Reputational Concerns with Altruistic Providers*

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Abstract

We study a model of reputational concerns when providers differ in the degree of altruism and altruism can be signaled by some observable choice, say quantity. We concentrate on equilibria involve the highly altruistic provider choosing his optimal strategy in the absence of reputational concerns. When reputation gains are high a pooling equilibrium arises where the provider with low altruism mimics the provider with high altruism by setting a high quantity. When reputation gains are low a separating equilibrium arises. When reputation gains are intermediate, a semi-separating equilibrium arises where the provider with low altruism provides high quantity with a positive probability. We also investigate how these equilibria are affected by varying prices, and therefore whether higher prices crowd out or crowd in intrinsic motivation.

Keywords: reputation; altruism; crowding in.

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1 Introduction

A key policy issue in the public sector, and in the health sector in particular, is how to incentivise providers (e.g., doctors, hospitals) to provide better care. Providers have at least two sources of motivation: monetary and non-monetary ones. Pay-for-performance incentive schemes can be used to motivate providers and this is the typical economists’ focus: for example, hospitals are paid a price for each patient treated, family doctors can be financially rewarded if they have better quality indicators. Non-monetary incentives can be equally important. The health economics literature has long recognised at least two other incentive forces. First, providers may be altruistic and care about their patients: altruism motivates them to provide better care. Second, providers may care about what society (or their peers) thinks about them. In this study we combine both of these non-monetary forces and seek to explain how they interact with each other. Doctors differ in the degree of their altruism, which is not observable. However, highly altruistic doctor may try to signal their altruism by setting some observable action. On the other hand, we assume that doctors care about their own reputation and they enjoy being known as good doctors and dislike being known as bad doctors.

The first objective of this study is to investigate the extent to which such reputational concerns can induce less altruistic (motivated) providers to exert more effort and provide more care to avoid a bad reputation. Policymakers increasingly publish, and make available to patients and the general public, information on relative doctors’ performance. Such policies can potentially enhance reputational concerns by more widely advertising the well-performing doctors and the under-performing ones. These policies are sometimes (colloquially) known as ‘name and shame’ where poorly performing doctors are subjected to ‘shame’ in front of the community. Can the simple fact of publishing information without any formal monetary incentive scheme change doctors’ behaviour? Do patients and doctors gain from such policies? As a second, subsidiary, question we also investigate whether a more extensive use of monetary incentives (e.g., higher prices) crowds out the non-monetary incentives. In different words, we investigate whether monetary and
non-monetary incentive schemes are complementary or substitutive. In doing so, we concentrate on equilibria that involve the highly altruistic agent choosing the action that would be optimal in the absence of reputational concerns. We discuss other possible equilibria below.

Given this restriction, we show that three equilibria can arise depending on the size of reputational concerns. When gains (losses) from a good (bad) reputation are high a high action pooling equilibrium arises: the provider with low altruism mimics the provider with high altruism and provides a high quantity. When reputational concerns are low a separating equilibrium arises: the provider with high altruism provides a higher quantity than the provider with low altruism. When they are intermediate, a semi-separating equilibrium arises where the provider with high altruism provides the high quantity and the provider with low altruism provides the high quantity with a positive probability (strictly less than one). Consumers are (weakly) better off when reputational concerns are larger since they benefit from higher quantity levels.

We show that the provider with low altruism is never able to build a good reputation but can at most avoid to build a bad one. This plays a key role in the analysis. When reputational concerns are low, the provider with low altruism provides the low quantity and therefore signals having low altruism, which then reduces to some extent her utility (due to loss from a bad reputation). In contrast, the provider with high altruism enjoys a good reputation since she can be easily identified by consumers. When reputational concerns are high, both providers provide the same (high) quantity. However, precisely because both providers provide the same quantity, consumers cannot distinguish between the highly altruistic provider from the provider with low altruism. There will be no reputation gains for both providers. This is a common feature of signaling models involving rational observers: the latter are never fooled.

The incentive for providers with low altruism to mimic the ones with high altruism is critically driven by the size of the reputation gain (i.e. the difference between the gain of signalling being the high type and the loss from signalling being a low type). It is again the
inability of providers with low-altruism to capture a positive reputation gain when both providers provide the same quantity that generates a third type of equilibrium (in addition to pooling and separating) for an intermediate range of reputational concerns. Here, the reputational concerns are not sufficiently high to make the low type mimic the high type (mimicking would only avoid a bad reputation but would not help to establish a good one), neither are sufficiently low that the low type prefers to provide the low quantity and have a reputation loss. A semi-separating equilibrium arises where the low type provides the high quantity with positive probability. Although consumers are better off under a semi-separating equilibrium than under a separating one, the gains for consumers are not as high as under pooling.

We show that the range of intermediate reputational concerns over which a semi-separating equilibrium arises, i.e., when the highest possible quantities cannot be gained by consumers, critically depends on the relative proportion of providers with high altruism. At one extreme, as the proportion of the high type approaches one, the semi-separating tends to disappear and the equilibrium quickly moves from separating to pooling. When the low type mimics the high type, so that consumers cannot distinguish between them, the expected type is close to the high type and therefore the reputation gain is close to zero. At the other extreme, as the proportion of the high type approaches zero, the expected type is close to the low type and the reputation loss is close to his highest. The pooling equilibrium arises only for when reputational concerns are very large (that tend to infinity when the proportion of high type tend to zero). Between the two extreme cases, suppose that the proportion of the low and high type is the same, then the range interval of intermediate reputational concerns over which a semi-separating equilibrium arises is at least as high as the range interval of low reputational concerns where a separating equilibrium arises. In summary, the analysis suggests that when the proportion of low types is quite high, even large reputational concerns may not be sufficient to induce providers with low altruism to provide the highest quantity.

The payoffs for providers under a separating and a pooling equilibrium are straight-
forward but are somewhat more intricate under the semi-separating equilibrium. Under a separating equilibrium the high type gains from having a good reputation and such benefits/losses are proportional to the size of the reputational concerns. The opposite is true for the low type. Under a pooling equilibrium, neither types gain any reputation. The low type is worse off compared to the separating equilibrium. Under a semi-separating equilibrium payoffs do not vary with reputational concerns. The reason is that larger reputational concerns reduce the expected type associated with a high quantity (because the low type provides the high quantity with a higher probability) and therefore makes it harder to separate types.

