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Can competition reduce quality?

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March 23, 2012

Abstract

We study the effect of competition on quality in markets such as health care, long-term care and education, when providers choose both prices and quality in a setting of spatial competition. We offer a novel mechanism whereby competition leads to lower quality. This mechanism relies on two key assumptions, namely that the providers are motivated and risk-averse. Our proposed mechanism can help explain several empirical findings of a negative effect of competition on quality.

Keywords: Quality and price competition; Motivated providers; Risk-averse providers.

JEL classification: D21, D43, L13, L30

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1 Introduction

Quality is a key concern for consumers in many sectors such as health, long-term care and education. Hospitals, nursing homes, schools and universities compete on quality to attract patients, residents and students. While in some countries prices are typically regulated and fixed, in other countries they are not. In this study we focus on institutional settings where providers compete both on quality and price. For example, prices are variable in the hospital sector in the US for patients who are not part of public programmes such as Medicare (for the elderly) or Medicaid (for the poor). In England, the government recently discussed whether public insurers should be able to negotiate prices with public hospitals, so that they would compete not only on quality but also on price. It was ultimately decided not to allow competition on prices due to concerns that quality may suffer (a fixed price regulation regime has therefore been maintained; Kmietowicz, 2011). In the UK, France and the US, long-term care institutions (e.g., nursing homes, residential homes) compete on prices to attract residents in addition to quality. Universities in the US, and from 2012 in the UK, compete on prices in addition to quality. In the UK nurseries offer different services in combination with different prices for child care, and therefore also compete on price and quality.

In this study we investigate whether competition among providers can lead to a reduction in quality when providers compete on both quality and price. We do so in a spatial Hotelling-type model, which is a standard framework for studying quality competition in sectors like health care or education. We show that competition can reduce quality in addition to prices when two assumptions hold: i) the provider is motivated and has a genuine concern for quality; ii) the marginal utility from profits is decreasing. We think that both assumptions are likely to hold in the type of sectors we have in mind. The first assumption has been well recognised in the health economics and motivated agents literature. The second assumption is also reasonable for providers with concentrated ownership, for liquidity-constrained providers, and for firms and organisations where control has been delegated to risk-averse managers.¹

In our Hotelling spatial set-up we model competition as the equivalent of lower transportation costs. The existing literature already points out two counteracting effects generated by compe-

¹See Section 2 for references and further discussion of both of these assumptions.

tion. While more competition increases the incentives to supply high quality for given prices, more competition also reduces the price-cost margin, which, in turn, reduces the incentives to invest in quality. Ma and Burgess (1993) report that the direct effect of more competition on quality is exactly offset by the indirect effect via lower prices so that overall there is no effect of more competition on quality. The same result is reported by Gravelle (1999). Thus, the existing spatial economics literature offers little insight about the determinants of the relative strength of the two above-mentioned effects. In particular, no specific mechanisms have been proposed that could produce a negative relationship between competition and quality.^{2,3} We show that under the two above-mentioned assumptions, a third effect emerges and competition actually reduces quality. The intuition is that more competition leads to lower prices, which in turn reduces profits and increases the marginal utility from profits. Being motivated, the providers work at a negative profit margin and will therefore respond optimally to fiercer competition by reducing quality in order to recover some of the profit losses generated by the price reduction.

Our proposed mechanism might rationalise some of the empirical evidence which finds a negative relationship between quality and competition. For example, Mukamel et al. (2002) find that competition increased mortality from 1982 to 1989 in California; Volpp et al. (2003) investigate the effect of price deregulation in New Jersey from 1990 to 1996 and find an increase in mortality; Propper et al. (2004) and Burgess et al. (2008) find in England a negative relationship between competition and quality (a positive relation between competition and mortality rates for patients with heart attack) when fixed-price regulation was not yet introduced and prices were allowed to vary. Grabowski (2004) finds that competition reduces the quality of nursing homes in the US.⁴

2 Model and analysis

Consider a market with two providers located at each endpoint of the line segment $S = [0, 1]$. Consumers are uniformly located on S with a total mass of one, and each consumer demands

²Using a Salop model, Economides (1993) finds that a higher number of firms leads to lower equilibrium quality, but this is purely due to a demand effect and not related to competition *per se*.

