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Can Competition Keep the Restrooms Clean? Price, Quality and Spatial Competition*

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Abstract

This article investigates the influence of competition on price and product quality among Austrian camping sites, a market characterized by both horizontal (spatial) and vertical product differentiation. Theoretically, the effect of competition on quality is ambiguous and depends on the degree of cost substitutability between output and quality. Estimating a system of equations shows that intense competition has a positive impact on product quality and a negative effect on prices (conditional on quality). As high quality is associated with high prices, the total effect of competition on prices is rather small.

Keywords: Spatial competition, product quality, retail prices, retail markets, camping sites

JEL code: D22, L13, L81, R32

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1 Introduction

This article investigates the impact of the intensity of competition on prices and product quality in a spatially differentiated market. While many retail markets are characterized by both horizontal (spatial) and vertical product differentiation, theoretical and empirical articles accounting for both dimensions of product differentiation are rather scarce. This might be explained by the difficulty of measuring product quality, which can at times only be assessed during or after the consumption of the product (experience good). This is not only a problem for economists analyzing certain markets, but also for consumers who have to base their buying decision on a posted price and on an (at least to some extent) unknown product quality. We know from Akerlof (1970) that with this information asymmetry between buyers and sellers in place, there might be a market for the worst quality products only. To reduce uncertainty and to establish a market for high quality goods there are numerous (independent) organizations assessing product quality in certain markets and publishing their results in respective guides. This includes markets for diverse products such as cars, wine, food in general, restaurants, hotels, or – as analyzed in this article – camping sites.

While the empirical literature on the relationship between prices, quality and competition is rather extensive, most articles focus on (reduced form) price equations while treating quality as exogenous explanatory variables.[1] The literature on quality competition is less comprehensive: Most of these articles analyze the health care market, where prices are often regulated and/or paid by insurances rather than directly by the consumers (see Gaynor, 2006, for an extensive survey of empirical contributions on this industry). Empirical evidence on other industries is rather scarce: Mazzeo (2003), for example, finds that competition reduces delays in the airline industry, and Matsa (2011) provides evidence that competition reduces stockouts in U.S. supermarkets. While both articles find that competition enhances product

[1]The empirical literature investigating the price effect of quality differences usually estimate a hedonic price equation, as done (for example) for wine (Combris et al., 1997; Benfratello et al., 2009; Roma et al., 2013; Pennerstorfer et al., 2017) or hotels (Andersson, 2010). Empirical contributions explicitly accounting for the intensity of competition include, among others, studies on restaurants (De Silva et al., 2013) or hospitals (Mobley, 2003; Mobley et al., 2009).

quality, they do not include the firms' pricing decisions in their analyses. Investigating either prices or quality rather than both variables simultaneously is an obvious limitation in these articles, as firms will choose their optimal combination of price and product quality to maximize profits.

There are only a few empirical articles outside the health industry considering both quality and prices as strategic variables when analyzing the impact of the intensity of competition. The findings of these articles regarding the effect of competition on product quality are mixed: Domberger et al. (1995), investigating competitively tendered contracts for cleaning services, provide evidence that competition reduces prices and maintains or even enhances product quality. Emmons and Prager (1997) investigate the impact of competition in the US cable television industry on prices and quality (measured by the number of channels) in local markets, and find that tougher competition reduces prices while leaving quality unaffected. Their results, however, are based on reduced-form price and quality equations only, without estimating interaction effects between these two variables. Fan (2013) analyzes a two-sided market (daily newspapers in the US), where firms set prices for both consumers (subscription prices) and advertisers (advertising rates). Based on a structural model and merger simulations she finds that a merger between two firms (i.e. a reduction in competition) increases subscription prices, reduces advertising rates, but also reduces product quality.

Similar to the empirical findings the theoretical literature investigating the effect of competition on product quality also provides mixed results (see section 2 below for thorough a discussion). The findings of the theoretical articles indicate that the effect of competition on product quality is closely related to firms' costs of providing high quality products. To emphasize the relationship between firms' production costs and quality provision I propose a spatial competition model characterized by a very general cost function. The results of this model suggest, first, that tougher competition enhances product quality if and only if the degree of production cost substitutability between quantity and quality is high enough (i.e. higher than consumers' marginal utility of quality). If cost substitutability is high enough for competition to increase quality, then, second, product quality is associated with higher prices. Therefore, third, conditional on product quality more competition reduces prices, while the unconditional effect is ambiguous.

This article contributes to the scarce empirical literature on spatial markets with endogenous price and quality choice by testing these predictions for the market for camping sites. In the empirical application I estimate the effect of competition (measured by the number of rivals in the vicinity) on prices and product quality in a system of equations, treating product quality as an endogenous variable in the price equation. Variables based on the nationality of tourists are used to identify the effect of product quality, assuming that the (marginal) valuation of quality differs between consumers across countries. Estimating a system of equations is preferred over a reduced form model because, first, this approach provides evidence on the strength of the interaction between the two choice variables (price and quality) and, second, the theoretical model proposed in this article predicts a price dampening effect of competition conditional on product quality, while the unconditional effect remains ambiguous.

The remainder of the article is organized as follows: Section 2 sets up the model and derives testable hypotheses of the effect of competition on (equilibrium) price and quality. Section 3 provides information on the industry and describes the data sources used in the empirical analysis. Additionally, this section describes the measures of price and product quality and discusses controlling for (endogenous) location choice of firms and identifying the system of equations. The results of the main specifications are presented in section 4 and results from the sensitivity analysis are reported in section 5. The concluding section 6 discusses the results, policy conclusions and directions for future research.

2 Model

To decide on a suitable vacation, tourists have to choose the holiday destination (region) and the type of lodging (e.g. hotel, bed and breakfast, camping site). It is reasonable to argue that consumers choose the destination and decide whether they intend to go on a camping holiday (or prefer a different type of accommodation) before picking a particular camping site. Deciding beforehand whether to camp or to stay at a different type of accommodation is fundamental, as camping typically requires very specific equipment. After making these decisions tourists can choose among a limited number of firms scattered across a particular destination. This situation can be described appropriately by models of spatial product differentiation, where products differ because of physical travel costs when switching from one supplier (accommodation) to another or due to the disutility when choosing a variety in the geographic space that is less than ideal. In addition to spatial product differentiation camping sites differ with respect to their quality, and products may also differ in other (horizontal) ways.

There are two different strands of literature to model markets with goods differentiated in multiple dimensions: The first one is in the tradition of Hotelling (1929) and extends the 'linear city model' to a two- (Tabuchi, 1994; Veendorp and Majeed, 1995), three- (Ansari et al., 1998) or an $m > 1$-dimensional (Irmen and Thisse, 1998) geographic and/or product space. All these articles find that the two rivaling firms maximize differentiation in the most important characteristic, but minimize differentiation in all other dimensions.[2] A similar result is obtained by Neven and Thisse (1990) for a market with both vertical and horizontal product differentiation, namely that firms maximize differentiation in the most important dimension while minimizing differentiation in the other category. The attractive feature of this type of models is that the location decision in (geographic or product) space can be explicitly addressed. All these contributions, however, restrict their analysis to duopolistic markets, impeding to draw conclusions on the relationship between the intensity of compe-

[2]Elizalde (2013) provides convincing empirical evidence for this theoretical result: When analyzing the Spanish movie theater exhibition market, where products are differentiated by their geographical location and by the set of movies exhibited, he finds a trade-off between the product differentiation in these two dimensions. Additionally, the author finds that firms choose to maximize differentiation in the location dimension if distance is important (i.e. when the local market is large) but minimum spatial differentiation when distance is less important (i.e. when the local market is small), supporting the theoretical result that firms choose maximum differentiation in the dominant characteristic.

tition, product characteristics and prices.

I therefore follow the second strand inspired by Salop's (1979) circular city model. A few theoretical contributions applying this model framework allow for both horizontal (spatial) and vertical product differentiation when analyzing the effects of competition on firm behavior (Economides, 1993, Gravelle, 1999, and Brekke et al., 2010). To ensure analytical tractability only symmetric equilibria are investigated. The results derived in these models differ: Gravelle (1999) finds that competition does not influence product quality, as opposed to a negative impact derived by Economides (1993). All models, however, predict lower equilibrium prices when competition increases. While these models use very specific cost functions, Brekke et al. (2010) present a more general theoretical model. Due to the general nature of their model they fail to make clear predictions on the impact of competition on both price and product quality, whereas they identify conditions under which competition can reduce prices and enhance product quality. Contrary to the other theoretical contributions Brekke et al. (2010) conclude 'that the scope for spatial competition to stimulate quality provision is larger than previously thought' (p. 478).

