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Abstract

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1 Introduction

Consumers cannot directly observe the full quality of many goods and services, sometimes even after the good has been purchased and used. There are many market and social responses to this ubiquitous problem, including voluntarily and socially imposed standards, and strategic actions taken by firms to signal quality. Consumers can consult “report cards” prior to many purchases. The magazine *Consumer Reports*, for example, contains detailed information about consumer durable goods, with ratings for many dimensions of quality. Reports can improve the functioning of the market by helping consumers find a product that suits their needs, and in so doing, give producers incentives to improve quality that would otherwise, because of unobservability, be left too low.

While the idea that more information about quality means more efficient markets appeals to common sense, it is not in general correct. Even in the simple case of comparing a firm selling a product whose quality can be observed with a product whose quality cannot be observed leads to no clear welfare ranking.\(^1\) This fundamental observation can be cast as a version of the familiar second-best argument. If there is more than one inefficiency at play in a market, fixing the unobservable quality problem may not improve matters overall.

We are primarily interested in the health care sector, where “quality” of health care providers is a major problem (Institute of Medicine, 2001), and where giving consumers

\(^{1}\)The quality outcomes of the two cases can be regarded as low and high quality. If quality is not observable, the only possible outcome is low. If quality is observable, the firm could choose to produce at quality high or low. Obviously, social surplus (the sum of profit and consumer surplus) could be higher in with low or high quality. It is easy to see the case in which observability improves social welfare. Here is the case in which observability reduces social welfare. Suppose social surplus is higher when quality is low, corresponding to the unobservable quality outcome. If quality were observable, the firm would evaluate its profits at quality high or low and choose accordingly. Depending on the shape of demand and cost functions, profits may be higher at the high quality given observability than at the low quality, and high quality would therefore be the outcome with disclosure. When profits are higher but social surplus is lower at quality high observability reduces social welfare.
and employers information about quality is being used as an instrument to try to improve quality. At the same time, the literature in health economics establishes that quality will be set inefficiently quite apart from observability due to problems of adverse selection. A plan or provider might set the qualities of its products too low (high) to deter (attract) certain groups of users. It can readily be seen that while revealing the quality of care might contend with one kind of efficiency problem, it might make the adverse selection problem worse. It is this concern that motivates our study of how to design quality reports in health care.

One set of results of our analysis is negative and expected: in the presence of another efficiency problem from adverse selection, reporting unobserved quality does not achieve the efficient quality. Furthermore, reporting quality may even make matters worse in comparison to unobserved quality. Another set of results, however, is positive, and at least to us, unexpected: while complete reporting of quality isn’t the right strategy, there is a way to design quality reports that does lead to the first-best quality. Furthermore, when the reporting policy is considered along with a “risk adjustment” policy of setting prices for various types of users, we can characterize the combination of risk adjustment and quality reports that minimizes the regulator’s cost of achieving the first-best quality of health care.

Section 2 of the paper reviews the policy problem of quality and quality reports in health care. Section 3 presents our basic model of quality reporting, and establishes some of our main results. We extend the model in Section 4 to integrate the polices of quality reporting and risk adjustment in order to characterize the optimal combination of the two instruments. Section 5... Section 6 concludes the paper with consideration of the implications of our analysis for design of and research on quality reports in health. Our work applies to other sectors, including education, and we also comment in this last section, on applying our ideas outside of health care.
2 Health Care Quality and Quality Reports

Recent reports from the National Academy of Sciences (Institute of Medicine, 2000, 2001) condemn the “chasmit” between actual and achievable quality, and the distressingly high rate of “medical errors,” in the U.S. health care system. Certain drugs or procedures should be provided to patients, but often they are not. [footnote with specifics]. Helpful tests are not conducted. [footnote]. Errors of commission harm patients. Low-skilled physicians and hospital staffs perform high-risk surgeries on patients resulting in needless deaths. [footnotes].

Prominent observers of the health care system believe that improving consumers’ ability to discern quality and choose on quality will improve the functioning of the U.S. health care system (Berwick, 2002; Eisenberg, 2002; Galvin and Milstein, 2002). Major efforts are underway by the federal and state governments, and by large private employers and employer groups, to systematically collect information about quality of plans and providers and to disseminate this information to buyers. In probably the most ambitious effort, the Centers for Medicare & Medicaid Services (CMS), a federal agency just released a list of ten quality ratings for 17,000 nursing homes nationally, and has plans to follow this with ratings for home health agencies, hospitals, and possibly doctors.2

Research is being conducted using focus groups, surveys, and data on consumer behavior to study how much information reaches consumers, how they understand and use the information, and how they respond to the information. There seems little question that consumers are interested in characteristics of plans and are prepared to choose on the basis of reliable information; the literature on the effect of premiums on choices establishes this clearly.3

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2 Consumers are invited to visit the “Nursing Home Compare” section of the CMS website at www.medicare.gov. See Pear (2002) for a recent news report on the CMS quality reporting policies.