After characterising the equilibria, we also investigate how such equilibria are affected by a change in price level. It has been argued that the use of prices in the public sector (and in particular the health sector) can ‘crowd out’ providers’ intrinsic motivation. In our model crowding out could be interpreted as a reduction in the range of reputational concerns over which a pooling equilibrium arises where both providers provide the high quantity. Whether crowding out arises in our model critically depends on how a change in price affects the incentive for the provider with low altruism to mimic the provider with high altruism. Our comparative statics results suggest that in general the effect of prices on crowding out is indeterminate. One one hand, higher prices increase the quantity of the high type making it more costly for the low type to mimic the high type, which tends to generate crowding out. On the other hand, an increase in price increases revenues more when the high quantity is chosen, therefore making more attractive to the low type to mimic the high type. Nevertheless, we are able to clearly identify conditions over which crowding out arises. We find that crowding out arises only under very specific assumptions: when the marginal benefit is constant and the convexity of the cost function increases with quantity (the third derivative of costs is positive). Under arguably more plausible assumptions, ‘crowding in’ (rather than ‘crowding out’) may arise: crowding in arises if the marginal benefit from care is decreasing and the convexity of the cost function weakly decreases with quantity. There is no ‘crowding out’ nor ‘crowding in’ if
both marginal benefit is constant and costs are quadratic.

1.1 Related Literature

The closest paper to ours is that of Cartwright and Patel (2013), which also studies the interaction between altruism and reputational concerns in a signaling model. They however concentrate on equilibria that are very different from the one we focus on. Indeed, they discard our high-action pooling equilibrium by means of the "intuitive criterion" of Cho and Kreps (1987) and focus instead on the so called "Riley Outcome", which consists on the separating equilibrium that is least costly to the high type agent\(^1\). However, if reputational concerns are strong then such outcome involves a very costly action on the part of the high type, which the payer must then compensate. It is therefore possible to use a forward induction argument that discards the Riley Outcome in such cases: the planner, by setting the right monetary incentives can implement her preferred actions (those balancing patients’ benefits and remuneration costs) from both types if the ensuing equilibrium is pooling. Moreover, the focus of the paper is different: they are interested in checking whether reporting actions to society in categories (say high, medium or low) changes the equilibrium actions. We instead focus on exact reporting (society learns the action exactly) and (1) provide conditions ensuring that the low type will behave as the high type and (2) provide sufficient conditions so that an increase in pecuniary incentives (for fixed warm glow intensity) does not crowd-out the agent’s intrinsic motivation.

As with Cartwright and Patel, our approach is in line with works modelling prosocial behaviour and warm glow (Bénabou and Tirole, 2006; Ellingsen and Johannesson, 2008, 2011; Andreoni and Bernheim, 2009; Cartwright and Patel, 2010; Daugherty and Reinganum, 2010; and Soetevent, 2011).

\(^1\)Under the high action pooling equilibrium, the less altruistic type has an incentive to set the same quantity as the more altruistic type in order to gain warm glow. The more altruistic type is then willing to increase his action up and above his personal optimum up to the point that deters the other type from disguising
2 The model

The players are a provider of some service, a third party payer, and society. Society’s role is modelled in a somewhat reduced form, as it will be explained later on. Define $q$ as the amount of care received by the consumers (e.g., patients). Providers (e.g., doctors) are altruistic. The degree of altruism is denoted with $\theta$. Providers differ in the degree of altruism $\theta$ and altruism can take two possible values $\{\underline{\theta}; \bar{\theta}\}$ with $\underline{\theta} < \bar{\theta}$. Therefore the value $\bar{\theta}$ denotes the more altruistic provider (the good doctor) and $\underline{\theta}$ the less altruistic one (the bad doctor). The prior probability that a provider is of type $\bar{\theta}$ is common knowledge and equal to $\lambda \geq 0$. We assume that altruism is private information.

Both types have the same costs of delivering care, given by $C(q)$, with $C_q > 0$ and $C_{qq} \geq 0$. These costs are the sum of the monetary and/or non-monetary ones (e.g., diagnostic effort, opportunity costs of time spent with the patient, and so on).

Consumers’ derive benefits from the quantity of care they receive given by $W(q)$, with $W_q > 0$, $W_{qq} \leq 0$. They observe the quantity of care received $q$ and use that observation to update their beliefs on the provider’s type. We denote these (posterior) beliefs as $\lambda^S$, which represents the probability that consumers put on the event $\theta = \bar{\theta}$ upon observation of $q$. We use the Bayesian Equilibrium notion to solve the game, and therefore use Bayes’ Rule to compute these beliefs whenever possible. We denote the expected type of a doctor using these posterior beliefs by $\theta^S = \lambda^S \bar{\theta} + (1 - \lambda^S) \underline{\theta}$. If there is no updating, then $\lambda^S = \lambda$ and the expected type is denoted by $E(\theta) = \lambda \bar{\theta} + (1 - \lambda) \underline{\theta}$, i.e., the expected type in the providers’ population. If updating is such that the provider is believed to be the good type, then $\lambda^S = 1$ and the expected type is $\bar{\theta}$. Similarly, if updating is such that the provider is believed to be the bad one, then $\lambda^S = 0$ and the expected type is $\underline{\theta}$.

The provider’s preferences can be represented by a linear and additively separable utility function over money, an altruistic component, and a reputational concern component. Starting with the first component, the revenues of the provider are given by $T + pq$,\(^2\) so

\(^2\)The assumption of linear contracts is without loss of generality.
that her (monetary) profits are

$$\pi (q) = T + pq - C(q).$$

As for the second component, and similarly to Ellis and McGuire (1986) and Chalkley and Malcomson (1998b), altruism is expressed as fraction of the consumers' (patients) benefits, $\theta W(q)$, where $\theta \in (0, 1]$. Alternatively, $\theta$ can be interpreted as the degree of *intrinsic motivation* of the provider, as in Dixit (2005) and Besley and Ghatak (2005).\(^3\)

The sum of the first two components is defined with $V = \pi + \theta W$.