Below I will set up the model based on a circular market. The aim of this formal approach is to derive testable hypotheses between the intensity of competition and firms' price and quality choices, and to propose a theory-based guidance to identify the system of equations for the empirical part. Note that the market for camping sites is a particularly well-suited retail market as it fits the assumptions of the theoretical model proposed in this article, but also of the models discussed above: (i) Each firm can choose prices and quality levels, (ii) prices do not vary within seasons and are non-negotiable (i.e. the posted price equals the actual price) (iii) spatial product differentiation as well as product quality are important,[3] and (iv) the market is characterized by independent retailers rather than retail chains controlling large numbers of outlets. Conceptually the model can be interpreted as a three-stage game, where

[3]In a survey conducted in Croatia in 2008 nearly 1,300 camping tourists were asked why they chose that particular camping site. 36.7% respectively 35.8% of the respondents reported that the 'general quality of the campsite', respectively the 'quality of the sanitary facilities' were important, whereas only 16.5% declared that the price was essential (Gržinić et al., 2010).

firms choose to enter in stage 1, locate in stage 2, and set quality and prices in stage 3.[4] Due to strong symmetry assumptions asymmetric equilibria with respect to firms' location choices are implausible. Stage 1 and stage 2 are therefore not explicitly solved and an equidistant distribution of an exogenous number of firms is assumed.[5]

Model Setup

Following Salop (1979) the spatial market is described as a circle with circumference equal to 1. n independent firms are located equidistantly (with distance $\frac{1}{n}$) on this circular market. Each firm i offers a product of price p_i and quality q_i. Each consumer buys exactly one unit of the preferred variety and the consumers are uniformly distributed around the circle with density L. A consumer located at a distance d_i (in the geographical or in the product space) from firm i has to bear linear transportation costs t.[6] The utility of a consumer buying from firm i, U_i, which is located at a distance d_i from this firm is given by:

$$U_i = v + b(q_i) + u(y) \tag{1}$$

with

$$y = Y - p_i - td_i \tag{2}$$

[4]It is a reasonable assumption for camping sites that quality and prices are chosen in one stage rather than in two consecutive stages: Investments in quality (e.g. redevelopment of sanitary infrastructure) usually take place during the winter season, where the site is either closed or demand is low. The sites therefore decide on both quality and price schedule before the start of the new (summer) season.

[5]One could also think about alternative game structures. First, quality levels and prices may be chosen in two consecutive stages. I, however, think that choosing both variables simultaneously is more appropriate in this industry (see footnote 4 above). Additionally, if firms choose these two variables in two consecutive stages the analysis is likely to be considerably complicated (see also the analysis in Brekke et al., 2010) and it is unlikely that the qualitative results regarding the influence of competition on equilibrium prices and quality levels change (see Economides, 1993, who analyzes both game structures in a similar setting). Second, an alternative model variant may consider that firms choose location and quality in one stage rather than two stages. Economides (1993) shows that that the equilibria are the same in both cases, because there is no strategic advantage of a precommitment in locations in a circular market (if locations are chosen simultaneously). Analyzing different game structures is beyond the scope of this article and is therefore left for future research.

[6]Transportation costs comprise direct costs associated with driving the car or the caravan (e.g. expenses for gasoline) and time costs. The assumption of linear transportation costs is reasonable for both components.

with Y as gross income. The utility consumers derive from the product can be divided in the net valuation v and in the utility depending on the quality of the product $b(q_i)$, with $b_q > 0$ and $b_{qq} \leq 0$.[7] v is assumed to be large enough to cover the market in equilibrium. y is a numeraire good and utility is assumed to be (weakly) concave in consumption of this numeraire, i.e. $u_y > 0$ and $u_{yy} \leq 0$.[8] Let firm $i+1$ $(i-1)$ be the firm located next to firm i on one (the other) side of the road, and denote the distance between the location of firm i and the consumer who is indifferent from buying at firm i and $i+1$ $(i-1)$ with d_{iz+} (d_{iz-}). d_{iz+} is implicitly given by:[9]

$$v + b(q_i) + u\left(Y - p_i - td_{iz+}\right) = v + b(q_{i+1}) + u\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right) \tag{3}$$

Total demand for firm i adds up to $X_i = L\left(d_{iz-} + d_{iz+}\right)$, with Ld_{iz+} being the consumers located between firm i and $i+1$ and Ld_{iz-} being the consumers located between firm i and $i-1$ that patronize firm i. The demand for firm i can be characterized by $\frac{\partial X_i}{\partial p_i} < 0$, $\frac{\partial X_i}{\partial q_i} > 0$, $\frac{\partial X_i}{\partial p_{i-1}} > 0$, $\frac{\partial X_i}{\partial p_{i+1}} > 0$, $\frac{\partial X_i}{\partial q_{i-1}} < 0$ and $\frac{\partial X_i}{\partial q_{i+1}} < 0$ (see Appendix A for a formal derivation of this system of equations). The firms have no (binding) capacity constraints and can therefore serve demand X_i.[10] Profits of firm i, π_i, are given by:

$$\pi_i = p_i X_i(.) - C(X_i(.), q_i) \tag{4}$$

where $C(X_i(.), q_i)$ denotes the production costs with $C_X > 0$, $C_{XX} \geq 0$, $C_q > 0$ and

[7] Parameters as subscripts denote the respective partial derivatives.

[8] This model is somewhat more restrictive compared to the model presented by Brekke et al. (2010), who model consumers' utility as $U_i = v + b(q_i) - \rho g(d_i) + u(y)$, with $y = Y - p_i - th(d_i)$ and $th(d_i)$ $(\rho g(d_i))$ as monetary (non-monetary) transport costs. Restricting $\rho = 0$ and $h(d_i) = d_i$ seems reasonable for the camping industry analyzed in this article and facilitates highlighting the importance of firms' cost structure when analyzing the effect of competition on firms' prices and quality choices.

[9] Characterizing d_{iz-} is very similar and is therefore omitted for convenience.

[10] Note that if capacity constraints are binding for one firm, then they are binding for all firms because the model is symmetric. In this case there are n local monopolies and equilibrium prices and quality levels are independent of the number of firms in the market. The assumption of non-binding capacity constraints is somewhat restrictive in this industry, in particular during peak season. A model with capacity constraints that are occasionally binding is, however, beyond the scope of this article. In the empirical part I include the capacity of the camping sites as a control variable.

$C_{qq} > 0$. Production costs of quality and quantity can be substitutes ($C_{Xq} > 0$), complements ($C_{Xq} < 0$) or independent ($C_{Xq} = 0$).

Firms are assumed to choose price and quality levels simultaneously. Based on first order conditions and on the assumption of a symmetric equilibrium, equilibrium quantity $X^* = \frac{L}{n}$ and the equilibrium price and quality, p^* and q^*, can be characterized by the following system of equations:[11]

$$p^* = \frac{t}{n} + C_X(\frac{L}{n}, q^*) \tag{5}$$

$$\frac{L}{nu_y\left(Y - p^* - \frac{t}{2n}\right)} b_q(q^*) - C_q(\frac{L}{n}, q^*) = 0 \tag{6}$$

The equilibrium price p^* is directly affected negatively by the intensity of competition (measured by n or the inverse of t) and positively by the marginal costs C_X. Note that marginal costs are fully shifted to consumers (this result has also been derived by Salop, 1979, without vertically differentiated products) and that equilibrium prices are not affected by the concavity of the utility of income. Equilibrium product quality depends positively on consumers' (marginal) valuation of quality, b_q (and therefore on a firm's marginal revenue generated by providing a marginal increase in quality, $\frac{L}{nu_y} b_q$), and negatively on both the marginal utility of the numeraire good, u_y, and the marginal production costs of quality, C_q.

Before investigating ways to identify the system of equations (5) and (6) as well as analyzing the effects of competition on prices and quality levels, some discussion on a number of simplifying assumptions of this stylized model is necessary: First, consumers are assumed to be uniformly distributed around the circular market with density L to ensure the analytical tractability of the model. This seems to contradict the observation that tourism is geographically very concentrated. The assumption, however, is not too restrictive, because it only restricts the density of consumers to be the same within this particular local mar-

[11]As the equilibrium is symmetric, p^* and q^* are identical for all firms. The subscript i is therefore suppressed for convenience.

ket, but this variable will (and is allowed to) vary across different local markets. Second, models of vertical product differentiation usually assume that consumers are heterogeneous with respect to their marginal utility of quality. In this model consumers are heterogeneous only with respect to spatial (horizontal) product differentiation, but have the same willingness to pay for higher product quality, which makes quality differentiation in equilibrium very unlikely. Even if consumers are heterogeneous with respect of their quality preferences within a local market, quality differentiation may not arise in equilibrium if products can also be horizontally differentiated, as demonstrated by Economides (1993). Note again that consumers' willingness to pay for higher product quality may vary considerable between different local markets (and variation of this variable across local market plays a distinguished role in identifying the system of equations, see below). In the empirical part of the analysis I will revisit this issue and investigate whether the competitive pressure exerted by rivals supplying similar quality is systematically different to competitors offering different quality levels.

Third, the model assumes that total demand is fixed, as the number of consumers is exogenously given and as each consumer's demand is inelastic (as long as the market is covered). Firms can therefore increase demand by attracting consumers from other (neighboring) firms only, but not by attracting additional consumers or by increasing individual consumer's demand. Models of horizontal product differentiation in the spirit of Hotelling (1929) or Salop (1979) typically assume this kind of consumer behavior, and all theoretical articles analyzing the effect of competition on prices and product quality in spatially differentiated markets discussed in the beginning of this section are no exceptions. Despite increasing the tractability of the model these assumptions are particularly appropriate in the empirical application of this article: From an individual consumer's (tourist's) perspective the time spent on vacation is mainly determined by her vacation entitlement rather than the price charged by the camping sites. This is particularly true for a low-budget vacation like camping holidays, where the average price (for an entire family) is less than 32 Euros per night (see section 3).

Regarding the number of consumers it is also plausible that this figure is rather inelastic: Product differentiation with respect to both other types of lodging and other regions are rather large, so decreasing (increasing) prices (quality levels) of all camping sites in a local market will probably increase the number of additional tourists only by a small amount.

While the model has to make restrictive assumptions in some aspects, it is quite general regarding the firms' cost functions with respect to quality and quantity. This is useful for the empirical analysis, as providing a certain quality level is likely to have both fixed and variable cost components. Some of the camping site's characteristics determining product quality, like the opening hours of the reception desk or the provision of particular services (e.g. providing a swimming pool) are associated with higher fixed costs, while providing a particular level of cleanliness of the camping site's sanitary accessories is likely to increase with the number of guests.

