Price and quality in spatial competition

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ABSTRACT

We study the relationship between competition and quality within a spatial competition framework where firms compete in prices and quality. We generalise existing literature on spatial price–quality competition along several dimensions, including utility functions that are non-linear in income and cost functions that are non-separable in output and quality. Our main message is that the scope for a positive relationship between competition and quality is underestimated in the existing literature. If we allow for income effects by assuming that utility is strictly concave in income, we find that lower transportation costs always lead to higher quality. The presence of income effects might also reverse a previously reported negative relationship between the number of firms and equilibrium quality. This reversal result is further strengthened if there are cost substitutabilities between output and quality. Equilibrium quality provision is always less than socially optimal in the presence of income effects.

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1. Introduction

Does more competition induce firms to produce higher quality goods or services? If firms compete along two different dimensions — price and quality — there are two basic counteracting effects of competition on incentives to provide quality. 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.[1] Thus, the net effect of competition on quality is *a priori* uncertain from a theoretical perspective.

In the present paper we analyse theoretically the relationship between competition and quality in a framework of spatial competition, in order to pinpoint what determines the relative strengths of the two counteracting effects mentioned above. We choose a spatial competition framework for two main reasons. First, this framework is well-suited for studying competition effects, since it provides us with

two different and precise measures of the intensity of competition in the market, namely *firm density* and *transportation costs*. Second, much of the existing empirical work on this topic, which is quite scant, has focused on industries that fit the spatial competition framework quite well.

Quality is inherently difficult to measure, and the empirical literature on the relationship between competition and quality is therefore limited.[2] Furthermore, as noted by Arora et al. (2010), this question has been mainly studied empirically in local service markets, which are naturally characterised by spatial competition. For example, Domberger and Sherr (1989) find that introduction of competition for conveyancing services in the UK increased the quality of the legal services offered. Similarly, Liao and Chuang (2004) report a positive relationship between the number of rival firms and quality in local fast food markets. Both of these studies are based on questionnaire data.

The empirical link between competition and quality has been perhaps most extensively studied in health care markets. Quality in health care is clearly a key issue and the effect of competition on

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[1] If prices are exogenous (e.g., due to price regulation), the latter effect disappears and the relationship between competition and quality is generally expected to be positive. See, e.g., Ma and Burgess (1993), Calem and Rizzo (1995), Wolinsky (1997), Brekke, Nuscheler and Straume (2006, 2007).

[2] A related but slightly different question is the relationship between market size and quality provision. For empirical studies of this question, see Dick (2007) for the case of banking markets and Berry and Waldfogel (forthcoming) for the case of restaurant and newspaper markets.

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quality is therefore of great policy relevance. This is also an example of a market where the firms (health care providers) compete in space. In addition to quality, there is strong empirical evidence that travelling distance is one of the main predictors of patients' choice of health care provider (see, e.g., Kessler and McClellan, 2000; Tay, 2003). Although the picture is somewhat mixed, the majority of studies find a positive relationship between competition and quality in health care markets where price is also a choice variable for the suppliers. Based on US data, and using various measures of competition and quality, a positive relationship is found by, e.g., Dranove et al. (1992), Sari (2002), Gowrisankaran and Town (2003), Howard (2005) and Abraham et al. (2007). However, Propper et al. (2004, 2008) find a significant (though small) negative relationship, based on UK data.[3]

A highly related type of spatial market with quality–price competition is the market for nursing homes. Starkey et al. (2005) find that in the US nursing home market some forms of competition, like the availability of nursing home substitutes and the level of excess demand, are significantly positively related to nursing home quality. In the same vein, Castle et al. (2008) find that following the introduction of report cards in the US, which provide more information about the quality of services for different providers, the quality improvements were more significant in the most competitive markets.

There are also a few empirical studies of the competition–quality relationship in the airline industry. One reason why this industry readily lends itself to the study of quality competition is the availability of a good quality measure, namely the frequency of on-time flight departures. Airline markets are also often modelled in a spatial competition framework, as the time-scheduling of flights can be interpreted as locations on a time line.[4] Using the frequency of on-time flight departures as a measure of quality in the US airline industry, Mazzeo (2003) finds a positive correlation between competition and quality, a result that is confirmed by Rupp et al. (2003). A positive relationship between competition and quality is also suggested by Prince and Simon (2009), when they find that multi-market contact negatively affects service quality in the US airline industry.