3 For a recent paper in this literature, see Buchmueller and Feldstein (1996), which contains references to
Studies of the impact of health plan reports have found mixed results, but this is not surprising given the diversity of policies that walk under the banner of quality reports, and the heterogeneity in baseline information and other characteristics of the groups studied. Some studies have found no effect of health plan reports on consumer behavior.\(^4\) Beaulieu (2002) and Scanlon (2002), on the other hand, found a small effect of reporting on plan choices. If consumers are more confident about the information they have about quality, they are less likely to judge quality by price, and should be more responsive to price differences among plans, a result found by Wedig and Tai-Seale (2003) in their study of the impact of plan quality reports distributed to federal employees.

Provider level reports, particularly hospital reports, seem more potent, affecting the distribution of demand across hospitals and hospitals' efforts to alter quality in response. Galvin (1998) argues that consumers are more interested in reports about particular providers, rather than plan-level information. Reports on cardiac mortality among hospitals and surgeons have been or are being put into place in several states (Marshall et al., 2000). New York State reports have been credited with major shifts in demand, quality improvement initiatives at the hospital level, including staff changes, and in lives saved ( ). Massachusetts is now putting into place a system for reporting of cardiac procedures and outcomes, with extensive data analysis capability (SLN ).

Optimistic studies of report impacts about hospitals have come in from Ohio, New York, Pennsylvania and elsewhere.\(^5\) But see Dranove, Kessler, McClellan and Satterthwaite (2003).


\(^5\)See also Malenka and O'Connor (1995); Hannan and Sui (1995); Dziuban et al., (1994); Bentley and Nash (1998); Romano, Rainwater and Antnus (1999); Rosenthal et al. (1998). In the late 1980s, the Health Care Financing Administration published national reports of hospital mortality rates (Berwick and Wald, 1990). The hospital industry succeeded in having the reports discontinued, arguing that any demand response would be misled by invalid comparisons.
Some research has taken place on the content of the reports, though the emphasis in these studies is on factors such as cost of reporting, non-gameability, and relevance and understandability to consumers (Edgman-Levitan and Cleary (1996); Hibbard and Jewitt 1996, 1997).

Attention to the form and content of reports.

3 Choosing What to Report

In this section we develop a basic model of quality reports and service quality. In health care, prices paid to providers and health plans are often fixed by regulation, so we conduct our analysis in this context. Fixed prices also create a simple version of selection problem that makes our analysis more applicable to health care. In a later section, we let the regulator choose prices as well as the form of the quality report.

3.1 A Basic Model of Quality Reports and Service Quality

Consider a firm that offers two services, 1 and 2. Let $p_i$ denote the price of service $i$ and let $q_i$ denote the quality of service $i$. Let $C_i(q_i)$ be the unit cost of producing service $i$ at quality $q_i$, with $C_i'(q_i) = 0$, $C_i'' > 0$ for $q_i > q_i^*$ and $C_i'' > 0$, $i = 1, 2$.

There are two consumers, Consumer 1 and Consumer 2. Consumer $i$ wishes to buy, at most, one unit of service $i$ and he does not want to buy service $j \neq i$. Let $U_i(q_i)$ be the utility of Consumer $i$ from consuming service $i$ at quality $q_i$, where $U_i'(q) = \infty U_i' > 0$ for $q_i > q_i^*$ and $U_i'' < 0$.

We assume that the prices of the two services are fixed at $p_1$ and $p_2$, and, hence, the only choice the firm has to make is the quality level of the two services.

Consider first the case, later referred to as NI (for no-information) where the quality
of both services is not observable by consumers. In this case the firm has no incentive to increase quality of any of the services beyond its minimal level $q_i$, since such an increase will only increase its costs as prices are given and consumers cannot observe quality. Thus, in the NI case the firm will choose $q_i = q_i$ and Consumer $i$ will purchase service $i$ if and only if $U_i(q_i) \geq p_1$, $i = 1, 2$.