Identification of Product Quality

Some aspects of the determinants of equilibrium prices and quality levels, characterized by equations (5) and (6), are particularly relevant for the identification of this system of equations in the empirical analysis: First, both endogenous variables (prices and quality levels) affect each other in equilibrium. Product quality impacts equilibrium prices due to its influence on marginal production costs (as long as $C_{Xq} \neq 0$). Equilibrium prices, however, affect product quality merely by influencing the marginal utility of consuming the numeraire good (u_y), which can be expected to be negligibly small, because consumers' expenses for staying at camping sites account only for a very small fraction of their income. Equations (5) and (6) can therefore be approximated by a triangular system of equations, where a change in product quality influences prices (by way of altering marginal production costs, C_X), while a change in prices does not affect quality levels. Second, both prices and quality levels depend on the firms' cost functions, which are assumed to be homogeneous in this stylized model. Differences in firms' production costs (for example because firms offer different amenities) have to be controlled for in the empirical analysis.

Third, consumers' gross incomes, Y, and the (marginal) valuation of quality, b_q, have a direct impact on equilibrium quality levels, but may influence prices only indirectly (as marginal costs C_X depend on q^*). This aspect is emphasized by Table 1, summarizing the partial derivatives of equilibrium quality, q^*, and equilibrium prices, p^*, with respect to consumers' marginal utility of quality, b_q, and with respect to consumers' income, Y. In the empirical analysis variables indicating consumers' income and their valuation of quality will be used to identify this system of equations. As these variables are not directly observable, I will draw on detailed information on the tourists' country of origin (nationalities) as an indicator for both income and quality preferences (see section 3 for a more thorough discussion).

Table 1: Effect of Consumer Preferences and Income on Equilibrium Price and Quality

	partial derivative of q^*	partial derivative of p^*
w.r.t. b_q:	$\frac{\partial q^*}{\partial b_q} = \frac{L}{nC_{qq}u_y} > 0$	$\frac{\partial p^*}{\partial b_q} = \underbrace{C_{Xq}}_{\lesseqgtr 0} \underbrace{\frac{\partial q^*}{\partial b_q}}_{>0} \lesseqgtr 0$
w.r.t. Y:	$\frac{\partial q^*}{\partial Y} = \underbrace{\frac{1}{Lb_{qq}u_y - nu_y^2 C_{qq}}}_{<0} \underbrace{Lb_q u_{yy}}_{\leq 0} \geq 0$	$\frac{\partial p^*}{\partial Y} = \underbrace{C_{Xq}}_{\lesseqgtr 0} \underbrace{\frac{\partial q^*}{\partial Y}}_{\geq 0} \lesseqgtr 0$

Effect of Competition on Price and Quality

In spatial competition models an increase in the degree of competition can be modeled as a decrease in transportation costs t or as an increase in the number of firms n in a market. Because transportation costs are not expected to vary much between local sub-markets, the following empirical application focuses on the number of firms to measure the intensity of competition. In evaluating the effect of competition on equilibrium prices and quality levels, marginal utility of consuming the numeraire good is assumed to be constant and is normalized to one for convenience (i.e. $u_y = 1$). This assumption is justified (in this sub-section) as costs for staying at camping sites usually account only for a small fraction of consumers' income. The effects of price changes – induced by a change in the intensity of competition – on the marginal utility of the numeraire good are expected to be (negligibly) small. Differentiating equation (6) that characterizes q^* with respect to n gives:

$$\frac{L}{n} b_{qq} \frac{\partial q^*}{\partial n} - \frac{L}{n^2} b_q + \frac{L}{n^2} C_{Xq} - C_{qq} \frac{\partial q^*}{\partial n} = 0 \tag{7}$$

rearranging gives:

$$\frac{\partial q^*}{\partial n} = \underbrace{\frac{1}{n\left(\frac{n}{L} C_{qq} - b_{qq}\right)}}_{>0} \underbrace{(C_{Xq} - b_q)}_{\lesseqgtr 0} \tag{8}$$

as $\frac{1}{n\left(\frac{n}{L} C_{qq} - b_{qq}\right)} > 0$ it depends on the term $C_{Xq} - b_q$ whether competition has a positive impact on quality. If cost substitutability between quality and output is sufficiently high (i.e. $C_{Xq} > b_q$) an increase in competition will increase equilibrium quality. Note that the provision of product quality is independent of the intensity of competition if $C_{Xq} = b_q$.

Differentiating equation 5 that characterizes p^* with respect to the number of firms gives:

$$\frac{\partial p^*}{\partial n} = -\frac{t}{n^2} + \frac{\partial C_X}{\partial X^*} \frac{\partial X^*}{\partial n} + \frac{\partial C_X}{\partial q^*} \frac{\partial q^*}{\partial n} = -\underbrace{\frac{t}{n^2}}_{>0} - \underbrace{\frac{L C_{XX}}{n^2}}_{\geq 0} + \underbrace{C_{Xq}}_{\lesseqgtr 0} \underbrace{\frac{\partial q^*}{\partial n}}_{\lesseqgtr 0} \tag{9}$$

The change in equilibrium prices comes from two sources: First, an increase in competition (the number of firms) reduces spatial product differentiation and therefore has a restraining effect on prices. This effect is captured by $-\frac{t}{n^2}$ and can also be derived from the 'classical' Salop (1979)-model for (vertically) homogeneous products. Second, a price change can stem from a change in marginal costs, denoted by C_{XX} and C_{Xq}. An increase in competition will reduce output (by $\frac{L}{n^2}$) leading to a (weak) reduction in marginal production costs (as $C_{XX} \geq 0$), which is fully passed on to consumers.

An increase in competition might also affect equilibrium quality. If output and quality are cost compliments ($C_{Xq} < 0$)[12] an increase in competition will reduce q^* ($\frac{\partial q^*}{\partial n} < 0$), which in turn increases marginal costs (as $C_{Xq} < 0$) and therefore equilibrium prices by $C_{Xq}\frac{\partial q^*}{\partial n} > 0$. If $0 < C_{Xq} < b_q$, competition has a negative effect on equilibrium quality, as well as (at least) a dampening effect on p^* ($C_{Xq}\frac{\partial q^*}{n} < 0$). If cost substitutability is sufficiently high ($C_{Xq} > b_q$), more competition leads to a higher q^*, which in turn has an upward impact on p^* ($C_{Xq}\frac{\partial q^*}{\partial n} > 0$).[13]

These results allow me to derive two testable hypotheses:

Proposition 1. *Conditional on product quality competition has a negative effect on equilibrium prices.*

Proposition 2. *If competition has a positive impact on product quality, then higher quality is associated with higher prices. In this case the price dampening effect of competition will be reduced or even reversed.*

These propositions will be tested for camping sites located in Austria. The following section provides information on this industry and discusses the empirical specification.

3 Industry Background, Data and Empirical Specification

Camping Sites and other Forms of Accommodations

Tourism is a very important industry in Austria. Within the one-digit industry (NACE) code ‘accommodation and food service activities’ firms generated sales of more than 7.3 billion Euros in 2011 and employed nearly 270,000 workers. In the summer season 2012 the number

[12]In order to keep the model as general as possible I do not exclude $C_{Xq} < 0$. However, it is difficult to think of firms in markets characterized by this cost structure.

[13]Note that this result also covers the special cases of Economides (1993) and Gravelle (1999): If $C_{Xq} = 0$ (as in Economides, 1993) marginal costs are unaffected by a change in q^*, leading to a negative effect of competition on quality ($\frac{\partial q^*}{\partial n} < 0$). If $C_{Xq} = b_q$ (as in Gravelle, 1999) equilibrium quality q^* is unaffected by competition ($\frac{\partial q^*}{\partial n} = 0$). In both cases $C_{Xq}\frac{\partial q^*}{\partial n} = 0$.

of overnight stays amounted to more than 65 million, which equals more than eight overnight stays per resident. These services are supplied by more than 63,000 accommodation facilities that offer a capacity of more than 1.2 million beds (Statistik Austria, 2013). More than two thirds of all facilities, which are households privately renting out rooms and holiday homes, account for less than one fourth of the entire capacity and for only 9% of all overnight stays. On the other hand, hotels account for only one fifth of all facilities, but comprise nearly one half of the entire capacity and cover nearly two thirds of all nights spent in any accommodation facility. The number of camping sites is only 557 and therefore accounts for less than 1% of all accommodation facilities. However, camping sites are rather large and supply a capacity of 340 'beds'[14] on average, which means that they account for more than 15% of the aggregate capacity and comprise more than 7% of all overnight stays (more than 4.6 million stays in in the summer season 2012).[15]

The industry structure of camping sites is characterized by independent retailers who usually control one outlet only, which well fits the assumption of independent firms in the theoretical model. This differs considerably from hotels (especially hotels with four and five stars), which often belong to large chains controlling multiple outlets. This structure justifies the assumptions that firms' decisions on prices and quality levels are based on local demand and cost conditions and on the intensity of competition within the local market, which might not be the case for other industries that are characterized by large chains (which is common in many retail markets, e.g. food retailing or retail gasoline). Unlike many hotels, prices for camping pitches usually do not vary on a day-to-day basis (only between peak season and off-season) and are non-negotiable. Prices are usually announced during winter for the following spring and summer and are typically not adjusted during the summer season.

[14]To calculate the number of beds the Austrian statistical office ('Statistik Austria') multiplies the number of pitches on a camping site by four.

