1)$, is given by:

$$\bar{s}^{FP} = \int_{\underline{\theta}}^{\hat{\theta}_1} \left[2\alpha\theta/(\hat{\theta}_1 - \underline{\theta})\right] d\theta - F^{FP} = \alpha(\hat{\theta}_1 + \underline{\theta}) - F^{FP} = [\alpha^2\underline{\theta} + (1-\alpha)F^{FP}]/\alpha. \tag{9}$$

In equilibrium, an uninformed buyer must be indifferent between entering an FP contract and being rationed under an NP contract, otherwise buyers would switch from one set to another. This indifference condition, under our assumption of proportional rationing, implies that the number of buyers accepting an NP contract is given by:

$$n_\theta^{NP} = s_\theta^{NP}/\bar{s}^{FP} = \theta/\bar{s}^{FP} = \alpha\theta/[\alpha^2\underline{\theta} + (1-\alpha)F^{FP}]. \tag{10}$$

We have constructed an equilibrium set of endogenous variables, conditional upon F^{FP}, that satisfies the requirements of a Perfect Bayesian Nash equilibrium. No entrepreneur has the incentive to change contract types or contract parameters (the fee and quality). Uninformed consumers, who are identical, are indifferent among all contract offers that they can accept. And informed consumers have no incentive to switch, since they already achieve the highest surplus that they could by switching to the best NP contract. In other words, *if* F^{FP} is an equilibrium value, the conditions for equilibrium are satisfied for the remaining parameters. It remains to show that there exists an equilibrium value for F^{FP}.

Computation of the equilibrium

An equilibrium value for F^{FP} is one for which the total number of buyers allocated to the FP and NP contracts in our conditional equilibrium equals U, the total number of uninformed buyers in the economy.[13] Given n_θ^{NP} in (10) for $\theta \in \Theta_{NP}$, and $n_\theta^{FP} = 1$ for $\theta \in \Theta_{FP}$, this condition is:

$$(\hat{\theta}_1 - \underline{\theta}) + \int_{\hat{\theta}_2}^{\hat{\theta}_3} n_\theta^{NP} d\theta = U. \tag{11}$$

Condition (11) is similar to a standard market clearing condition, but here takes account of the rationing of buyers (required of equilibrium) at NP firms. Substituting for $\hat{\theta}_1$, $\hat{\theta}_2$ and $\hat{\theta}_3$ from (7) and n_θ^{NP} from (10), and integrating, yields the following as an equilibrium condition for F^{FP} (for $\hat{\theta}_1 > \underline{\theta}$ and $\hat{\theta}_3 > \hat{\theta}_2$):

$$\frac{F^{FP}}{\alpha^2} - \underline{\theta} + \frac{\alpha^2(\overline{\theta} - I)^2 - k^2}{2\alpha[\alpha^2\underline{\theta} + (1-\alpha)F^{FP}]} = U. \tag{12}$$

We cannot guarantee that this condition has a solution in F^{FP} for arbitrary values of the exogenous parameters: the condition is predicated upon the assumption that all four sets of the equilibrium partition are non-empty (our interest being in equilibria in which not-for-profit and for-profit firms are both present). Furthermore, as is standard in models of adverse selection (Mas-Colell et al. 1995, p. 442) multiple equilibria (i.e., multiple solutions to (12)) may exist.

Solutions to (12) are easily found for a range of parameters, in which the corresponding equilibrium values of the cut-off points yield the full partition. For example, if $(\alpha, k, \underline{\theta}, \overline{\theta}, I, U) = (0.6, 0.5, 0.1, 1, 0.1, 0.8)$, we obtain an equilibrium with $F^{FP} = 0.225$. In this equilibrium, the boundary points of the four intervals in the equilibrium partition are $(\underline{\theta}, \widehat{\theta}_1, \widehat{\theta}_2, \widehat{\theta}_3, \overline{\theta}) = (0.1, 0.625, 0.833, 0.9, 1)$. This is depicted in figure 1. Note that in the left side of the partition in figure 1, we have the standard Gresham's Law effect of adverse selection equilibria: the worst types of sellers drive out the better types in this range, so that the sellers remaining out of the market are an interior interval in the partition.