Finally, the reputational concerns convey that the provider cares about society’s “impression” of provider’s (doctor’s) altruism. This impression comes from the composition of two elements. The first element is society’s perception of the doctor’s altruism, which is given by the difference between conditional expectation $\theta^S$, based on posterior beliefs $\lambda^S(q)$, and the unconditional average $E(\theta)$. This is consistent with the idea that if no new and relevant information is revealed, the provider’s reputation remains the same. For instance, in a pooling equilibrium where all types set the same $q = q_0$, observing $q = q_0$ is not informative and therefore there should be neither a reputational gain nor a loss of it. The other element measures how intensely society takes into account this perception, which we measure by parameter $\alpha$. This parameter could be determined by several aspects. For instance, it could measure how much publicity does a doctor reputation get.

Formally, we assume that reputational concerns are given by

$$G(q) = \alpha(\theta^* (q) - E(\theta)).$$

Notice that if observing some (low) value for $q$ generates posterior beliefs that the provider is of type $\theta^*$ (that is, if $\lambda^S(q) = 0$) then $G(q)$ becomes negative. Also, as mentioned above, if observing a certain value $q$ is uninformative then $\lambda^S(q) = \lambda$ and $G(q) = 0$, and so on.

Our model could be interpreted in several ways. For instance, it could be taken as

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\(^3\)See also Jack, 2005?, Ma (2007) and Ma and Chone (2007), plus others.
reduced-form of some future action on the part of society that affects the provider, like increased demand of future services.

To sum up, providers’ preferences are represented by

\[ \pi + \theta W + G = V + G, \]  

where we have summarized non-reputational factors in the function \( V = \pi + \theta W \).

We next define the equilibrium concept used to solve the model.

**Definition 1** An equilibrium is a pair of functions of quantities \( q^E(\theta) : \{\theta; \bar{\theta}\} \rightarrow R_+ \) and beliefs \( \lambda^S(q) : R_+ \rightarrow [0, 1] \) such that

(i) for every \( \theta \) in \( \{\theta; \bar{\theta}\} \), \( q^E(\theta) \) maximizes \( \pi(q) + \theta W(q) + G(q) \) once \( \theta^S(q) = \lambda^S(q)\theta + (1 - \lambda^S(q)) \bar{\theta} \) has been substituted into \( G(q) \).

(ii) \( \lambda^S(q) \) is computed using Bayes’ rule whenever possible, and

(iii) \( \lambda^S(q) \) is any number between 0 and 1 when Bayes’ rule cannot be applied.

**2.0.1 Out of equilibrium beliefs (OEEB)**

Bayes’ rule cannot be applied when the observed quantity \( q \) is neither types’ posited equilibrium choice (i.e., the denominator of Bayes’ formula is zero). As an example of an out of equilibrium action, suppose that in (a pooling) equilibrium all types set \( q = q_0 \), then any \( q \neq q_0 \) is a non-equilibrium action. We will assume that beliefs satisfy the following properties:

(i) If the posited equilibrium has \( q^E(\bar{\theta}) = \bar{q} \) with positive probability and \( q^E(\theta) = \bar{q} \) with probability 1, and if \( \bar{q} < \bar{q} \), so that \( \lambda^S(q) = 0 \) and \( \lambda^S(\bar{q}) = x \in (0, 1) \) by Bayes’ rule, then

\[ \lambda^S(q) = \begin{cases} 0 & \text{for all } q < \bar{q} \\ x & \text{for all } q \geq \bar{q} \end{cases} \]

(ii) If the posited equilibrium has \( q^E(\bar{\theta}) = q^E(\theta) \) so that \( \lambda^S(q^E(\bar{\theta})) = \lambda^S(q^E(\theta)) = \lambda \)
by Bayes’ rule, then

\[
\lambda^S(q) = \begin{cases} 
0 & \text{for all } q < q^E(\bar{\theta}) = q^E(\bar{\theta}) \\
\lambda & \text{for all } q \geq q^E(\bar{\theta}) = q^E(\bar{\theta})
\end{cases}
\]

Informally, we are saying that society holds beliefs that are the most pessimistic Bayes’
rule and (2) leading to a weakly increasing function of \( q \).

Even with this beliefs restriction (and as is typical in signaling games), there is a large
multiplicity of equilibria. We focus on the equilibria where the highly altruistic agent is
taking his optimal action in the absence of reputational concerns.

To do this, we first define the function \( q^*(\theta) \) as the optimal quantity of a provider
facing no reputational concerns (i.e., when \( \alpha = 0 \)):

\[
q^*(\theta) \text{ maximises } V(q | \theta).
\]  

Hence \( q^*(\theta) \) is such that

\[
p + \theta W_q = C_q.
\]

The marginal benefit of raising quantity due to monetary and altruistic concerns is equal
to the marginal cost.\(^4\) We also have:

\[
\frac{\partial q^*}{\partial \theta} = \frac{W_q}{-(\theta W_{qq} - C_{qq})} > 0.
\]

In the absence of reputational concerns, higher altruism implies higher quantity, as it is
natural.

In the next three sections we characterise the set of parameter values which sustain a
separating, a pooling and a semi-separating equilibrium, respectively.

2.1 Separating equilibrium

Each type \( \theta \) chooses \( q^*(\theta) \), with \( q^*(\bar{\theta}) > q^*(\bar{\theta}) \). Then beliefs are such that observing
a high (low) quantity signals with certainty high (low) altruism: \( \lambda^S(q^*(\bar{\theta})) = 1 \) and

\(^4\)We assume the Second Order Condition is satisfied \( \theta W_{qq} - C_{qq} < 0 \).
$\lambda^S (q^* (\bar{\theta})) = 0$, while any other quantity is, according to our OOEB assumption, $\lambda^S (q) = 0$ (so $\theta^* (q) = \bar{\theta}$) for any $q < q^* (\bar{\theta})$ and $\lambda^S (q) = 1$ (so $\theta^* (q) = \bar{\theta}$) for any $q \geq q^* (\bar{\theta})$