**Assumption 3.1:** $p_1 > U_1(q_1)$ and $U_2(q_2) > p_2 > C_2(q_2)$

Under Assumption 3.1, if quality is not observable, Consumer 1 will stay out of the market and Consumer 2 will purchase one unit of service 2. The social surplus in this case is:

$$W^{NI} = U_2(q_2) - C_2(q_2).$$

Suppose alternatively that the quality of both services is observable by the consumers, before purchasing the service. In this case, later referred to as FI (for full-information) the firm has no incentive to increase the quality of service 2 beyond $q_2$ since this will result only in higher costs without any change in revenues. The firm may, however, have the incentive to increase $q_1$ beyond $q_1$, since at $q_1$ Consumer 1 does not purchase the service.

Let $\hat{q}_1$ be the quality such that $U_1(\hat{q}_1) = p_1$. $\hat{q}_1$ is the lowest quality level at which Consumer 1 is willing to purchase the service.

**Assumption 3.2:** $U_1(\hat{q}_1) > C_1(\hat{q}_1)$.

Under Assumption 3.2, in the FI case, the firm will choose the quality $\hat{q}_1$ for service 1, $q_2$ for service 2 and both consumers are in the market when quality is observable.

The social surplus when quality is observable is, therefore,

$$W^{FI} = U_1(\hat{q}_1) - C_1(\hat{q}_1) + U_2(q_2) - C_2(q_2) > W^{NI}$$

A regulator who observes the products’ quality can increase social surplus by fully reporting the products’ quality to consumers. Notice, however, that consumers’ surplus has
not gone up, and neither has the quality of product 2, when quality became public.

In what follows we will show, however, that a regulator can improve social surplus and consumer surplus above those obtained in the full information case if instead of revealing the quality of both products separately the regulator reports a weighted average of the quality of the two products.

Assume again that the consumers cannot observe the quality of both products, but the Regulator can. Suppose that instead of revealing the quality of both products to consumers, the regulator reports an average quality $\bar{q}_\alpha$:

$$\bar{q}_\alpha = \alpha q_1 + (1 - \alpha)q_2,$$

where $q_i$, $i = 1, 2$ is the quality chosen by the firm for products 1 and 2, and $0 \leq \alpha \leq 1$.

More formally, let $M_\alpha$ be the following mechanism:

Stage 1: The regulator announces $\alpha$, $0 \leq \alpha \leq 1$.

Stage 2: The firm chooses $q_1$ and $q_2$.

Stage 3: The regulator observes $q_1$ and $q_2$ and announces: $\bar{q}_\alpha = \alpha q_1 + (1 - \alpha)q_2$.

Stage 4: Both consumers observe $\bar{q}_\alpha$ and each consumer $i$ decides whether or not to purchase product $i$.

Given $\alpha$, the mechanism $M_\alpha$ defines a game of incomplete information with three players, the firm and the two consumers. The equilibrium notion, to be called market equilibrium, ME, consists of the firm’s strategy, $(q_1^*(\alpha), q_2^*(\alpha))$, consumers’ strategies - a decision whether or not to purchase their desired product as a function of their beliefs about the products’ qualities - and consumers’ beliefs over the unobservable qualities, such that $(q_1^*(\alpha), q_2^*(\alpha))$ maximizes the firm’s profit given consumers’ strategies.
Each consumer’s strategy is optimal (i.e., maximizes his utility), for any possible information, given his beliefs. In equilibrium, the consumers’ beliefs are confirmed. These equilibrium conditions are standard requirements in the spirit of sequential (or perfect bayesian) equilibrium and hence do not require further explanation.

Let \((q_i^c(\alpha), q_2^c(\alpha))\) be the qualities chosen by the firm in equilibrium of the game defined by the mechanism \(M_\alpha\). One can easily see that when \(\alpha = 0\), \(q_i^c(0) = q_i\), for \(i = 1, 2\) and only Consumer 2 purchases. That is for \(\alpha = 0\) the equilibrium of the mechanism above coincides with the one where qualities where unobservable by consumers. Similarly, when \(\alpha = 1\), \(q_1^c(1) = \hat{q}_1\), \(q_2^c(1) = q_2\) and both consumers purchase. That is, when \(\alpha = 1\) the equilibrium of the mechanism above coincides with the one are both qualities are observable by consumers.