³In a very different theoretical framework, with monopolistic competition, imperfect information and consumer search, Dranove and Satterthwaite (1992) show that improved price information might reduce quality provision, possibly to the extent that welfare is reduced.

⁴See also Gaynor (2006) for survey on the effects of competition on quality in health care markets.

one unit from the most preferred provider. The utility of a consumer located at $x \in S$ and buying from provider i is given by

$$U(x) = \begin{cases} v + q_1 - tx - p_1 & \text{if } i = 1 \\ v + q_2 - t(1-x) - p_2 & \text{if } i = 2 \end{cases}, \quad (1)$$

where v is gross consumer surplus, q_i is the quality of provider i , p_i is the price charged by provider i and t is a transportation cost parameter measuring the importance of travelling distance relative to quality differences.

Each consumer makes a utility-maximising choice of provider, which gives the demand for provider 1 as

$$D_1 = \frac{1}{2} + \frac{1}{2t}(q_1 - q_2 - (p_1 - p_2)), \quad (2)$$

while demand for provider 2 is $D_2 = 1 - D_1$. Lower travelling costs make demand for each provider more price- and quality-elastic. Thus, following the standard practice in the literature, we will measure the degree of competition in the market by t^{-1} .

Profits for provider i is given by

$$\pi_i = (p_i - c)D_i - g(q_i), \quad (3)$$

where c is the marginal cost of providing the good and $g(q_i)$ is the fixed cost of quality with $g_{q_i} > 0$ and $g_{q_i q_i} > 0$.

The objective function of provider i is given by

$$U^i(q_i, \pi_i). \quad (4)$$

We make two critical assumptions. First, we assume that providers are motivated and have a concern about quality: $U_{q_i} > 0$ and $U_{q_i q_i} \leq 0$. This could be due to altruism or motivation. This assumption is likely to hold in the health, long-term care and education sectors, as well as other public sector industries. In the health economics literature, it has long been recognised that providers (doctors, nurses, health care managers) are, at least to some extent, altruistic.⁵ This

⁵See, e.g., Ellis and McGuire, 1986; Chalkley and Malcomson, 1998; Eggleston, 2005; Jack, 2005.

assumption is also made in the recent literature on motivated agents in the broader public sector, where the agent is assumed to share, to some extent, the objective function of the principal.⁶ The main idea is that organisations that provide public (or publicly-provided private) goods have a mission, and individuals who work in such organisations are ‘mission-oriented’ or ‘motivated’. Examples given in this literature include doctors and nurses who are committed to improve health, teachers who care about good learning, and researchers who are committed to expanding knowledge.

Second, we also allow for risk-averse providers by assuming that $U_{\pi_i}^i > 0$ and $U_{\pi_i\pi_i}^i < 0$. There are several reasons why firms or organisations in general might display risk-averse behaviour, such as concentrated ownership or delegation of control to risk-averse managers whose remuneration is linked to firm performance. A firm’s payoff function might also be concave in profits due to liquidity constraints and costly financial distress. If external financing is more costly than internal financing, the firm’s marginal value of profits will decrease with the profit level. Thus, the assumption of decreasing marginal utility of profits might be particularly relevant for organisations that have small profit margins or that are close to breaking even.⁷ In the context of health care markets, which is one of the main applications of the present note, the assumption of risk-averse hospitals have been used by, e.g., Hodgkin and McGuire (1994), Mougeot and Naegelen (2008) and Felder (2009).

To keep the analysis simple we assume that $U_{\pi_i q_i}^i = 0$ since this is not critical for our main result. We assume that the two providers choose price and quality simultaneously. The first-order conditions for the optimal quality and price for provider i are, respectively,

$$U_{q_i}^i + U_{\pi_i}^i \left(\frac{p_i - c}{2t} - g_{q_i} \right) = 0 \quad (5)$$

and

$$U_{\pi_i}^i \left(D_i - \frac{p_i - c}{2t} \right) = 0. \quad (6)$$

⁶See, e.g., Francois (2000); Besley and Gathak (2005); Delfgaauw and Dur (2008); Prendergast (2007); Makris (2009).