For these strategies and beliefs to constitute a separating Bayesian Equilibrium, we need the incentive-compatibility (IC) constraints for both types to be satisfied:

$$V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta)) \geq \begin{cases} V(q | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta)) & \text{for all } q < q^* (\bar{\theta}) \\ V(q | \bar{\theta}) & \text{for all } q \geq q^* (\bar{\theta}) \end{cases}$$

which is equivalent to

$$V(q^* (\bar{\theta}) | \bar{\theta}) \geq \begin{cases} V(q | \bar{\theta}) - \alpha(\bar{\theta} - \bar{\theta}) & \text{for all } q < q^* (\bar{\theta}) \\ V(q | \bar{\theta}) & \text{for all } q \geq q^* (\bar{\theta}) \end{cases}$$

and

$$V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta)) \geq \begin{cases} V(q | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta)) & \text{if } q < q^* (\bar{\theta}) \\ V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta)) & \text{if } q \geq q^* (\bar{\theta}) \end{cases}$$

which is equivalent to

$$V(q^* (\bar{\theta}) | \bar{\theta}) \geq \begin{cases} V(q | \bar{\theta}) & \text{if } q < q^* (\bar{\theta}) \\ V(q | \bar{\theta}) + \alpha(\bar{\theta} - \bar{\theta}) & \text{if } q \geq q^* (\bar{\theta}) \end{cases}$$

These expressions ensure that the utility for the provider with high (low) altruism from choosing the high (low) quantity is higher than choosing any other quantity. Notice that the high type IC (??) is always satisfied. On the one hand, $q^* (\bar{\theta})$ maximizes $V(q | \bar{\theta})$. On the other hand, choosing this quantity instead of any other quantity increases the reputational concern. As for the low type, also the upper expression in the right hand side of (6) is always satisfied since $q^* (\bar{\theta})$ maximizes $V(q | \bar{\theta})$ and choosing $q^* (\bar{\theta})$ generates the same reputation loss as any other quantity (except for $q^* (\bar{\theta})$). Hence, only the lower expression in the right hand side of (6) puts any restriction. Notice first that the RHS $V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(\bar{\theta} - \bar{\theta})$ is maximized (subject to $q \geq q^* (\bar{\theta})$) at $q = q^* (\bar{\theta})$. Hence the
restriction says that the provider with low altruism must be better-off by providing $q^*(\theta)$ than by disguising himself by providing $q^*(\bar{\theta})$ as the high type. This will only occur if the reputational concerns captured by mimicking are sufficiently low, with

$$0 \leq \alpha \leq \tau \overset{\text{def}}{=} \frac{V(q^*(\theta) | \theta) - V(q^*(\bar{\theta}) | \bar{\theta})}{\bar{\theta} - \theta}. \quad (7)$$

Hence, for sufficiently small $\alpha$, condition (7) is satisfied and the posited strategies and beliefs constitute a separating equilibrium. The parameter $\tau$ has an intuitive interpretation: it conveys a low type’s costs of disguising herself, relative to the distance between the two types. In terms of payoffs, the provider with high altruism enjoys

$$V(q^*(\bar{\theta}) | \bar{\theta}) + \alpha(\bar{\theta} - E(\theta))$$

or

$$V(q^*(\bar{\theta}) | \bar{\theta}) + \alpha(1 - \lambda)(\bar{\theta} - \theta),$$

which includes an increase in his reputation, while the provider with low altruism enjoys

$$V(q^*(\theta) | \theta) - \alpha(E(\theta) - \bar{\theta})$$

or

$$V(q^*(\theta) | \theta) - \alpha \lambda(\bar{\theta} - \theta),$$

which includes a loss in his reputation.

We summarise with the following proposition.

**Proposition 2** If reputational concerns are sufficiently low, a separating equilibrium arises where the provider with higher altruism provides a higher quantity than the provider with lower altruism. Formally, for $0 \leq \alpha \leq \tau$, in equilibrium we have $q^E(\bar{\theta}) = q^*(\bar{\theta})$ and $q^E(\theta) = q^*(\theta)$. The provider with high altruism enjoys a reputation gain while the provider with low altruism suffers a reputation loss.
2.2 High-quantity pooling equilibrium

Suppose that both types of provider choose the high quantity: \( q^E (\theta) = q^* (\bar{\theta}) \) for all \( \theta \). Then individuals cannot distinguish between providers with high and low altruism. There is therefore no updating in their beliefs after observing quantity \( q^* (\bar{\theta}) \). Hence \( \lambda^S (q^* (\bar{\theta})) = \lambda \) and \( \theta^* (q^* (\bar{\theta})) = E (\theta) \). According to our beliefs assumption we have \( \lambda^S (q) = 0 \) (and \( \theta^* (q) = \bar{\theta} \)) for any \( q < q^* (\bar{\theta}) \) and \( \lambda^S (q) = \lambda \) (and \( \theta^* (q) = E (\theta) \)) for \( q \geq q^* (\bar{\theta}) \).

For these strategies and beliefs to constitute a pooling equilibrium, we need again the incentive-compatibility constraints to be satisfied:

\[
V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(E (\theta) - E (\theta)) \geq \begin{cases} 
V(q | \bar{\theta}) + \alpha(E (\theta) - E (\theta)) & \text{for all } q \geq q^* (\bar{\theta}) \\
V(q | \bar{\theta}) + \alpha(\theta - E (\theta)) & \text{for all } q < q^* (\bar{\theta})
\end{cases}
\]

which is equivalent to

\[
V(q^* (\bar{\theta}) | \bar{\theta}) \geq \begin{cases} 
V(q | \bar{\theta}) & \text{for all } q \geq q^* (\bar{\theta}) \\
V(q | \bar{\theta}) - \alpha(E (\theta) - \theta) & \text{for all } q < q^* (\bar{\theta})
\end{cases}
\]

and

\[
V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha(E (\theta) - E (\theta)) \geq \begin{cases} 
V(q | \theta) + \alpha(E (\theta) - E (\theta)) & \text{for all } q \geq q^* (\bar{\theta}) \\
V(q | \theta) + \alpha(\theta - E (\theta)) & \text{for all } q < q^* (\bar{\theta})
\end{cases}
\]

which is equivalent to

\[
V(q^* (\bar{\theta}) | \theta) \geq \begin{cases} 
V(q | \theta) & \text{for all } q \geq q^* (\bar{\theta}) \\
V(q | \theta) - \alpha(E (\theta) - \theta) & \text{for all } q < q^* (\bar{\theta})
\end{cases}
\]