Consider now the case where \(0 < \alpha < 1\). It may be useful to see why in this case the full-information equilibrium is no longer an equilibrium. Suppose that \(q_1^c(\alpha) = \hat{q}_1\) and \(q_2^c(\alpha) = q_2\). That is suppose that given some \(0 < \alpha < 1\) the firm chooses the same levels of quality as the ones it would have chosen if quality were fully observed by consumers. If these are indeed the equilibrium qualities then in Stage 3 the regulator will announce \(\bar{q}_\alpha^{FI}\), where,

\[
\bar{q}_\alpha^{FI} = \alpha \hat{q}_1 + (1 - \alpha)q_2
\]

and, along the equilibrium path, in Stage 4, the consumers, observing \(\bar{q}_\alpha^{FI}\), must infer that \(q_1 = \hat{q}_1\) and \(q_2 = q_2\). This is so since in equilibrium, consumers’ beliefs about the firm’s actions (i.e. the choices of \(q_1\) and \(q_2\)) must be correct. We will show, however, that given that these are the consumers’ beliefs at \(\bar{q}_\alpha^{FI}\), there is another pair of qualities \((q'_1, q'_2)\) such that \(\alpha q'_1 + (1 - \alpha)q'_2 = \bar{q}_\alpha^{FI}\) that the firm can deviate to and increase it’s profit.

Suppose, therefore, that upon observing \(\bar{q}_\alpha^{FI}\) consumers believe that \(q_1 = \hat{q}_1\) and \(q_2 = q_2\) and hence both consumers purchase their desired service. In this case, however, the firm can
increase its profit by choosing the quality pair \((q'_1, q'_2)\) such that:

\[
\alpha q'_1 + (1 - \alpha) q'_2 = \bar{q}'_{FI}
\]

and

\[
\frac{C'_1(q'_1)}{\alpha} = \frac{C'_2(q'_2)}{1 - \alpha},
\]

instead of \((\hat{q}_1, \hat{q}_2)\).

Notice that \((q'_2, q'_2)\) is the quality pair that minimizes the firm’s total costs of producing one unit of each service subject to the constraint that the reported quality is equal to \(\bar{q}'_{FI}\). Thus, by deviating from \((\hat{q}_1, \hat{q}_2)\) to \((q'_1, q'_2)\) the firm’s revenue stays at \(p_1 + p_2\) since both consumers still observe \(\bar{q}'_{FI}\) and hence purchase their service (believing that the quality pair is \((\hat{q}_1, \hat{q}_2)\)) but the firm’s costs are lower, as \(C_1(q'_1) + C_2(q'_2) < C_1(\hat{q}_1) + C_2(\hat{q}_2)\). Thus \((\hat{q}_1, \hat{q}_2)\) cannot be the equilibrium choice of qualities when \(\alpha < 1\). The discussion above is essentially the proof of the following Lemma.

**Lemma 3.1** Let \((q^*_1(\alpha), q^*_2(\alpha))\) be an equilibrium in qualities of the game defined by \(M_\alpha\), \(0 < \alpha < 1\), then it must be that 

\[
\frac{C'_1(q^*_1(\alpha))}{\alpha} = \frac{C'_2(q^*_2(\alpha))}{1 - \alpha}.
\]

Notice that the requirement that upon observing \(\bar{q}_\alpha\), the consumers’ beliefs that \((q_1, q_2)\) satisfy ( ) must hold only along the equilibrium path. Without further restrictions on consumers’ beliefs off the equilibrium path, several equilibria may emerge, among them the (no-information) one where the firm simply chooses \(q_i = q_i\) for \(i = 1, 2\) and only Consumer 2 purchases his service. This equilibrium is supported by the off equilibrium beliefs that whenever the regulator reports \(\bar{q}_\alpha > \bar{q}_{\alpha NI} \equiv \alpha q_i + (1 - \alpha) q_j\) consumers believe that \(q_1 = q_i\) and \(q_2 = (\bar{q}_\alpha - \alpha \bar{q}_{\alpha NI})/(1 - \alpha) > q_{\alpha NI}\). Notice that if these are the consumers’ beliefs, only Consumer 2 will purchase his service, thus, in equilibrium the firm has no incentive to choose quality levels above \(q_i = q_i\) for \(i = 1, 2\).
Lemma 3.2 Let \((q_1^e(\alpha), q_2^e(\alpha))\) be an equilibrium pair of qualities of the game defined by \(M_\alpha\), \(0 < \alpha < 1\), then either:

a) \(q_i^e(\alpha) = q_i^{\hat{}}\) for \(i = 1, 2\) and only Consumer 2 purchases his desired service, or

b) \(q_i^e(\alpha) \geq q_i^{\hat{}}\), \((q_1^e(\alpha), q_2^e(\alpha))\) satisfy \(\frac{C_1^e(q_1^e(\alpha))}{\alpha} = \frac{C_2^e(q_2^e(\alpha))}{1 - \alpha}\) and both consumers purchase their desired service.