[15]Other types of accommodation include commercial holiday homes, youth hostels, recreation homes for children, sanatoria, alpine huts and 'other' accommodation facilities, which account for about 10% of all accommodation facilities.

Data and Empirical Specification

Empirical Specification: The system of equations (5) and (6) of the theoretical model characterizing equilibrium prices and quality levels indicate that variables determining product quality also indirectly influence prices (by way of altering marginal production costs, C_X), while variables influencing equilibrium prices might affect quality levels directly, but not indirectly (by influencing prices). Put differently, product quality can be considered as an (endogenous) regressor in the price equation. These findings translate to the following triangular system of equations of the empirical model specification:

$$\boldsymbol{p} = \varphi_p \boldsymbol{q} + \delta_p \boldsymbol{n} + \boldsymbol{V}\boldsymbol{\beta}_p + \boldsymbol{\epsilon}_p \tag{10}$$

$$\boldsymbol{q} = \delta_q \boldsymbol{n} + \boldsymbol{V}\boldsymbol{\beta}_q + \boldsymbol{Z}\boldsymbol{\gamma}_q + \boldsymbol{\epsilon}_q \tag{11}$$

with $\boldsymbol{p}$ and $\boldsymbol{q}$ as price and quality, $\boldsymbol{n}$ as the number of competitors (as a measure of the intensity of competition) and $\boldsymbol{V}$ comprising variables to control for demand heterogeneity and cost differences (corresponding to variables L and C in the theoretical model). The identification of the system of equations requires variables that affect firms' quality choices, but not (directly) product prices. These variables are summarized in $\boldsymbol{Z}$. $\boldsymbol{\epsilon}_p$ and $\boldsymbol{\epsilon}_q$ are the error terms and φ_p, δ_p, $\boldsymbol{\beta}_p$, δ_q, $\boldsymbol{\beta}_q$ and $\boldsymbol{\gamma}_q$ are the (vectors of) parameters to be estimated. In the remainder of this section I will describe the data sources and variables utilized in the analysis as well as the variables used to identify this system of equations. Summary statistics on all variables included in the regression analysis are reported in Table 5 in Appendix B.

Data Sources: The main data source is the German car drivers' association ADAC that provides information on camping sites valid for the years 2010, 2011 and 2012.[16] The data covers an unbalanced panel of 292 Austrian camping sites (859 observations in total) including information on the location of the site (address and coordinates), price and quality of the offered product as well as various site and product characteristics. This sample is sup-

[16]This information is given in an annually published guide named 'ADAC Camping und Caravaning Führer Südeuropa' ('ADAC Camping and Caravaning Guide Southern Europe').

plemented by data on the location of all other camping sites not covered by the ADAC-guide to get a comprehensive sample of all Austrian camping sites. This additional information has been gathered from the web-page 'www.campingfuehrer.at', collected in 2012, and from 'Herold Marketing' (see below), a telephone directory containing firm level data such as firms' addresses and industry codes. This data sample on camping sites is supplemented by information on other tourism activities in the vicinity (tourist information, hotels, restaurants, etc.), coming again from 'Herold Marketing' and collected from 2008. Additional data on the number of touristic overnight stays, on the nationality of tourists in and on the altitude of the municipality, where the camping site is located, as well as information on potential settlement space in the camping site's neighborhood are provided by the Austrian statistical office ('Statistik Austria').

Price (p^*): Besides prices on 'single items' like overnight stays for adults and children, fees for a pitch, a tent, a car or a caravan and (fixed or variable) rates on electricity, the ADAC camping guide also offers a so-called 'reference price' that summarizes consumer expenses for a standardized product. This reference price includes the price for a one-night-stay for two adults and a 10-year-old child and the plot fee for a car or a caravan (up to a length of 5 meters), including taxes, expenses for warm showers, electricity and garbage disposal. The empirical analysis is based on this reference price, as it includes the expenses for a standardized product and is therefore comparable across camping sites. The reference price is unavailable (or reported from a previous year) in about one third of all observations summarized in the ADAC camping guide, leaving 567 price quotes of 241 camping sites.

Product Quality (q^*): ADAC divides product quality in two different categories (sanitary accessories and tent/trailer pitches) on a six-stage scale (ranging from zero to five stars) for either category. The evaluation of quality (in each category) combines cardinal data (like the number of showers in relation to the capacity of the site, or the size of the pitch) and binary data (e.g. whether pitches are subdivided and are connected to power supply) with qualitative assessments (e.g. cleanliness).[17] I construct a composite quality index by aggregating the quality ratings of both categories, which results in a single measure of quality ranging from zero to 10. Figure 1 shows the distribution of the measure of product quality used in this analysis and Figure 2 illustrates the average price for each level of quality. Figure 2 indicates that high quality levels are also associated with higher prices.

Intensity of Competition (n): To construct measures of competition I follow related empirical articles that define the intensity of competition based on the number of competitors within a particular distance[18] and calculate the number of rival firms within a distance of two miles and the number of rivals within a distance between two and four miles. The exact location of all camping sites (given by their coordinates) are linked to the Austrian road network using the ArcGIS extension WIGeoNetwork to generate accurate measures of distance, measured in driving rather than air-line distance. Note that information on all 557 camping sites is used to calculate these variables measuring the intensity of competition.

Heterogeneity in Demand (L): To control for demand heterogeneity a number of variables at different levels of regional aggregation are considered: At a district level fixed effects are included in all specifications to capture demand (and other forms of unobserved) heterogene-

[17]Note that this detailed information on the sub-dimensions (like the number of showers relative to the capacity of the site) is not available to me.

[18]This is a quite common approach and is applied e.g. by Barron et al. (2004), Thomadsen (2005), Lewis (2008), Pennerstorfer (2009), Chandra and Tappata (2011) or De Silva et al. (2013).

Figure 1: Distribution of Product Quality

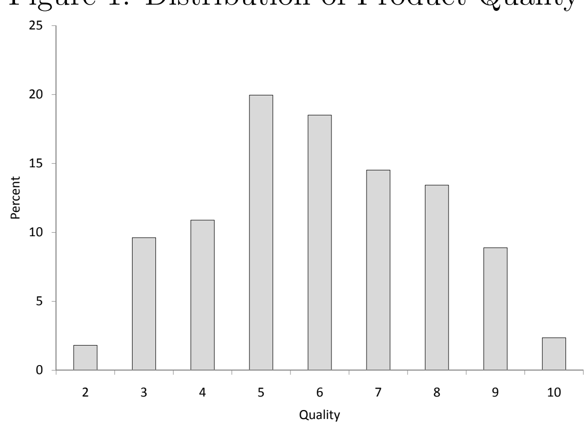
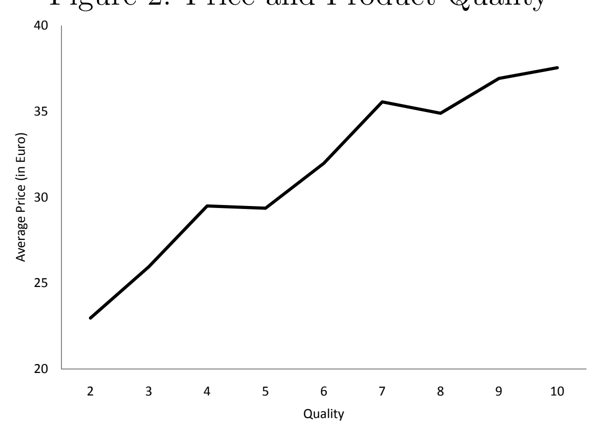


Figure 2: Price and Product Quality



ity. At the municipality level the number of overnight stays (for the summer season 2008) is included.[19] Despite the small size of Austrian municipalities[20] these variables might still be insufficiently accurate to capture small-scale differences in local demand. The analysis therefore utilizes information on other firms in the local market, which supply (predominantly) tourist services. These variables may have no causal influence on the demand for camping sites, but the location choices of these related industries will depend on similar variables as camping sites' demand function (e.g. inherent natural beauty of the region, proximity to major sights). As these native market characteristics are unavailable at a regionally more disaggregated scale I use outcome variables of related markets as indirect control variables. The data on these other industries comes from a telephone directory ('Herold Marketing') and includes the addresses and industry codes of all firms that have a telephone (the information is therefore expected to be comprehensive). The information comprises five categories: Tourist information (875 observations), hotels (14,477), guesthouses (9,924), restaurants (7,538) and bars/cafes (5,313).[21] The addresses are supplemented with coordinates using the program 'GPS Visualizer' and again linked to the Austrian road system. In the regression analysis I include the driving distance from each camping site to the next tourist information and the number of hotels, guesthouses, restaurants and bars/cafes within one mile, between one and two, between two and three, and between three and four miles (driving) distance from the respective camping site.[22] Data on these firms are again from 2008 to reduce concerns about endogeneity.

Differences in Production Costs (C) *and other Forms of Product Differentiation*: To account for differences in production costs I include a number of camping site specific char-

[19]This variable is normalized by the population of the municipality to control for differences in the size of these regional units.

[20]The average (median) Austrian municipality is 13.8 (9.4) square-miles large and has $3,373$ $(1,575)$ inhabitants.

[21]'Hotels' capture all firms that offer (primarily) overnight stays, which includes hotels, bed and breakfast, holiday flats, hostels and motels. Guesthouses usually offer both accommodation and meals. Bars/cafes include places which do not (primarily) offer meals like bars, pubs, clubs, ice-cream parlors and cafes.