The IC for the provider with high altruism is always satisfied since, on the one hand, \( V(q | \bar{\theta}) \) is maximized at \( q^* (\bar{\theta}) \) and, on the other hand, the term \( -\alpha (E (\theta) - \theta) \) is negative.
Intuitively, not setting \( q^* (\overline{\theta}) \) brings a reputational loss. As for the IC for the provider with low altruism, notice that the upper inequality is satisfied since \( V(q | \theta) \) is decreasing to the right of \( q^* (\overline{\theta}) \). The lower inequality does impose a restriction on parameters. It is satisfied only if the reputational concerns are sufficiently high. To see this, notice first that the RHS is maximized at \( q = q^* (\overline{\theta}) \), so it is sufficient that \( V(q^* (\overline{\theta}) | \theta) \geq V(q^* (\overline{\theta}) | \theta) - \alpha (E (\theta) - \overline{\theta}) \), which can be written as

\[
\alpha \geq \frac{\tau}{\lambda}.
\]

In terms of equilibrium payoffs, the high type’s is \( V(q^* (\overline{\theta}) | \theta) \) whereas for the low type’s is \( V(q^* (\overline{\theta}) | \theta) \). No type enjoys any reputation gain or loss. This is unsurprising. Observing \( q = q^* (\overline{\theta}) \) is not informative since both types are choosing this quantity. However, the high type is setting its optimal quantity whereas the low type suffers a mimicking cost \( V(q^* (\theta) | \theta) - V(q^* (\overline{\theta}) | \theta) \). This is the numerator in \( \tau \). He is willing to incur in this cost to avoid a reputation loss.

We summarise with the following proposition.

**Proposition 3** If reputational concerns are sufficiently high, a pooling equilibrium arises where both providers choose a high quantity and neither type gains or losses any reputation. Formally, for \( \alpha \geq \tau / \lambda \), we have \( q^E (\overline{\theta}) = q^E (\theta) = q^* (\overline{\theta}) \).

Comparing propositions 1 and 2, we notice that there is an empty intersection for intermediate levels of reputational concerns, where \( \tau < \alpha < \tau / \lambda \), where neither the separating equilibrium nor the high-quantity pooling equilibrium exists. This empty intersection is due to the impossibility under the high-quantity pooling equilibrium for the low type to capture the highest potential reputation gain (given by \( \alpha (\overline{\theta} - E (\theta)) \)). He must content himself with avoiding a reputation loss (which would be given by \( \alpha (E (\theta) - \theta) \)). As mentioned above, under pooling individuals cannot infer the level of altruism from the observed quantities.
2.3 Semi-separating equilibrium

We now derive the equilibrium for $\tau < \alpha < \tau/\lambda$, which turns out to be semi-separating. The proof of all the results given next is relegated to the appendix and explained in words below. Suppose that the provider with higher altruism chooses the high quantity $q^E(\bar{\theta}) = q^*(\bar{\theta})$ with certainty (probability equal to one), and the provider with low altruism chooses the low quantity with probability $r$ and the high quantity with probability $(1 - r)$:

$$q^E(\bar{\theta}) = \begin{cases} q^*(\bar{\theta}) & \text{with probability } 1 - r, \\ q^*(\bar{\theta}) & \text{with probability } r. \end{cases}$$

Then the equilibrium is characterised by:

$$r = r^E \overset{\text{def}}{=} 1 - \frac{\lambda}{(1 - \lambda)} \left( \frac{\alpha - \tau}{\tau} \right) < 1, \quad (9)$$

$$\lambda^S(q^*(\bar{\theta})) = 0, \quad \lambda^S(q^*(\bar{\theta})) = \frac{\tau}{\alpha} > \lambda, \quad (10)$$

$$\theta^S(q^*(\bar{\theta})) = \bar{\theta}, \quad \theta^S(q^*(\bar{\theta})) = \bar{\theta} + \lambda^S(q^*(\bar{\theta}))(\bar{\theta} - \hat{\theta}) = \bar{\theta} + \frac{\tau}{\alpha}(\bar{\theta} - \hat{\theta}) > \bar{\theta} + \lambda(\bar{\theta} - \hat{\theta}) = E(\bar{\theta}).$$

Equilibrium payoffs for the low and high type are, respectively:

$$V(q^*(\bar{\theta}) \mid \bar{\theta}) - \alpha(E(\bar{\theta}) - \bar{\theta}) = V(q^*(\bar{\theta}) \mid \bar{\theta}) + \alpha[\theta^S(q^*(\bar{\theta})) - E(\bar{\theta})] = V(q^*(\bar{\theta}) \mid \bar{\theta}) + (\tau - \alpha \lambda)(\bar{\theta} - \hat{\theta})$$

and

$$V(q^*(\bar{\theta}) \mid \bar{\theta}) + \alpha[\theta^S(q^*(\bar{\theta})) - E(\bar{\theta})] = V(q^*(\bar{\theta}) \mid \bar{\theta}) + (\tau - \alpha \lambda)(\bar{\theta} - \hat{\theta}).$$

In words, in equilibrium the probability of facing a high type conditional on observing a low quantity is zero. The probability of facing a high type conditional on observing a high quantity is positive but less than one. Hence the observation of $q^*(\bar{\theta})$ induces the sure belief that the provider is of low type and the consequent reputation loss. In contrast, the observation of $q^*(\bar{\theta})$ is not fully informative. It could either come form a high type or be the outcome of the randomization performed by the low type, who would then be mimicking the high type. Bayes rule does pin down the posterior probability,
given by (10), that the provider is of high type upon observation of \( q^* (\theta) \). It is interesting and important that this posterior probability induces a (conditional) expected type that is larger than the average. Hence, if the randomization comes out "mimic", the provider enjoys a reputation gain, although small. This reputation gain is given by \((\tau - \alpha \lambda) (\theta - \bar{\theta})\) (see the RHS of (12)), which is decreasing in \( \alpha \). This is not surprising since since the low type tends to mimic with a higher probability when \( \alpha \) is larger (see (9)). Notice also that the slope with respect to \( \alpha \) is constant.