Assumption 3.3: Consumers’ beliefs off the equilibrium path are such that upon observing \(\bar{q}_\alpha\) they believe the \(q_1\) and \(q_2\) satisfy:

\[\alpha q_1 + (1 - \alpha)q_2 = \bar{q}_\alpha\]

and

\[\frac{C_1^e(q_1)}{\alpha} = \frac{C_2^e(q_2)}{1 - \alpha}\]

We can now present our main result

Proposition 3.1 There exists an \(\alpha, 0 < \alpha < 1\) such that under Assumption 3.3,

a) If \(\alpha < \underline{\alpha}\) the unique equilibrium of the game defined by \(M_\alpha\) is such that \(q_i^e(\alpha) = q_i^{\hat{}}\) for \(i = 1, 2\) and only Consumer 2 purchases service 2.

b) If \(\alpha > \underline{\alpha}\) the unique equilibrium of the game defined by \(M_\alpha\) is such that \(q_i^e(\alpha) = q_i^{\hat{}}\) and \(q_2^e(\alpha)\) satisfies \(\frac{C_1^e(q_1)}{\alpha} = \frac{C_2^e(q_2^e(\alpha))}{1 - \alpha}\) and both consumers purchase their desired service.

Proof Let \(\alpha\) be such that \(q_2(\alpha)\) satisfies ( ) and

\[\pi(\hat{q}_1, q_2(\alpha)) = p_1 - C_1(\hat{q}_1) + p_2 - C_2(q_2(\alpha)) = \pi(q_1^e, q_2^e)\]

Notice that by our assumption such an \(\alpha\) always exists, \(0 < \alpha < 1\) and that at \(\alpha\) the firm is just indifferent between producing \((\hat{q}_1, q_2(\alpha))\) and selling to both consumers and producing \((\bar{q}_1, q_2(\alpha))\) and selling only to consumer 2. Furthermore by ( ) we know that \(dq_2(\alpha)/d\alpha < 0\)
and hence for every \( \alpha > \underline{\alpha} \), \( \pi(q_1, q_2) > \pi(q_1, q_2) \) and the firm will choose the qualities given by Proposition 3.1 (b); and for \( \alpha < \underline{\alpha} \), \( \pi(q_1, q_2) > \pi(q_1, q_2) \) and hence the firm will choose the qualities given by Proposition 3.1 (a).

3.2 Welfare Properties

We are now ready to discuss the welfare properties of the equilibrium studied above. We will show that there always exists a mechanism \( M_\alpha \) with \( \underline{\alpha} \leq \alpha < 1 \), such that social surplus under this mechanism is higher than the social surplus where no information is reported to consumers (\( \alpha = 0 \)) or when full information is reported (\( \alpha = 1 \)).

Let \( W(\alpha) \) be the social surplus at the equilibrium given in Proposition 3.1. One can see that

\[
W(\alpha) = U_1(q_1) - C_1(q_1) + U_2(q_2(\alpha)) - C_2(q_2(\alpha))
\]

for \( 1 \geq \alpha \geq \underline{\alpha} \), and

\[
W(\alpha) = U_2(q_2) - C_2(q_2)
\]

for \( 0 \leq \alpha < \underline{\alpha} \).

One can also see that

\[
W(1) = W^{FI} > W^{NI} = W(0).
\]

Full information, however, is not where social surplus is maximized.

**Proposition 3.2** There exists an \( \alpha^* \), \( \underline{\alpha} \leq \alpha^* < 1 \) such that \( W(\alpha^*) > W^{FI} \).

**Proof** Follows simply from \( (\_\_\_) \) and the fact that \( dW(1)/d\alpha < 0 \). Thus, for a given price \( (p_1, p_2) \) the mechanism \( M_\alpha^* \) maximizes social surplus. One can also see that the mechanism \( M_\alpha^* \) maximizes the consumers’ surplus. Notice, however, that for a given price, \( M_\alpha^* \) does not necessarily implement the first best levels of qualities, as follows from the following corollary.
Corollary Let $q_i^*$ be the (first best) level of quality at which $U_i'(q_i^*) = C_i'(q_i^*)$. A necessary condition for $M_\alpha$ to implement the first best levels of quality $q_i^*$, $i = 1, 2$ is that $p_1 = U_1(q_1^*)$.