[22]The availability of restaurants or cafes in the vicinity of the camping site may also be interpreted as a form of product quality. This form, however, is beyond the influence of the camping site and is in any case controlled for in the regressions.

acteristics, including information on the size of the camping sites (measured by the number of pitches). This is particularly important as marginal production costs are not restricted to be constant and as the cost substitutability between quality and quantity is crucial for the influence of competition on product quality. Other characteristics of the camping sites include information on particular services (health treatments, spa, horse riding, water trekking) or services for particular consumer groups (families, naturists, caravan owners) as well as information on extended opening hours (winter camping). These variables are considered to capture heterogeneity in production costs that may depend on these additional services. Additionally, these characteristics constitute other dimensions of product differentiation and are explicit choice variables of the camping sites. These variables are included in most specifications to control for this kind of product differentiation, but are left out in some regressions to show that the results are robust to the exclusion of these choice characteristics. Additional variables capturing the heterogeneity of camping sites include information whether the camping ground is located next to a lake and whether the site offers an 'extraordinary' or a 'nice' view. These variables cover site characteristics that depend on the location and cannot be changed after the location is chosen. Besides, fixed time effects are included to control for shifts in costs (but also demand) that affect all firms similarly.

Empirical Identification Strategy

Identification of Product Quality: As outlined in section 2 identifying product quality in the system of equations will be related to indicators of consumers' income and their marginal utility of quality in the local market. As these variables are not directly observable, the identification strategy applied in this article is based on the assumption that these variables are correlated with the tourists' countries of origin (nationalities). Statistik Austria provides data on the number of overnight stays at the municipality level, classified by the nationality of tourists (but not classified by the type of accommodation). Variables derived from the national composition of tourists are partially correlated with product quality (and can therefore serve as instruments) if two assumptions hold: First, tourists from different countries prefer different levels of product quality. This might result from differences in (average) income or from differences in the marginal utility for product quality of tourists from different countries (because of e.g. differences in home countries' quality standards). Second, the national composition of tourists within a municipality must be correlated with the national composition of tourists of different types of accommodation (within this municipality). Note that this does not preclude systematic differences in the composition of tourists across different types of accommodations (that e.g. tourists from Northern European countries are overrepresented among hotel guests and underrepresented at camping sites), as long as the national composition is correlated across different types of lodgings. If these assumptions hold, then the national composition of tourists in the entire municipality affects the (equilibrium) quality choice of camping sites. These instruments are valid if consumers' incomes and quality preferences do not influence equilibrium prices directly. This is the case as long as total demand is independent of these variables. As discussed above, this is plausible in the present empirical application.[23] Additionally, this claim is also statistically supported by Hansen J tests on the validity of instruments (see section 4 below).

To construct variables on the national composition of tourists I group all European tourists[24] into tourists from Northern, Eastern, Southern and Western European countries.[25] Note that fixed district effects are included throughout the empirical analysis. Identification

[23] Note that the total number of overnight stays is controlled for in the empirical application anyway.

[24] I focus on tourists from European countries as tourists from other continents hardly ever reside at camping sites. The number of tourists from Europe accounts for more than 93% of all tourists and the correlation between the number of overnight stays of European tourists and of all tourists (irrespective of their nationality) is 99.7% in the sample used in the empirical analysis.

[25] I follow the United Nations geoscheme for Europe to group the countries and include all nations with the largest share of both population and territory located in Europe. Eastern Europe comprises Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia and Ukraine, Northern Europe includes Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden and the United Kingdom, Southern Europe covers Bosnia and Herzegovina, Croatia, Greece, Italy, Macedonia, Malta, Montenegro, Portugal, Serbia, Slovenia and Spain, and Western Europe refers to Austria, Belgium, Germany, France, Liechtenstein, Luxembourg, Monaco, the Netherlands and Switzerland. There is no data available on Albania, Belarus, Moldavia and on mini-states. Regrouping the countries such that Eastern Europe comprises all formerly Socialist countries hardly effects the results, as the number of tourists from the respective countries (affected by the regrouping) is very small.

therefore stems from variation of the nationality of tourists between municipalities within a district. To avoid endogeneity concerns of the instrumental variables excluded from the price equation, regionally aggregated (at the municipality level) and temporally lagged (from the summer season 2008) data is used. Despite the small size of municipalities a particular camping site typically accounts for only a small fraction of tourism-related overnight stays in the respective municipality.[26]

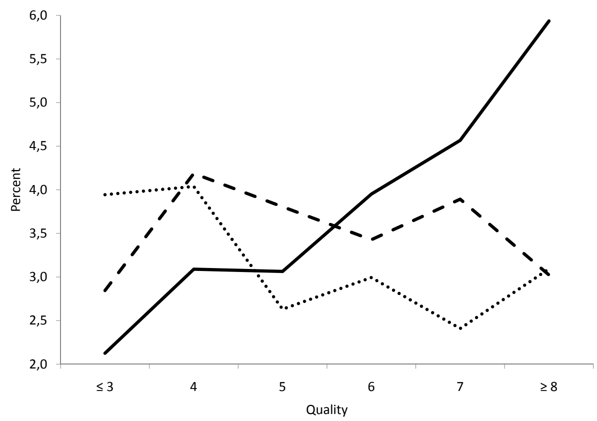
Figure 3 shows the correlation between these instrumental variables and the product quality supplied by the camping sites by illustrating the average share of overnight stays of Eastern, Northern and Southern European tourists for each quality level separately. The product quality supplied by camping sites seems to be (weakly) negatively correlated with the share of tourists from Eastern European countries, whereas no particular relation to the share of tourists from Southern Europe is exhibited. However, there is a strikingly strong (positive) correlation between the share of tourists from Northern European countries and camping sites' product quality.

Endogeneity of Competition: In the theoretical model proposed in section 2 above market entry is not modeled and the number of firms in a local market (n) is assumed to be exogenously given. As outlined above, a large number of variables are considered to capture demand heterogeneity (L) across local markets. These measures will not only affect prices and quality levels of camping sites directly, but will also influence firms' location choices. Including these variables in the empirical analysis can therefore control for the endogeneity of the number of rival firms (control function approach, see Cameron and Trivedi, 2005).

In an alternative approach I address the endogeneity of firms' location choices more directly and instrument the intensity of competition along with product quality. When modeling market entry explicitly, researches often use land prices as an indicator for fixed costs of market entry. This idea dates back at least to the seminal paper of Bresnahan and Reiss (1991) when analyzing 'Entry and Competition in Concentrated Markets'. In

[26] The mean size of a camping site is 145 pitches, whereas the capacity of hotels in the municipality where the campsites are located is more than 2,000 beds on average.

Figure 3: National Composition of Tourists



Notes: The solid (dotted) [dashed] line denotes the share of Tourists from Nothern (Eastern) [Southern] Europe.

many retail markets land prices do neither affect demand nor variable production costs, and therefore only have an indirect impact on prices (or quality levels) by influencing profitability and therefore market entry. For camping sites, however, land prices affect variable production costs of product quality, as the size of the pitches influences the composite quality index.

While land prices may not be well-suited as an instrument for the number of rival firms, the availability of a piece of land, appropriate for opening a camping site, may affect the number of firms in a market without influencing firms' costs. To derive a measure for the availability of land I rely on a classification of Statistik Austria, dividing the entire country into areas appropriate for long-term settlement. Potential long-term settlement spaces are defined as areas that are used or could be used for settlement activities, traffic infrastructure or agriculture. To get an accurate measure of the area that may be used to open up a camping site I can draw on detailed grid data. Statistik Austria places regional statistical grid units of a size of 250 meters × 250 meters (about 270 yards) over the entire territory of Austria, which are independent of administrative boundaries. Note that this provides very detailed information about the spatial distribution of the potential settlement space. At the grid cell level the potential long-term settlement space is indicated by a binary variable depending whether the majority of the cell is used or can be used for settlement activities, traffic infrastructure or agriculture. I aggregate the number of cells that are considered as potential settlement space within a one mile (airline) distance around each camping site to calculate the share of the potential settlement space within this distance as an indicator of the availability of land.[27]

Additionally, I include the altitude of the municipality, where the camping site is located, as an instrument for the number of rival firms. In alpine regions it is more difficult to find flat areas that are well-suited for opening a camping site, and thus the altitude of the municipality can also be interpreted as an indicator for the scarcity of appropriate pieces of land.[28]

4 Results

To estimate the system of price and quality equation (10) and (11) a two-stage least squares procedure (2SLS), a limited-information maximum likelihood (LIML) and Fuller's modified LIML estimator (Fuller-k) are applied. The regression results are summarized in Table 2. The price equation for all estimation methods is reported in column 1 to 3. The first-stage quality equation is independent of the method used and therefore reported only once (in column 4). The reduced form price equation is summarized in column 5. Column 6 and 7 report results on the price and quality equation when information on additional services of the camping site are excluded. As the main interest of this analysis lies in the effect of competition and in the interrelation between price and quality, only estimates on the coefficients φ_p, δ_p and δ_q are reported, along with the parameter estimates on the instruments excluded from the price equation, $\boldsymbol{\gamma}_q$. Regression results on other (control) variables are summarized in Table 6 in Appendix B.

[27] I use a shorter cut-off distance compared to calculating the number of rival firms because the variable indicating potential settlement space is based on airline rather than driving distance.

[28] As pointed out by an anonymous referee, the altitude also can be interpreted as a form of product differentiation and may be correlated with other unobserved touristic attributes. However, this variable has no significant influence on prices and quality levels when included in the respective regressions. Additionally, a Hansen J test supports the claim that the altitude seems to be a valid instrument for the number of rival firms in the vicinity.