Two predictions follow from the model: The first is the characterization, via the partition, that for-profit firms are located in the tails of the distribution of quality whereas not-for-profit firms are in the middle of the distribution. The second is the existence of rationing at NP firms. The model is consistent with the *average* quality being higher or lower in the not-for-profit sector than in the for-profit sector, however. Depending in particular on the relative sizes of the FP and $\overline{FP}$ sets (among other parameters), the average quality across the entire for-profit set, $FP \cup \overline{FP}$, may be lower or higher than the average quality in the not-for-profit

13 For clarity, note that an unusual property of our equilibrium compared to most economic models is that the existence of rationing is an implication of the individual best response conditions, and therefore conceptually prior to the market-clearing type condition (which determines F^{FP} in our model).

set, *NP*. This resolves the puzzle as to the mixed results in the empirical literature comparing average quality between for-profit and not-for-profit firms.

We turn next to evidence on our main testable implication.

4. Preliminary evidence

The prediction that follows from our stylized model is stark. For-profit firms appear only in the tails of the distribution of quality across providers and not-for-profit firms appear only in the middle of the distribution. Stepping back from the stylized model, however, one must recognize that there are many factors apart from organizational form that affect quality of output. These additional factors can be represented by the addition of a random "error term" to the quality predicted in our the stylized model. With this extension, the stark prediction of a partitioning of the quality spectrum gives way to a more robust prediction: that the variance of quality is greater across for-profit firms than across not-for-profit firms. Our theory, in short, explains ambiguity in evidence on the relative size of *first* moments of the distribution of quality between the two organizational forms and offers a prediction about the relative *second* moments.

We test the prediction on data from the US hospital industry. Quality is measured as 30-day post-admission risk-adjusted (controlled for patient characteristics) mortality rates (RSMR) for heart attacks. This measure of quality is common in the literature (McClellan and Staiger 2000; Shen 2002). The mortality rate for heart attacks can be viewed as a proxy for average quality across all services. Because heart attack victims in general travel to the nearest hospital rather than choose which hospital to attend, it is realistic to assume that this proxy is orthogonal to other influences on quality. As in the related literature, this allows us to interpret the proxy as unaffected by consumer choice, and hence less vulnerable to a selection bias.

Our data are obtained from the US Department of Health and Human Services Hospital Compare. The RSMRs are calculated by the Hospital Compare service using all admissions of Medicare and Medicaid insured patients between July 2006 and June 2007.[14] Hospitals' organizational forms and addresses are obtained from the same source. Demographic variables are obtained from the 2000 US Census.

The unit of observation in our cross-sectional regressions is an MSA-organizational form pair.[15] We compute standard deviations of RSMR by

14 For the details of the initial estimating procedure of mortality rates, refer to Krumholz et al. (2006).

15 MSAs (Metropolitan Statistical Areas) correspond well to Hospital Referral Regions (HRRs) and take into account any obstacles to travelling. See Horwitz and Nichols (2007).

organizational form within each MSA, and regress them on MSA characteristics, and a dummy for organizational form.[16]

Larger hospitals (with higher volumes of patients), however, tend to have higher quality, all else equal (Feldman and Scharfstein 2000; Gowrisankaran et al. 2006). To control for size here, the RSMR for each hospital is weighted by hospital's share of patients in its MSA and organizational form. Formally: for hospital h, let $O(h)$ denote the set of all hospitals of the same organizational form as h (all across the US). Similarly, let $M(h)$ be the set of all hospitals located in the same MSA as h. This allows us to define the set $H(h)$ containing all hospitals that are of both the same organizational form as h and are located in the same MSA, $H(h) \equiv O(h) \bigcap M(h)$. Let n_h be the number of patients in hospital h treated for heart attacks (from which the RSMR figure was calculated). Then each weighted RSMR for hospital h' is a product of the original RSMR of h' in the dataset and the weight $n_{h'}/(\sum_{h \in H(h')} n_h)$. Larger hospitals receive a higher weight, which increases their RSMR, while smaller hospitals receive a lower weight, which decreases their RSMR. After these weights are applied, the standard deviation of these weighted RSMR is calculated for each MSA by organizational form.