That the low type randomizes implies that the he must be indifferent between the two quantities, as expressed in the first equality in (12). The payoff of the high type is given by (13), which also contains the small reputation gain \((\tau - \alpha \lambda) (\theta - \bar{\theta})\). The high type’s payoff \( V(q^* (\theta) \mid \bar{\theta}) + (\tau - \alpha \lambda) (\theta - \bar{\theta}) \) tends to \( V(q^* (\theta) \mid \bar{\theta}) + \tau (1 - \lambda) (\theta - \bar{\theta}) \) when \( \alpha \) tends to \( \tau \), which is the same as the separating payoff at \( \alpha = \tau \) (see (REFERENCE)).

Also, \( V(q^* (\theta) \mid \bar{\theta}) + (\tau - \alpha \lambda) (\theta - \bar{\theta}) \) tends to \( V(q^* (\theta) \mid \bar{\theta}) \) when \( \alpha \) tends to \( \tau/\lambda \), which is the same as the pooling payoff. This is an interesting feature of the semi-separating equilibrium: it connects the separating and the pooling equilibrium. As with the high type payoffs, the semi-separating equilibrium tends towards the separating equilibrium when reputational concerns \( \alpha \) tend to the lower bound \( \tau \) and tends towards the pooling equilibrium where both types provide the high quantity \( q^* (\theta) \) when reputational concerns \( \alpha \) tend to the the upper bound \( \tau/\lambda \). This can be easily checked by inspection. The three equilibria are illustrated in Figure 1.

3 Comparative statics

3.1 An increase in price: crowding in or crowding out?

As explained in the introduction, we refer to crowding in to the effect that an increase in pecuniary remuneration may weaken the effect of the warm glow. Since \( \alpha \) is exogenous, in our model this can only occur if variations in prices \( p \) affect the equilibrium that is outstanding for some given values of \( \alpha \). Recall that: \( \tau = \frac{V(q^* (\bar{\theta}) \mid \bar{\theta}) - V(q^* (\bar{\theta}) \mid \bar{\theta})}{\alpha - 2} \), which gives the cost of the low type of disguising as the high type relative to the distance between the
two types. (Recall $V(q|\theta) = pq + \theta W(q) - C(q)$).

How does an increase in price affect $\tau$? Using the envelop theorem, we have that: 
$$\frac{\partial V(q^*(\theta)|\theta)}{\partial p} = q^*(\theta) > 0;$$
a higher price increases revenues and therefore the utility of the low type when the optimal quantity $q^*(\theta)$ is chosen.

In contrast,
$$\frac{\partial V(q^*(\theta)|\theta)}{\partial p} = q^*(\theta) + [p + \theta W(q^*(\theta)) - C_q(q^*(\theta))] \frac{\partial q^*(\theta)}{\partial p} \geq 0.$$ Higher prices increase revenues but also increase the quantity of the high type, which makes it more costly for the low type to disguise as the high type. We can re-write $p + \theta W(q^*(\theta)) - C_q(q^*(\theta)) = - (\bar{\theta} - \bar{\theta}) W_q(q^*(\theta)) < 0^5$ so that:
$$\frac{\partial \tau}{\partial p} = -q^*(\theta) - q^*(\theta) \frac{\partial q^*(\theta)}{\partial \theta} + W_q(q^*(\theta)) \frac{\partial q^*(\theta)}{\partial p} \geq 0$$

where the first term is negative and the second is positive. Intuitively, higher prices increase the revenues when the low type provides the lower quantity $q^*(\theta)$ and when it provides the high quantity $q^*(\theta)$. However, since revenues are higher when the high quantity is provided, a higher price tends to increase the utility of the low type more when she is disguising as the high type compared to when not (first term of the above expression). This effect, which we call "revenue" effect, is negative and tends to reduce $\tau$. However, a higher price also increases both quantities $q^*(\theta)$ and $q^*(\theta)$. By the envelope theorem we know that an increase in $q^*(\theta)$ will have no effect on the utility of the low type, while an increase in $q^*(\theta)$ will reduce it because it brings the low type even further away from the desired quantity. This effect, which we call "quantity" effect, is positive and tends to increase $\tau$. Depending on which of the two effects dominates we may have that an increase in price may lead to an increase or a reduction in $\tau$.

To gain some further insights on this relationship we can write the above expression as:\footnote{This is obtained by adding and subtracting $\theta W_q(q^*(\theta))$ and then noting FOC of high type bla}
$$\frac{\partial \tau}{\partial p} = \frac{\partial q^*(\theta)}{\partial \theta} - q^*(\theta) \frac{\partial q^*(\theta)}{\partial \theta}.$$

\footnote{Notice that $\frac{\partial q^*(\theta)}{\partial \theta} = \frac{W_q(q^*(\theta))}{-p W_q(q^*(\theta)) + C_q(q^*(\theta))} = W_q(q^*(\theta)) \frac{\partial q^*(\theta)}{\partial p}$.}
The effect of prices on $\tau$ then depends on the concavity or convexity of quantity as a
function of altruism $q^*(\theta)$. If the function is concave (convex), i.e. $\frac{\partial^2 q^*(\theta)}{\partial \theta^2} < (>)0$, then $\frac{\partial q^*(\theta)}{\partial \theta} < (>) \frac{\partial q^*(\theta)}{\partial \theta}$. Therefore $\frac{\partial \tau}{\partial p}$ has the same sign as $\frac{\partial^2 q^*(\theta)}{\partial \theta^2}$. After differentiation we have that:

$$\frac{\partial^2 q^*(\theta)}{\partial \theta^2} = \frac{2W_{qq} + (\theta W_{qqq} - C_{qqq}) \frac{\partial q^*(\theta)}{\partial \theta}}{\left(-\theta W_{qq} + C_{qq}\right)^2}.$$  

hence

$$\text{SIGN} \left( \frac{\partial^2 q^*(\theta)}{\partial \theta^2} \right) = \text{SIGN} \left( \frac{2W_{qq} + (\theta W_{qqq} - C_{qqq}) \frac{\partial q^*(\theta)}{\partial \theta}}{-\theta W_{qq} + C_{qq}} \right).$$

We summarize our results in Table 1. In words, whether there is crowding in or
crowding out depends on the second and third derivatives of the benefit function, and
the third derivative of the cost function. A sufficient (but not necessary) condition for
crowding in is that $W_{qq} < 0$, $W_{qqq} \leq 0$ and $C_{qqq} \geq 0$. For example, if the cost function is
quadratic or linear (so that $C_{qqq} = 0$), and the benefit function is quadratic then there
is always crowding in. If the benefit function is not quadratic, a sufficient condition for
crowding in is that $W_{qqq} < 0$. If the marginal benefit is constant, the sign of $\frac{\partial \tau}{\partial p}$ depends
on $C_{qqq}$. If the cost function is quadratic $\frac{\partial \tau}{\partial p} = 0$ and there is no crowding in, nor crowding
out. If the convexity of the cost function increases with quantity (for example cost is
exponential) then we have crowding out. If it decreases then we have crowding in.