Table 2: Regression Results

	Price	Price	Price	Quality	Price (reduced form)	Price	Quality
Method	2SLS	LIML	Fuller-k	OLS	OLS	LIML	OLS
Quality	3.652 ***	4.044 ***	3.832 ***			4.350 **	
	(1.171)	(1.404)	(1.274)			(2.078)	
# rival firms	-1.206 ***	-1.306 ***	-1.252 ***	0.252 ***	-0.306	-1.386 **	0.253 ***
within 2 miles	(0.401)	(0.460)	(0.427)	(0.089)	(0.208)	(0.586)	(0.083)
# rival firms	-0.761 **	-0.787 **	-0.773 **	0.072	-0.534 **	-0.850 **	0.037
between 2 and 4 miles	(0.333)	(0.362)	(0.346)	(0.087)	(0.217)	(0.386)	(0.083)
Share tourists				-4.070 *	-13.320 **		-1.436
Eastern Europe				(2.208)	(6.235)		(3.240)
share tourists				4.286 **	14.172 *		4.825 *
Northern Europe				(2.172)	(7.324)		(2.564)
Share tourists				-1.337	-15.094 **		-0.633
Southern Europe				(2.155)	(6.892)		(2.467)
constant				4.985 ***	29.519 ***		3.283
				(0.981)	(2.150)		(0.857)
Information on additional services included	Yes	Yes	Yes	Yes	Yes	No	No
N	546	546	546	546	546	546	546
R^2	0.206			0.676	0.777		0.560
log-likelihood		-1,598.84	-1,577.41			-1,657.00	
Joint-significance of	3.10	3.10	3.10			1.33	
instruments $F(3, 230)$	(p = 0.028)	(p = 0.028)	(p = 0.028)			(p = 0.264)	
Hansen J test on	1.42	1.25	1.34			1.62	
overidentification $\chi^2(2)$	(p = 0.492)	(p = 0.536)	(p = 0.512)			(p = 0.445)	
Endogeneity of	6.32					2.32	
quality $F(1, 230)$	(p = 0.013)					(p = 0.129)	
AR test on	4.94	4.94	4.94			2.37	
significance of quality $F(3)$	(p = 0.002)	(p = 0.002)	(p = 0.002)			(p = 0.071)	

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, as well as the size of the camping site and whether the camping site is located next to a lake or characterized by a nice view. Column one to five also include information on additional services. Parameter estimates on these variables are relegated to Table 6 in Appendix B. All regressions include fixed district and fixed time effects, which are not reported for convenience. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage quality regression corresponds to the Kleibergen-Paap Wald rk F statistic. The F test on the endogeneity of quality (Wooldridge, 1995) tests the null hypothesis that quality is an exogenous variable in the price equation. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameter on quality differs from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum estimator bias of 10% (20%) [30%] are 9.08 (6.46) [5.39] for 2SLS and 7.90 (6.61) [5.60] for Fuller-k. The respective critical value for the maximum Wald test size distortion of 10% (20%) are 22.30 (9.54) for 2SLS, 6.46 (3.69) for LIML and 7.18 (5.87) for Fuller-k. Critical values for the maximum estimator bias for LIML are not available. All reported critical values are based on the assumption of i.i.d. errors.

For each estimation method and irrespective of including information on additional services of the camping sites the results show that higher product quality is associated with higher prices: An increase in quality by one point increases prices by 3.7 to 4.4 Euros. Note that 4 Euros are more than 12% of the average price charged by camping sites. As long as quality is controlled for, competition has a negative impact on prices, as expected. An increase by one rival within a distance of less than two miles reduces prices by about 1.3 Euros, an additional competitor within a distance between two and four miles reduces prices by about 0.8 Euros. While both coefficients are statistically significant at the 5%-significance level in all specifications, the effect gets smaller as distance increases. However, product quality is positively affected by competition, and an additional rival within a distance of less than two miles causes product quality to increase by 0.25 points. The effect of competition on product quality seems to decrease more quickly with distance than its impact on prices, as the effect of the number of rivals between two and four miles is small (albeit positive) and not statistically different from zero. On the other hand, the positive effect of the number of rivals located very closely (within two miles) is statistically significant at the 1%-level. If the number of rivals increases by one standard deviation (i.e. an increase by 1.7 [1.5] competitors within two miles [between two and four miles]) the quality provided by the camping site is expected to increase by 0.5 points, which will cause prices to rise by about 2.0 Euros on average. Conditional on the change in product quality, the increase in competition by one standard deviation is expected to cause prices to fall by 3.2 to 3.6 Euros, depending on the model specification.

In municipalities with a larger share of tourists from Eastern (Northern) European countries, camping sites offer lower (higher) product quality. Both parameter estimates take the expected sign (based on the correlation revealed in Figure 3). The estimated coefficients are significantly different from zero at the 10% (Eastern European tourists) and the 5% (Northern European tourists) level, respectively, as long as information on additional services provided by the camping site are included in the regression analysis. When these variables are excluded, the coefficients on the nationality of tourists from Northern and Eastern European countries are less precisely estimated. In any model specification the share of tourists from Southern European countries does not have a significant influence on product quality. This might be due to the large heterogeneity among these countries or due to (too) small differences to Western European countries (the reference category).

Column 5 in Table 2 reports regression results of a reduced-form price equation. According to these results the intensity of competition does influence equilibrium prices, even if the quality effect is not controlled for. The negative price effect is, however, considerably smaller, especially for very close competitors (within a two miles' distance), where the coefficient drops (in absolute numbers) from 1.3 to 0.3 and is not significantly different from zero anymore.

These results support the hypotheses formulated in section 2: Conditional on product quality, competition reduces prices (Proposition 1). Observing a quality-enhancing effect of competition, quality is associated with higher prices, which reduces the price dampening effect of competition (Proposition 2).

Several specification tests are reported in Table 2: Hansen J tests on overidentification do not reject the validity of the instruments (excluded from the price equation) for all estimation techniques used, suggesting that these instruments are correctly excluded from the price equation. A robust regression-based F test, proposed by Wooldridge (1995), rejects the hypothesis of quality as an exogenous variable (at least when additional services of the camping sites are controlled for), supporting the approach taken here to treat quality as an endogenous variable in the price equation against a simple OLS-specification of both price and quality equations. A first-stage F test shows that the coefficients on all instrumental variables excluded from the price equation are jointly significant at the 5%-significance level. While this test statistic suggests that the model is identified, concerns may arise as the instruments might be (too) weak: The F statistic of 3.10 in the main specification is clearly below the rule of thumb suggested by Staiger and Stock (1997), labeling instruments as weak if the first-stage F test statistic falls below 10.[29]

To mitigate concerns about the credibility of the results due to weak instruments I report a number of sensitivity analyses and additional specification tests: First, it is well-recognized in the literature that LIML and Fuller-k are less sensitive to weak instruments, as estimator bias is less of a problem and the results are in general more reliable than 2SLS in this case (see Staiger and Stock, 1997, Mariano, 2001, Stock et al., 2002, Stock and Yogo, 2005, and Baltagi, 2008). This conclusion is also supported by the critical values reported in Stock and Yogo (2005) for the maximum estimator bias and for the maximum Wald test size distortion due to weak instruments, which are considerably smaller for LIML or Fuller-k compared to 2SLS.[30] Table 2 therefore reports the results based on LIML and Fuller-k in addition to 2SLS, and most regressions in the sensitivity analysis rely on LIML-based techniques. Even if the reported critical values are still rather high for LIML and Fuller-k relative to the first-stage F statistic, the finding that the estimated parameters and confidence intervals are very similar to 2SLS when using methods that are partially robust to weak instruments (LIML, Fuller-k) strengthens the confidence in the main results.

Second, in the sensitivity analysis information on the number and the nationalities of tourists is included at a more disaggregated level. The regressions reported in Table 2 consider these variables in an aggregated way to facilitate the interpretation of the results. Disentangling the respective variables results in a first-stage F statistic that is significantly different from zero at the 1% significance level, and causes the critical values reported in Stock and Yogo (2005) to decreases dramatically for LIML and Fuller-k. The parameter estimates of the variables interest vary only by a small (and statistically insignificant) amount due to this modification and are therefore relegated to Appendix C (see Table 7).

Third, Table 2 reports the Anderson-Rubin (AR) test statistic. This statistic, proposed by

[29]Note that the parameter estimates of the variables of interest are hardly affected when additional services are not controlled for. The first-stage F-statistic, however, drops considerably in this case.

[30]The respective critical values are reported in the notes of Table 2. Note that the critical values are based on the assumption of i.i.d. errors and have to be interpreted with caution when being compared to the (cluster robust) Kleibergen-Paap Wald rk F statistic. See Baum et al. (2007) for a discussion.

Anderson and Rubin (1949), is a test whether the parameter of the endogenous variable in the structural equation (i.e. product quality) is significantly different from zero. The advantage of the test statistic is that it is fully robust to weak instruments (see Stock et al., 2002, for a discussion). The test may reject the null hypothesis if the parameter on quality differs from zero, or if the instruments are invalid. As the Hansen J tests on the validity cannot be rejected in any model specification, the confidence that quality is indeed significantly related to prices is considerably strengthened by the AR specification test. Additional sensitivity analyses are provided in the following section.

5 Sensitivity Analysis

Endogeneity of Competition

So far the endogeneity of firms' location choices – and therefore the endogeneity of the measure of competition – has been addressed by including variables to control for differences in demand and production costs between local markets (control function approach). In this sensitivity analysis the number of rival firms is instrumented along with product quality. I take a single measure of competition, namely the number of rival camping sites within two miles distance, to keep the number of variables to be instrumented small. As discussed in section 3 above, the share of potential settlement space in the vicinity of the camping site and the altitude of the municipality, where the site is located, are included to identify the number of rival firms.