We estimate the following specification across MSAs:

$$SDMort_{mo} = \beta_0 + \beta_1 FP_{mo} + \beta_2 GOV_{mo} + X'_m \beta_3 + \zeta_{mo}. \tag{13}$$

In specification (13), $SDMort_{mo}$ is the standard deviation of RSMR in MSA m for hospitals of organizational form o. Dummy variables capture the effect of the organizational form. FP equals one if $SDMort_{mo}$ corresponds to for-profit hospitals (in MSA m), and GOV equals one if it corresponds to government-owned ones (not-for-profit category omitted). X_m includes MSA income, education and population size.[17] ζ_{mo} is the error term capturing unobserved market and organizational form characteristics.[18]

Table 1 presents the summary statistics for mortality rates. Each observation of a mortality rate corresponds to a hospital. The number of not-for-profit hospitals is almost four times as large as the number of for-profit hospitals and almost five times as large as the number of government-owned ones. Both the means and the standard deviations of mortality rates averaged across markets are fairly

16 The small number of hospitals within MSAs (see table 2 and the discussion in Dubrovinsky 2009) introduces noise into the dependent variable. Market-level moments of quality distribution, however, should be viewed as *population* moments rather than sample moments. The dataset we use contains all the relevant hospitals (acute care hospitals treating heart attacks) that fall within MSAs. The MSAs, however, are a sample of US regional markets.

17 Jones and Wildman (2008) report evidence on the impact of income on health status. DeWalt et al. (2004) review evidence on education and health. Controlling for population size is important due to economies of scale in provision of mortality-reducing services (e.g., enhanced 911 service; see Athey and Stern 2000), which are likely to induce higher investment in these services in more populated MSAs. Related studies also control for income and population (McClellan and Staiger 2000; Shen 2002).

18 Residuals may be potentially correlated at the MSA-level, as each MSA appears as an observation up to three times (once for each organizational form). To check for robustness, we cluster the standard errors. Clustering does not seem to matter (see table 3).

TABLE 1
Risk adj. mortality rates for heart attacks by org. form (estimated from 2006–2007 Medicare/Medicaid admissions)

Org. form	Obs.	Mean	Std. dev.	Min	Max
FP	322	16.072	1.097	12.5	19.5
NP	1112	15.968	1.208	12.4	20
GOV	256	16.11	0.996	12.7	20.8

NOTES: FP in this table corresponds to all for-profit hospitals. NP corresponds to all not-for-profit hospitals.
SOURCE: Health and Human Services Hospital Compare.

TABLE 2
Summary statistics

Variable	Mean	Std. dev.	Min	Max
MSA population (mill.)	0.899	2.06	0.058	21.2
Med. HH income 1999 (000s $)	39.175	6.755	11.385	62.024
High school degree (%)	30.1	6.2	17.8	50
Number of FP hospitals in MSA	1.298	3.693	0	47
Number of NP hospitals in MSA	4.484	10.571	0	112
Total number of hospitals in MSA	6.815	14.347	1	135
No. of obs.		N = 248		

NOTES: FP in this table corresponds to all for-profit hospitals. NP corresponds to all not-for-profit ones.
SOURCE: Health and Human Services Hospital Compare and 2000 US Census.

close between the not-for-profit and for-profit organizational forms. The not-for-profits have slightly lower average and slightly higher standard deviation of mortality.

The remaining summary statistics for the variables used in the analysis of hospital quality appear in table 2. Population size varies significantly across MSAs (standard deviation of over 2 million inhabitants). We control for population size. The income dispersion between the highest and the lowest median MSA income is more than $50,000 a year.