<table>
<thead>
<tr>
<th>$W_{qq}$</th>
<th>$W_{qq} &lt; 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$W_{qqq}$</td>
<td>$W_{qqq} = 0$</td>
</tr>
<tr>
<td>$C_{qqq} = 0$</td>
<td>Neither</td>
</tr>
<tr>
<td>$C_{qqq} &gt; 0$</td>
<td>Crowding in</td>
</tr>
<tr>
<td>$C_{qqq} &lt; 0$</td>
<td>Crowding out</td>
</tr>
</tbody>
</table>
3.2 An increase in the proportion of more altruistic providers

An increase in the proportion of more altruistic providers $\lambda$ increases the range over which the pooling equilibrium arises. The presence of more altruistic providers increases the expected altruism $E(\theta)$ under the pooling equilibrium and the reputational gain that arises under this equilibrium. In turn, this makes the low type more willing to mimic the high type at the margin. A larger proportion of more altruistic providers also implies that under the semi-separating equilibrium the provider with lower altruism chooses the high quantity with a higher probability.\footnote{Notice that $\tau$ does not depend on $\lambda$ and the semi-separating equilibrium connects the separating equilibrium with the pooling one. Analytically, $\partial r^E/\partial \lambda = -(\alpha/\tau - 1)(1/(1 - \lambda)^2)$.}

4 References


Dixit, A., 2005. Incentive contracts for faith-based organisations to deliver social services. In: Lahiri, Sajal, Maiti, Pradip (Eds.), Economic Theory in a Changing World:


5 Appendix: The semi-separating equilibrium

Assume $\alpha \in (\tau, \zeta)$. Given the posited strategies, Bayes’ Rule can always be applied to $q \in \{q^*(\bar{\theta}), q^*(\underline{\theta})\}$. Indeed, posterior beliefs when either of these two quantities is observed are

$$\lambda^S(q^*(\bar{\theta})) = 0.$$ 

and

$$\lambda^S(q^*(\underline{\theta})) = \frac{\Pr(\theta = \bar{\theta} | q = q^*(\bar{\theta}))}{\Pr(q = q^*(\bar{\theta}) | \theta = \bar{\theta}) \Pr(\theta = \bar{\theta}) + \Pr(q = q^*(\underline{\theta}) | \theta = \bar{\theta}) \Pr(\theta = \underline{\theta})} = \frac{\lambda}{1 - r(1 - \lambda)}.$$ 

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These beliefs yield the following expected types:

$\theta^S(q^*(\bar{\theta})) = \lambda^S(q^*(\bar{\theta})) \bar{\theta} + (1 - \lambda^S(q^*(\bar{\theta})))\bar{\theta} = \bar{\theta};$

$\theta^S(q^*(\bar{\theta})) = \lambda^S(q^*(\bar{\theta})) \bar{\theta} + (1 - \lambda^S(q^*(\bar{\theta})))\bar{\theta} = \frac{\lambda\bar{\theta} + (1 - r)(1 - \lambda)\bar{\theta}}{1 - r(1 - \lambda)}.$

Any quantity $q \notin \{q^*(\bar{\theta}), q^*(\bar{\theta})\}$ is out of equilibrium. Recall that out of equilibrium beliefs are

$\lambda^S(q) = 0$ for all $q \notin \{q^*(\bar{\theta}), q^*(\bar{\theta})\}.$

Hence expected type upon observation of such $q$ is

$\theta^S(q) = \lambda^S(q) \bar{\theta} + (1 - \lambda^S(q))\bar{\theta} = \bar{\theta}.$

We can now determine the reputational payoff:

$G(q) = \begin{cases} 
-\alpha(E(\theta) - \bar{\theta}) & \text{if } q < q^*(\bar{\theta}), \\
\alpha \left( \frac{\lambda\bar{\theta} + (1 - r)(1 - \lambda)\bar{\theta}}{1 - r(1 - \lambda)} - E(\theta) \right) & \text{if } q \geq q^*(\bar{\theta}).
\end{cases}$

For these strategies and beliefs to constitute an equilibrium we need 3 conditions. First, the low type is indifferent between $q = q^*(\bar{\theta})$ and $q = q^*(\bar{\theta})$; second, the low type (weakly) prefers any of the latter to setting $q \notin \{q^*(\bar{\theta}), q^*(\bar{\theta})\}$; and third, the high type weakly prefers $q = q^*(\bar{\theta})$ to $q \neq q^*(\bar{\theta})$ despite the fact that a high output does not fully reveal his type. The 3 conditions can be written as:

$V(q^*(\bar{\theta}) | \bar{\theta}) + \alpha \left( \frac{\lambda\bar{\theta} + (1 - r)(1 - \lambda)\bar{\theta}}{1 - r(1 - \lambda)} - E(\theta) \right) = V(q^*(\bar{\theta}) | \bar{\theta}) - \alpha (E(\theta) - \bar{\theta}),$
\[
V(q^* (\bar{\theta}) | \bar{\theta}) - \alpha (E(\bar{\theta}) - \bar{\theta}) \geq \begin{cases} V(q | \bar{\theta}) - \alpha (E(\bar{\theta}) - \bar{\theta}) & \text{for all } q < q^* (\bar{\theta}) \\ V(q | \bar{\theta}) + \alpha \left( \frac{\lambda \bar{\theta} + (1-r)(1-\lambda)\bar{\theta}}{1-r(1-\lambda)} - E(\bar{\theta}) \right) & \text{for } q \geq q^* (\bar{\theta}) \end{cases}
\]

\[
V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha \left( \frac{\lambda \bar{\theta} + (1-r)(1-\lambda)\bar{\theta}}{1-r(1-\lambda)} - E(\bar{\theta}) \right) \geq \begin{cases} V(q | \bar{\theta}) - \alpha (E(\bar{\theta}) - \bar{\theta}) & \text{for all } q < q^* (\bar{\theta}) \\ V(q | \bar{\theta}) + \alpha \left( \frac{\lambda \bar{\theta} + (1-r)(1-\lambda)\bar{\theta}}{1-r(1-\lambda)} - E(\bar{\theta}) \right) & \text{for } q \geq q^* (\bar{\theta}) \end{cases}
\]