Table 3: Regression Results with Number of Rival Firms as Endogenous Variable

	Price	Quality	# rival firms	Price	Quality	# rival firms
Method	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS
Quality	5.304 ***			4.297 ***		
	(0.959)			(1.223)		
# rival firms within 2 miles	-3.364 ***	0.204		-3.772 ***	0.469 *	
	(0.930)	(0.200)		(1.150)	(0.239)	
Share tourists Eastern Europe		-2.311 *	2.608 *		-2.504 *	2.717 **
		(1.328)	(1.549)		(1.350)	(1.352)
Share tourists Northern Europe		3.174 ***	0.079		3.973 ***	-0.323
		(1.108)	(1.171)		(1.520)	(1.183)
Share tourists Southern Europe		-3.449 ***	-1.976		-2.415	-1.443
		(1.303)	(1.584)		(1.570)	(1.500)
Potential settlement space			1.673 ***			1.618 ***
(within 1 mile, share)			(0.381)			(0.370)
Altitude (in 100 meters)			-0.178 ***			-0.182 ***
			(0.057)			(0.055)
constant	3.715	4.996 ***	-0.717	10.929 **	3.306 ***	-0.660 *
	(5.567)	(0.651)	(0.656)	(4.946)	(0.749)	(0.625)
Information on additional services included	Yes	Yes	Yes	No	No	No
N	546	546	546	546	546	546
R^2	0.159	0.673	0.663	0.263	0.545	0.657
Joint-significance of Instruments	F(5,230)	F(2,230)		F(5,230)	F(2,230)	
quality	2.10			1.44		
	(p = 0.067)			(p = 0.212)		
# of rival firms	2.54	4.67		2.53	4.59	
	(p = 0.030)	(p = 0.010)		(p = 0.030)	(p = 0.011)	
Hansen J test on overidentification	$\chi^2(3)$ 3.97	$\chi^2(1)$ 0.10		$\chi^2(3)$ 8.97	$\chi^2(1)$ 0.056	
	(p = 0.265)	(p = 0.747)		(p = 0.030)	(p = 0.813)	

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, as well as the size of the camping site and whether the camping site is located next to a lake or characterized by a nice view. Column one to three also include information on additional services. These control variables are listed in Table 6 in Appendix B. All regressions include fixed district and fixed time effects, which are not reported for convenience. Standard errors are reported in brackets. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage regressions on quality and the # of rival firms and the Hansen J tests on overidentification have been conducted on the two stage least squares estimation of the regression on prices and quality, respectively, and are based on residuals that are clustered at the camping site level.

This system of equations is estimated by three-stage least squares (3SLS, see e.g. Greene, 2002 for a good general treatment of this subject) and the results are reported in Table 3. In the first specification (column 1 to 3) information on additional services offered by the camping sites are included, whereas these variables are not considered in the second specification (column 4 to 6). The parameter estimates of the regression on the number of rival firms suggest that the number of competitors is indeed higher if the share of potential settlement space within a distance of one mile is larger and if the camping site is located at a lower altitude. Both estimated coefficients are significantly different from zero at the 1%-significance level. Hansen J tests and first-stage F statistics suggest that these instruments are valid and rather strong instruments.

The results regarding the relationship between competition, product quality and prices are very similar compared to the main Table 2: Higher product quality is associated with higher prices, the respective parameter estimates of 5.3 (column 1) and 4.3 (column 4) are significantly different from zero at the 1%-level and slightly larger compared to the main specification. The number of rival firms has a positive effect on quality, but the effect is significantly different from zero (at the 10%-level) only if additional services offered by the camping site are not included in the regressions. The effect on prices is significantly positive in both specifications and considerably larger compared to the main specification. The effect of the national composition of tourists on product quality reveals very similar patterns as in the main specifications reported in Table 2.

Quality Differences and Intensity of Competition

Up to now the intensity of competition has been restricted to be the same for all camping sites within a particular distance. However, as an anonymous referee pointed out, competition among camping sites with different quality may be less fierce compared to competition between firms providing similar quality levels. I account for this by separating the total number of camping sites into rival firms with similar, and into competitors offering considerably different product quality. Firms with similar quality are defined as camping sites with an (absolute) difference in product quality of at most one quality point.

The regression results, reported in Table 4, support the hypothesis that competition is more intense if rival firms offer similar quality levels: When additional services offered by the camping sites are controlled for (column 1 and 2), an additional competitor within two miles distance offering similar quality reduces prices by 3.4 Euros. If that rival offers a considerably different product quality, the effect reduces to about 0.9 Euros. The difference between the impact of rivals offering similar and considerably different quality levels is even more pronounced in the quality equation: The effect of an additional competitor within two miles distance is significantly positive and quite large (with a point estimate of 0.7), while the effect of rivals offering distinct quality levels is small and not significantly different from zero. A similar pattern can be observed for competitors within a distance between two and four miles, although the effect of the number of rival firms offering similar quality levels is significantly different from zero in the quality equation only. If additional services offered by the camping sites are excluded (see column 3 and 4) of Table 4 the point estimates of the coefficients hardly change, but similar to previous specifications the parameters are less precisely estimated (in particular regarding the price equation).

Further Sensitivity Analyses

Various additional robustness exercises have been carried out to show that the results are not driven by the particular specifications of the model. These results are reported and discussed in Appendix C. In the first sensitivity analysis, reported in Table 7, a larger number of instrumental variables is included in a more disaggregated way by dividing the share of tourists from Northern, Eastern, Southern and Western European countries into tourist groups of single countries or smaller groups of countries to address concerns regarding the weakness of the instruments. While the qualitative results remain unaffected by this modification, the excluded instruments are jointly significant at the 1% significance level in

Table 4: Regression Results Controlling for Quality of Rival Firms

Method	Price LIML		Quality OLS		Price LIML		Quality OLS	
Quality	4.395	***			4.686			
	(1.713)				(2.872)			
# rival firms within 2 miles	-3.429	**	0.696	***	-3.877		0.927	***
with similar quality	(1.415)		(0.216)		(2.646)		(0.232)	
# rival firms within 2 miles	-0.886	*	0.138		-0.868	*	0.082	
with different quality	(0.471)		(0.103)		(0.484)		(0.097)	
# rival firms between 2 and 4 miles	-1.326		0.299	*	-1.688		0.371	**
with similar quality	(0.885)		(0.157)		(1.363)		(0.149)	
# rival firms between 2 and 4 miles	-0.590		-0.047		-0.479		-0.137	
with different quality	(0.504)		(0.118)		(0.651)		(0.115)	
Share tourists Eastern Europe			-2.809				-0.198	
			(2.339)				(3.150)	
Share tourists Northern Europe			4.082	*			4.288	
			(2.195)				(2.654)	
Share tourists Southern Europe			-1.644				-1.058	
			(2.094)				(2.334)	
constant			4.640	***			3.109	***
			(0.886)				(0.762)	
Information on additional services included	Yes		Yes		No		No	
N	546		546		546		546	
R^2			0.690				0.593	
log-likelihood	-1,624.54				-1,679.91			
Joint-significance of instruments $F(3{,}230)$	2.30		(p = 0.078)		1.04		(p = 0.374)	
Hansen J test on overidentification $\chi^2(2)$	1.06		(p = 0.590)		1.64		(p = 0.440)	
AR-Test on significance of quality $F(3)$	4.27		(p = 0.006)		2.08		(p = 0.104)	

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, as well as the size of the camping site and whether the camping site is located next to a lake or characterized by a nice view. Column one and two also include information on additional services. These control variables are listed in Table 6 in Appendix B. All regressions include fixed district and fixed time effects, which are not reported for convenience. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage quality regression corresponds to the Kleibergen-Paap Wald rk F statistic. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameter on quality differs from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum Wald test size distortion of 10% (20%) are 6.46 (3.69) and are based on the assumption of i.i.d. errors. Critical values for the maximum estimator bias for LIML are not available.

this sensitivity analysis and the corresponding F test statistic is much closer to the critical values reported in Stock and Yogo (2005).

An additionally robustness exercise deals with the categorical (ordinal) nature of the variable indicating product quality and applies an ordered probit model to estimates the quality equation rather then OLS. The parameter estimates, reported in Table 8, are nearly identical compared to the main results reported in Table 2. Further, the intensity of competition is measured by the driving distance to the closest rivals rather than by the number of competitors within particular distance bands. These results, summarized in Table 9, show that a larger distance to the two or three closest rivals (i.e. less competition) is associated with significantly higher prices and lower quality levels. Interestingly, the effects are much smaller in absolute size (and not significantly different from zero) if only the distance to the closest competitor is included in the regression analysis.

To allow for a more flexible functional form between the measurement of competition and firms' choice variables dummy variables indicating the number of rival firms are included instead of restricting the effect of competition to prices and quality levels to be linear. These results, reported in Table 10 and illustrated in Figures 4 and 5, suggest that the relationships between competition on the one hand and prices and quality levels on the other hand are almost linear. The final sensitivity analysis relaxes the (somewhat arbitrary) assumption that both categories of product quality (sanitary accessories and tent/trailer pitches) are equally important dimensions for the composite quality index, and a new composite quality index based on endogenous weights is constructed. In a first step, both quality indices are included separately (see Table 11). Then I use the parameter estimates of the two quality dimensions in the price regression as relative weights for the new composite quality index. While the quality of tent/trailer pitches seems to have a somewhat stronger influence on prices than the quality of sanitary accessories, the regression results using this newly constructed composite quality index, reported also in Table 11, are again nearly identical to the main specification reported in Table 2.