⁷See, e.g., Asplund (2002) and Banal-Estañol and Ottaviano (2006) for further discussions about risk-averse firms.

The symmetric Nash equilibrium, denoted by q^* and p^* , has quality and price given by⁸

$$U_{q^*} + U_{\pi} \left(\frac{p^* - c}{2t} - g_{q^*} \right) = 0 \quad (7)$$

and

$$U_{\pi} \left(\frac{1}{2} - \frac{p^* - c}{2t} \right) = 0. \quad (8)$$

From the optimality condition on price we obtain:

$$p^* = c + t \quad (9)$$

Thus, more competition, in the form of lower transportation costs, reduces the price. Substituting $p^* = c + t$ into the condition for optimal quality yields

$$U_{q^*} + U_{\pi} \left(\frac{1}{2} - g_{q^*} \right) = 0. \quad (10)$$

What is the effect of more competition on quality? Differentiating (10) with respect to t , and keeping in mind that equilibrium profit is $\pi = \frac{t}{2} - g(q^*)$, we derive

$$\frac{\partial q^*}{\partial t} = \frac{\frac{1}{2} U_{\pi\pi} \left(\frac{1}{2} - g_q \right)}{- \left[U_{qq} - U_{\pi} g_{qq} + U_{\pi\pi} \left(\frac{1}{2} - g_q \right)^2 \right]} > 0, \quad (11)$$

where the denominator is positive by the second-order condition. From (10), notice that $\left(\frac{1}{2} - g_q \right) = -\frac{U_q}{U_{\pi}} < 0$. Therefore, more competition *reduces* quality. The intuition for our key result is the following. More competition generates three effects. First, it makes the demand more responsive to a marginal increase in quality. For a given mark-up ($p^* - c = t > 0$), this effect tends to increase quality. However, more competition also reduces the mark-up, which reduces the marginal profit from an increase in quality. These two effects offset each other completely. Under our two critical assumptions, there is however a third effect. More competition reduces the price, which in turn reduces profits and increases the marginal utility from profits. Since providers are motivated, the marginal profit of quality is negative in equilibrium ($\frac{1}{2} - g_q < 0$).

⁸The second-order conditions are: i) $d^2 U^i / dq_i^2 = U_{q_i q_i} - U_{\pi_i} g_{q_i q_i} + U_{\pi_i \pi_i} \left(\frac{p_i - c}{2t} - g_{q_i} \right)^2 < 0$, ii) $d^2 U^i / dp_i^2 = U_{\pi_i \pi_i} \left(D_i - \frac{p_i - c}{2t} \right) - U_{\pi_i} \left(\frac{1}{t} \right) = -U_{\pi_i} \left(\frac{1}{t} \right) < 0$; iii) $d^2 U^i / dq_i^2 \times d^2 U^i / dp_i^2 > 0$.

Therefore, each provider responds optimally to more competition by reducing quality in order to recover some of the profit losses generated by the price reduction.

Notice the criticality of our two key assumptions. If marginal utility does not decrease with higher profits, then $U_{\pi\pi} = 0$ and $\partial q^*/\partial t = 0$. If the marginal utility is constant, variations in profits do not affect the relative willingness to provide quality. If the provider is not motivated, then $U_q = 0$, $\frac{1}{2} - g_q = 0$ and $\partial q^*/\partial t = 0$. In this case, quality is set to maximise profits so that, by the Envelope Theorem, a marginal reduction in quality has no effect on profits.

3 Conclusions

The relationship between competition and quality in sectors like health care, elderly care and education, is a hotly debated policy issue in several countries. While several empirical studies have found a negative relationship between competition and quality in these sectors, the existing theoretical literature is lacking in terms of offering precise mechanisms that can explain these findings. In this note we have offered one such possible (and novel) mechanism and shown that this mechanism relies on two key assumptions, namely that the providers are *motivated* and *risk-averse*. For given quality levels, fiercer competition results in lower profits due to lower prices. We have shown that providers with the two above-mentioned characteristics will respond by lowering their quality in order to recover some of these profit losses.

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