Table 3 reports results of regression specification (13) which estimates the relative size of the variance on quality across not-for-profits and for-profits at the market-level controlling for various factors. Column (4) presents the results, including all relevant controls: population size, income and the overall level of education. The coefficient of interest in this regression is on the for-profit dummy variable. This estimated coefficient is large. The standard deviation of for-profit quality is more than 60% higher than the average standard deviation for not-for-profits. The controls, and market-level analysis are important: without them, the standard deviation of mortality is in fact slightly higher for not-for-

TABLE 3
Organizational form and the variance of quality (RSMR)

Dependent variable:	(1) SD mort.	(2) SD mort.	(3) SD mort.	(4) SD mort.	MSA-clustered S.E. SD mort.
FP	0.381	0.685	0.649	0.736*	0.736*
	(0.433)	(0.418)	(0.417)	(0.427)	(0.426)
GOV	1.019*	1.422***	1.453***	1.521***	1.521***
	(0.556)	(0.525)	(0.523)	(0.526)	(0.515)
Population (mill.)		−0.301***	−0.262***	−0.249***	−0.249***
		(0.052)	(0.052)	(0.053)	(0.071)
Income (000s $)			−0.041*	−0.034	−0.034
			(0.023)	(0.021)	(0.022)
High school degree (%)				4.292	4.292
				(3.515)	(3.324)
Constant	3.423***	3.858***	5.488***	3.935***	3.935***
	(0.224)	(0.228)	(0.931)	(1.389)	(1.372)
Observations	232	232	232	232	232
R-squared	0.02	0.14	0.15	0.16	0.16

NOTES: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. FP in this table corresponds to all for-profit hospitals.

profits, as reported in table 1. The p-value of the key estimated coefficient is 0.087.[19]

In short, the empirical results show a higher variance of quality for for-profits relative to not-for-profits in the data. This evidence is consistent with the central and novel implication of our theory.

5. Conclusion

Our theory of organizational form and output quality predicts that for-profit providers are concentrated in the tails of the distribution of quality, with not-for-profit providers in the middle. Stepping back from our stylized model, the more robust prediction is that the variance of quality is higher across for-profit firms than across not-for-profit firms. Our theory both explains the lack of consistent evidence for the central implication of the existing theory, that the average quality of not-for-profit firms is higher, and offers the new prediction on relative variance.

The empirical evidence on the health care market offered in this paper must be regarded as indicative or preliminary, given the proxies for variables that must be adopted to test the theory. While commonly used in the empirical literature,

19 Observations are omitted, for each organizational form, when the number of hospitals of this form in the MSA is less than 2, since in this case the standard deviation cannot be calculated. When the regression is restricted to markets where both for-profit and not-for-profit firms number 2 or more (not reported here), the estimated coefficient on for-profit increases to 0.80; the standard error also increases due to the smaller sample size.

these proxies are only approximate. The coefficient of interest in our regression measures the impact of organizational form on the standard deviation of quality. We find the standard deviation to be about 60% higher for for-profits, consistent with the predictions of our theory, with a p-value for this difference of $p = 0.087$. The evidence, while only suggestive, supports our prediction that the variance in quality is higher in the for-profit sector relative to the not-for-profit sector.

References

Alchian, A. A., and H. Demsetz (1972) "Production, information costs, and economic organization," *The American Economic Review* 62(5), 777–95

Andreoni, J. (1990) "Impure altruism and donations to public goods: A theory of warm-glow giving," *Economic Journal* 100(401), 464–77

Arrow, K. J. (1963) "Uncertainty and the welfare economics of medical care," *American Economic Review* 53(5), 941–73

Athey, S., and S. Stern (2000) "The adoption and impact of advanced emergency response services." In D. M. Cutler, ed., *The Changing Hospital Industry: Comparing Not-for-Profit and For-Profit Institutions*, pp. 113–55. Chicago: The University of Chicago Press

Besley, T., and M. Ghatak (2005) "Competition and incentives with motivated agents," *The American Economic Review* 95(3), 616–36

Biglaiser, G., and C. A. Ma (2007) "Moonlighting: Public service and private practice," *The RAND Journal of Economics* 38(4), 1113–33

Brekke, K. A., and K. Nyborg (2010) "Selfish bakers, caring nurses? A model of work motivation," *Journal of Economic Behavior & Organization* 75, 377–94

Delfgaauw, J., and R. Dur (2010) "Managerial talent, motivation, and self-selection into public management," *Journal of Public Economics* 94, 654–60

DeWalt, D. A., N. D. Berkman, S. Sheridan, K. N. Lohr, and M. P. Pignone (2004) "Literacy and health outcomes: A systematic review of the literature," *Journal of General Internal Medicine* 19(12), 1228–39