Using the fact that \( q^* (\cdot) \) maximizes \( V(q|\cdot) \), and that \( \frac{\lambda \bar{\theta} + (1-r)(1-\lambda)\bar{\theta}}{1-r(1-\lambda)} - \bar{\theta} = \lambda \frac{\bar{\theta} - \bar{\theta}}{1-r(1-\lambda)} \),
these three conditions simplify to

\[
V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha \lambda \frac{\bar{\theta} - \bar{\theta}}{1-r(1-\lambda)} = V(q^* (\bar{\theta}) | \bar{\theta}), \tag{15}
\]

\[
V(q^* (\bar{\theta}) | \bar{\theta}) \geq V(q | \bar{\theta}) \text{ for all } q \notin \{ q^* (\bar{\theta}) , q^* (\bar{\theta}) \}, \tag{16}
\]

\[
V(q^* (\bar{\theta}) | \bar{\theta}) + \alpha \lambda \frac{\bar{\theta} - \bar{\theta}}{1-r(1-\lambda)} \geq V(q | \bar{\theta}) \text{ for all } q. \tag{17}
\]

Notice that (16) is always satisfied because \( q^* (\bar{\theta}) \) maximises \( V(q | \bar{\theta}) \). Similarly, (17) is also always satisfied because \( V(q | \bar{\theta}) \) is maximized at \( q^* (\bar{\theta}) \) and, since \( 1-r(1-\lambda) > 0 \) because \( \lambda \) and \( r \) are interior probabilities, the second term in the LHS is positive. Hence only (15) is restrictive and equivalent to

\[
\frac{\alpha \lambda}{1-r(1-\lambda)} = V(q^* (\bar{\theta}) | \bar{\theta}) - V(q^* (\bar{\theta}) | \bar{\theta})
\]

or

\[
\frac{\alpha \lambda}{1-r(1-\lambda)} = \tau
\]

If we subtract 1 form both side we can rewrite this as

\[
r = 1 + \frac{\tau - \alpha \lambda}{\tau (1-\lambda)} - 1
\]

\[
r = 1 + \frac{\tau - \alpha \lambda - \tau (1-\lambda)}{\tau (1-\lambda)}
\]

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\[ r = 1 - \frac{\lambda}{(1 - \lambda)} \left( \frac{\alpha - \tau}{\tau} \right), \]

which is the equilibrium strategy provided in (????) and denoted by \( r_E \). Substituting this expression into the expression for \( \lambda^S (q^* (\tilde{\theta})) \), or (14), we obtain

\[
\lambda^S (q^* (\tilde{\theta})) = \frac{\lambda}{1 - \left( 1 - \frac{\lambda}{(1 - \lambda)} \left( \frac{\alpha - \tau}{\tau} \right) \right) (1 - \lambda)} =
\]

\[
\frac{\lambda}{1 - \left( (1 - \lambda) - (1 - \lambda) \frac{\lambda}{(1 - \lambda)} \left( \frac{\alpha - \tau}{\tau} \right) \right)}
\]

\[
\frac{\lambda}{1 - 1 + \lambda + \lambda \left( \frac{\alpha - \tau}{\tau} \right)}
\]

\[
\frac{1}{1 + \frac{\alpha - \tau}{\alpha}}
\]

\[
\frac{\tau}{\alpha}
\]

as given in the main text. Then \( \theta^S (q^* (\tilde{\theta})) = \theta + \lambda^S (q^* (\tilde{\theta})) (\tilde{\theta} - \theta) = \theta + \frac{\tau}{\alpha} (\tilde{\theta} - \theta) \) as also given in the main text (second expression in (11)).

Let us now calculate equilibrium payoffs. Recall that in order to sustain a mixed strategy with support \( \{ q^* (\tilde{\theta}), q^* (\theta) \} \), the low type must be indifferent between these two quantities. The payoff when choosing \( q^* (\theta) \), which reveals that the type is low, is given by

\[ V(q^* (\theta) \mid \theta) = \alpha (E (\theta) - \tilde{\theta}). \]
or

\[ V(\theta^* \theta | \theta^*) = \alpha \lambda (\theta - \theta') \]

The high type's payoff is given by

\[ V(\theta^* \theta | \theta) + \alpha \left[ \theta^S (\theta^* \theta) - E(\theta) \right] \]

Substitute the expression \( \theta^S (\theta^* \theta) = \theta + \frac{\tau}{\alpha} (\theta - \theta) \) to get.

\[ V(\theta^* \theta | \theta) + \alpha \left[ \theta + \frac{\tau}{\alpha} (\theta - \theta) - E(\theta) \right] \]

or

\[ V(\theta^* \theta | \theta) + \alpha \left[ \frac{\tau}{\alpha} (\theta - \theta) - \lambda (\theta - \theta) \right] \]

or

\[ V(\theta^* \theta | \theta) + (\tau - \alpha \lambda) (\theta - \theta) \]

as given in the main text.
Figure 1. Quantities

Expected Quantity

\[ q^* (\overline{\theta}) \]

\[ q^* (\theta) \]

Reputational concerns

- Low (separating)
- Moderate (semi-separating)
- High (pooling)
Figure 1. Pay-offs

Quantities

$V(q^*(\theta) | \theta)$

$V(q^*(\overline{\theta} | \theta)$

$V(q^*(\theta | \overline{\theta})$

Reputational concerns

$\tau$

$\tau/\lambda$

Low (separating)  Moderate  High (pooling) (semi-separating) (pooling)