4 The Choice of Optimal Prices

In the analysis so far the prices of the two products were taken as given. If, in addition to choosing whether or not to reveal information about products’ quality the regulator can choose prices, the first best level of quality, $q_i^*$, $i = 1, 2$, can be easily implemented. The regulator can simply choose $p_i^* = U_i(q_i^*)$ and reveal all the information about qualities to consumers. In this case the firm will produce $q_i = q_i^*$, for $i = 1, 2$ and extract the entire social surplus. One can show, however, that a mechanism of the type studied above, can also implement the first best, at a lower cost to consumers.

Suppose that in addition to choosing the reporting strategy, the regulator can decide on the prices of the two products. Thus let $M_\alpha(p_1, p_2)$ be the mechanism studied above with the only modification that in the first stage, the regulator publicly announces $(p_1, p_2)$ in addition to $\alpha$.

Assume that the regulator’s objective is to implement the socially efficient levels of quality at the lowest cost to consumers. That is, let $q_i^e(\alpha, p_1, p_2) = 1, 2$, be the equilibrium qualities for the mechanism $M_\alpha(p_1, p_2)$. Then the regulator’s objective is to find $\alpha$, $p_1$ and $p_2$ that solve the following problem:

$$\text{Min } p_1 + p_2$$

$$\text{s.t. } q_i^e(\alpha, p_1, p_2) = q_i^*, \ i = 1, 2.$$  

Let $(\alpha^0, p_1^0, p_2^0)$ be the solution to the problem above.

Using Proposition ( ) one can see that $\alpha^0$ is independent of the prices and is given by:

$$\frac{C_1'(q_1^*)}{\alpha^0} = \frac{C_2'(q_2^*)}{1 - \alpha^0}$$
Thus, the regulator’s problem is to find the pair of prices \((p_1^0, p_2^0)\) that, given \(\alpha^0\), implements the first best at lowest costs to consumers. Notice that the mechanism \(M_{\alpha^0}(p_1^*, p_2^*)\), where \(p_i^* = U_i(q_i^*)\) is a feasible mechanism that implements the first best levels of quality. Thus, the full information outcome can be induced by the mechanisms above. However, as Proposition ( ) below states, there always exists a mechanism that implements the first best levels of qualities at lower costs to consumers. The basic idea is that given corollary ( ) the regulator must set the price of one of the two products equal to the full information price, \(p_i^*\), but then the price of the other product can be set lower than \(p_j^*\) and still the firm will choose \((q_i^*, q_j^*)\).

**Proposition:** Either \(p_1^0 = p_1^*\) and \(p_2^0 < p_2^*\) or \(p_1^0 < p_1^*\) and \(p_2^0 = p_2^*\).

**Proof:** From Corollary ( ) we know that \(p_i^0 = p_i^*\) for either \(i = 1\) or \(i = 2\). Furthermore in order for \((p_1^0, p_2^0)\) to implement the first best levels of quality the following conditions must hold:

\[
p_1^0 + p_2^0 \geq C_1(q_1^*) + C_2(q_2^*)
\]

which means that the firm at least covers its costs at \((q_1^*, q_2^*)\), since otherwise it could simply exit the market.

The other condition that must hold is that if \(p_i = p_i^*\) then either \(p_j^0 > U_j(q_j)\) or \(p_j^0 < C_j(q_j)\). If at least one of these conditions is satisfied the firm has no incentive to deviate from \((q_1^*, q_2^*)\) to \((q_1, q_2)\) and sell only product \(j\) (Notice that if \(p_i^0 = p_i^*\), it must be that \(p_i^0 > U_i(q_i)\) and Consumer \(i\) will never buy product \(i\) at the price \(p_i^0\)). If the first condition above holds, Consumer \(j\) will not buy the product at the price \(p_j^0\) and quality \(q_j\) and if the second condition holds the firm will lose money if it deviates to \(q_j\) at the price \(p_j^0\).

Thus, if \(p_i = p_i^*\) and

\[
p_j' = \max\{U_j(q_j), C_j(q_j^*)\}
\]
the mechanism $M_{\alpha'}(p'_1, p'_2)$ implements $(q'^*_1, q'^*_2)$ at cost to consumers $p'_1 + p'_2 < p'^*_1 + p'^*_2$, since $p'_j < p'^*_j$. 