Dubrovinsky, D. (2009) *Organizational Form and the Provision of Quality in Healthcare Markets*. PhD dissertation, University of British Columbia, available at http://hdl.handle.net/2429/14681

Easley, D., and M. O'Hara (1983) "The economic role of the nonprofit firm," *The Bell Journal of Economics* 14(2), 531–38

Feldman, S., and D. Scharfstein (2000) "Managed care and provider volume." In D. M. Cutler, ed., *The Changing Hospital Industry: Comparing Not-for-Profit and For-Profit Institutions*, pp. 229–48. Chicago: The University of Chicago Press

Francois, P. (2007) "Making a difference," *The RAND Journal of Economics* 38(3), 714–32

Francois, P., and M. Vlassopoulos (2008) "Pro-social motivation and the delivery of social services," *CESifo Economic Studies* 54, 22–54

Glaeser, E. L., and A. Shleifer (2001) "Not-for-profit entrepreneurs," *Journal of Public Economics* 81, 99–115

Gowrisankaran, G., V. Ho, and R. J. Town (2006) "Causality, learning and forgetting in surgery," mimeo, Department of Economics, University of Arizona

Hansmann, H. B. (1980) "The role of nonprofit enterprise," *Yale Law Journal* 89, 835–901

Hirth, R. A. (1999) "Consumer information and competition between nonprofit and for-profit nursing homes," *Journal of Health Economics* 18, 219–40

Horwitz, J. R., and A. Nichols (2007) "What do nonprofits maximize? Nonprofit hospital service provision and market ownership mix," NBER working paper no. 13246

Jones, A. M., and J. Wildman (2008) "Health, income and relative deprivation: Evidence from the BHPS," *Journal of Health Economics* 27(2), 308–24

Krumholz, H. M., Y. Wang, J. A. Mattera, Y. Wang, L. F. Han, M. J. Ingber, S. Roman, and S.-L. T. Normand (2006) "An administrative claims model suitable for profiling hospital performance based on 30-day mortality rates among patients with an acute myocardial infarction," *Circulation* 113, 1683–92

Liu, Y., and C. B. Weinberg (2009) "Pricing for nonprofit organizations." In V. R. Rao, ed., *Handbook Of Pricing Research In Marketing*, chapter 24, pp. 512–34. Cheltenham, UK: Edward Elgar Publishing

Mas-Colell, A., M. D. Whinston, and J. R. Green (1995) *Microeconomic Theory*. New York: Oxford University Press

McClellan, M., and D. Staiger (2000) "Comparing hospital quality at for-profit and not-for-profit hospitals." In D. M. Cutler, ed., *The Changing Hospital Industry: Comparing Not-for-Profit and For-Profit Institutions*, pp. 93–112. Chicago: The University of Chicago Press

Newhouse, J. P. (1970) "Toward a theory of nonprofit institutions: An economic model of a hospital," *American Economic Review* 60(1), 64–74

Prendergast, C. (2007) "The motivation and bias of bureaucrats," *The American Economic Review* 97(1), 180–96

Rosenau, P. V., and S. H. Linder (2003) "Two decades of research comparing for-profit and nonprofit health provider performance in the United States," *Social Science Quarterly* 84(2), 219–41

Salop, S., and J. E. Stiglitz (1977) "Bargains and ripoffs: A model of monopolistically competitive price dispersion," *The Review of Economic Studies* 44(3), 493–510

Schlesinger, M., and B. H. Gray (2006) "Nonprofit organizations and health care: Some paradoxes of persistent scrutiny," In W. W. Powell and R. Steinberg, eds., *The Nonprofit Sector: A Research Handbook* – 2nd ed., chapter 16, pp. 378–431. New Haven, CT: Yale University Press

Shen, Y.-C. (2002) "The effect of hospital ownership choice on patient outcomes after treatment for acute myocardial infarction," *Journal of Health Economics* 21, 901–22

Weinberg, C. B. (1980) "Marketing mix decision rules for nonprofit organizations," *Research in Marketing* 3, 191–234