Although there are some mixed results, the main picture painted from the above-referred empirical studies of quality in spatial competition is that increased competition generally leads to a higher supply of quality. However, the existing theoretical literature on spatial competition (with mill pricing) is not able to explain these empirical findings. To our knowledge there are three different papers that address the relationship between competition and quality when firms also compete on prices. None of these papers report a positive relationship between competition and quality within a spatial framework. Using the transportation costs as an inverse measure of the degree of competition, Ma and Burgess (1993) report no effect of more competition on quality incentives. In their paper, the direct effect of more competition on quality incentives is exactly offset by the indirect effect via lower prices. The same result is reported by Gravelle (1999). Using the number of firms as a competition measure, Economides (1993) finds that more firms in the market *reduce* the incentives to invest in quality. Since a higher number of firms reduces the potential demand for each single firm, the returns to quality investments are correspondingly reduced.

In the present paper, we revisit the existing theoretical literature on price and quality competition in a spatial framework. We use a Salop-type model where firms have different locations, referring to product space or geographical space. In this set-up, we allow for price–quality competition. For the main part of the analysis, we assume that firms choose price and quality simultaneously. In an extension to the main model, we also allow for sequential choices, where quality is treated more as a long term variable. We take a closer look at the effects of spatial competition on quality and prices by extending and generalising previous work along several dimensions. First, and most importantly, we allow for income effects by assuming that the utility function is concave in the numeraire good. Second, we decompose the transportation costs into monetary and non-monetary costs. While non-monetary transportation costs affect utility directly, monetary transportation costs add to the consumption expenditures and affect utility through the budget constraint. This distinction should be particularly relevant with respect to different interpretations of the competition space. For example, if competition takes place in geographical space, the transportation costs are monetary costs of physical travel. On the other hand, if competition takes place in product space, transportation costs must be understood as the (non-monetary) disutility of consuming a less-than-ideal product variety. Third, we apply general benefit and production cost functions where we allow for quality and output to be either cost complements or cost substitutes.

Our theoretical analysis produces two main results. First, the relationship between competition and quality depends crucially on the presence of income effects; i.e., whether utility is linear or strictly concave in income. If utility is linear in income, more competition — as measured by lower transportation costs — leads to lower prices but has no effect on quality, since the two aforementioned effects exactly cancel each other out (as in Ma and Burgess, 1993; Gravelle, 1999). Clearly, this is a special case. If we allow for utility to be strictly concave in income, the dampening effect of competition on quality incentives via a lower price–cost margin is smaller, implying that the net effect is positive: lower transportation costs always lead to *higher* quality in equilibrium. This conclusion holds regardless of whether we are considering monetary or non-monetary transportation costs. In a simplified version of the model, we also show that this conclusion is robust to the case where quality and price choices are made sequentially.

Second, the degree of cost substitutability between output and quality is important in determining the quality effects of a higher number of firms in the market. With constant marginal utility of income and cost independence between quality and output, we replicate the result by Economides (1993) that more firms lead to lower quality (which is due to the lower demand for each firm). However, we show that this result is reversed for a sufficient degree of cost substitutability between quality and output (more firms reduce demand which in turn reduce the marginal cost of quality, ultimately inducing an increase in quality). Furthermore, with decreasing marginal utility of income we can establish a positive relationship between firm density and equilibrium quality even for (mild) cost complementarities.

These two results suggest that the special assumptions of linear utility functions and cost separability between quality and output are not innocuous and have led to an underestimation of the scope for competition to improve quality in the spatial competition literature. By generalising the standard spatial competition framework along these two dimensions, we are able to reconcile the theory with several empirical findings of a positive relationship between competition and quality in spatial markets.

We also show that the relationship between competition and prices is not necessarily straightforward. More specifically, we show that increased competition in the form of lower *monetary*

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[3] For more references, see the comprehensive survey by Gaynor (2006) on competition and quality in health care markets.

[4] For analyses of airline competition in a spatial framework, see, e.g., Borenstein and Netz (1999) and Salvanes et al. (2005).