All the results of the additional sensitivity analyses, reported and discussed in Appendix C, support the main findings of this article, namely that competition has a positive effect on quality and (conditional on product quality) a negative effect on prices, while better quality is associated with higher prices.

6 Discussion

This article investigates price and quality competition among camping sites in Austria as an example of a market characterized by spatial competition. The main findings are that more competition increases product quality and that better quality is associated with higher prices, whereas competition reduces prices (conditional on product quality). The indirect effect of competition on prices (via influencing product quality) reduces the direct effect so that the total effect of competition on prices (unconditional on product quality) is small (albeit negative), and significantly different from zero in some specifications only. In this industry consumers benefit from tough competition mainly due to higher quality, and to a lesser degree due to lower prices. Based on the predictions derived from the theoretical model these results suggest that the production costs of quantity and quality are substitutes. This is not surprising, as the quality index is influenced, for example, by the number of showers in relation to the number of pitches and by the size of one pitch. The additional costs of increasing these dimensions of product quality obviously increase along with output (or, more precisely, capacity). In this market cost substitutability is high enough for an increase in the number of competitors to increase product quality. In such a case the theoretical model predicts that higher quality is associated with higher prices (Proposition 2), while a larger number of rivals causes prices (conditional on product quality) to decrease (Proposition 1), which exactly corresponds to the results found in the empirical analysis.

Although product quality is an important issue, empirical evidence on the relation between competition and quality is scarce, which is especially true for spatial markets. Most articles dealing with this topic investigate the health care industry. Due to idiosyncrasies of this industry, where prices are often regulated and typically not (always) paid by consumers directly, results on this industry are usually not well-suited for generalizations. The present analysis contributes to the scarce empirical literature outside the health care market. The findings of the present analysis are most closely related to the results of Domberger et al. (1995), who find qualitatively similar results, but in their analysis 'differences in predicted quality [between different levels of competition] were more modest than predicted prices' (p. 1469). Despite finding a negative price effect of competition when analyzing the cable television industry, Emmons and Prager (1997) do not find a (statistically significant) positive effect on quality. This disparity can be explained by differences in the firms' cost structures, namely that providing higher quality (i.e. additional channels) in the cable television industry is likely to affect fixed rather than variable production costs (cost independence between quality and quantity). As predicted by the theoretical model this reduces (or possibly reverses) the positive effect of competition on product quality.[31]

The effects of competition enhancing or reducing incidents on product quality are (besides impacts on prices) important issues for competition authorities. This is especially true if providing low quality induces negative externalities. In the present example of camping sites low sanitary standards might cause ill health. Similar arguments (with even more severe consequences) also apply for other industries like health care or food production. To assess ex-ante effects of competition enhancing policies or of a decline in the number of competitors (due to market exits or mergers) it is crucial to evaluate the cost structure (namely the degree of cost substitutability or complementarity) in the industry: If additional costs of providing high quality products are rather independent of output, more competition threatens do decrease quality levels, as the costs of providing high quality incurred by a single firm has to be borne by a smaller number of consumers. The higher the degree of cost substitutability,

[31] The results reported in the present article are not directly comparable to the findings of Gravelle et al. (2016) – who find a negative effect of competition on prices, but no statistically significant impact on quality when investigating competition among general practitioners in Australia – due to idiosyncrasies of the health care industry.

the higher the chances that more competition will enhance product quality.

In this article, competition is measured by the number of rivals in the vicinity. In spatial models competition can also be heightened by reducing transportation or search costs, which may lead to different policy conclusions. Brekke et al. (2010) and Gravelle (1999) find that quality is not affected by changes in transport costs (as long as utility is linear in income), even if providing high quality is associated with an increase in fixed costs only.

The present research could be extended in other directions: Unlike the camping industry many (especially retail) markets (like hotels, retail banking or clothing) are characterized by large chains controlling multiple outlets. For markets with spatial (but without vertical) product differentiation Giraud-Héraud et al. (2003) show theoretically that an increase in the number of outlets of one chain leads to price increases, as long as the outlets are spatially clustered. Pennerstorfer and Weiss (2013) provide empirical evidence for the retail gasoline market supporting this conclusion. The effects of competition in spatial markets, which are dominated by a few chains controlling large numbers of outlets, on product quality is yet unexplored.

Throughout the article I have assumed that all consumers know about prices and quality levels of all suppliers and act accordingly, which is a simplification typically applied in models in the spirit of Hotelling (1929) or Salop (1979). However, consumers have to incur (monetary and non-monetary) costs to search for camping sites that provide low prices and/or high quality. Guides summarizing information on these product characteristics, as the 'ADAC Camping and Caravaning Guide' used in this analysis, increase consumers' level of information and reduce their search costs, but introduce heterogeneity in the range of information among consumers. Models incorporating heterogeneity in consumers' search costs (so-called 'clearinghouse models') in the spirit of Varian (1980) or Stahl (1989), who distinguish between 'informed' consumers (characterized by zero search costs) and 'uninformed' consumers (who have to pick one store randomly or have to engage in costly sequential search) find that increasing the share of 'informed' consumers reduces average prices, but predict a nonmonotonous effect on price dispersion. Extending these models by incorporating vertical product differentiation could also be a fruitful undertaking.

References

Akerlof, G. A., 1970. The market for 'lemons': Quality uncertainty and the market mechanism. Quarterly Journal of Economics 84 (3), 488–500.

Anderson, T. W., Rubin, H., 1949. Estimation of the parameters of a single equation in a complete system of stochastic equations. Annals of Mathematical Statistics 20, 46–63.

Andersson, D. E., 2010. Hotel attributes and hedonic prices: an analysis of internet-based transactions in Singapore's market for hotel rooms. The Annals of Regional Science 44 (2), 229–240.

Ansari, A., Economides, N., Steckel, J., 1998. The max-min-min principle of product differentiation. Journal of Regional Science 38 (2), 207 – 230.

Baltagi, B. H., 2008. Econometrics, 4th Edition. Springer.

Barron, J. M., Taylor, B. A., Umbeck, J. R., 2004. Number of sellers, average prices, and price dispersion. International Journal of Industrial Organization 22 (8-9), 1041–1066.

Baum, C. F., Schaffer, M. E., Stillman, S., 2007. Enhanced routines for instrumental variables/generalized method of moments estimation and testing. The Stata Journal 7 (4), 465–506.

Benfratello, L., Piacenza, M., Sacchetto, S., 2009. Taste or reputation: What drives market prices in the wine industry? Estimation of a hedonic model for Italian premium wines. Applied Economics 41, 2197–2209.

Brekke, K. R., Siciliani, L., Straume, O. R., 2010. Price and quality in spatial competition. Regional Science and Urban Economics 40, 471–480.

Bresnahan, T. F., Reiss, P. C., 1991. Entry and competition in concentrated markets. The Journal of Political Economy 99 (5), 977–1009.

Cameron, A. C., Trivedi, P. K., 2005. Microeconometrics. Methods and applications. Cambridge [et al.], Cambridge University Press.

Chandra, A., Tappata, M., 2011. Consumer search and dynamic price dispersion: An application to gasoline markets. The RAND Journal of Economics 42 (4), 681–704.

Combris, P., Lecocq, S., Visser, M., 1997. Estimation of a hedonic price equation for Bordeaux wine: Does quality matter? The Economic Journal 107, 390–402.

De Silva, D. G., Elliott, C., Simmons, R., 2013. Restaurant wars: Spatial competition in UK restaurants, economics Working Paper Series 2013/013 of the Lancaster University Management School.

Domberger, S., Hall, C., Li, E. A., 1995. The determinants of price and quality in competitively tendered contracts. The Economic Journal 105, 1454–1470.

Economides, N., 1993. Quality variations in the circular model of variety-differentiated products. Regional Science and Urban Economics 23, 235–257.

Elizalde, J., 2013. Competition in multiple characteristics: An empirical test of location equilibrium. Regional Science and Urban Economics 43 (6), 938 – 950.

Emmons, W. M., Prager, R. A., 1997. The effects of market structure and ownership on prices and service offerings in the U.S. cable television industry. RAND Journal of Economics 28 (4), 732–750.

Fan, Y., 2013. Ownership consolidation and product characteristics: A study of the us daily newspaper market. American Economic Review 103 (5), 1598–1628.

Firgo, M., Pennerstorfer, D., Weiss, C. R., 2015. Centrality and pricing in spatially differentiated markets: The case of gasoline. International Journal of Industrial Organization 40, 81–90.

Gaynor, M., 2006. What do we know about competition and quality in health care markets?, Working Paper No. 12301, NBER Working Paper Series.

Giraud-Héraud, E., Hammoudi, H., Mokrane, M., 2003. Multiproduct firm behaviour in a differentiated market. Canadian Journal of Economics 36 (1), 41–61.

Gravelle, H., 1999. Capitation contracts: Access and quality. Journal of Health Economics 18 (3), 315–340.

Gravelle, H., Scott, A., Sivey, P., Yong, J., 2016. Competition, prices and quality in the market for physician consultations. Journal of Industrial Economics 64 (1), 135–169.

Greene, W. H., 2002. Econometric Analysis, 5th Edition. Upper Saddle River [et al.], Pearson Prentice Hall.

Gržinić, J., Žarković, A., Zanketić, P., 2010. Positioning of tourism in central Dalmatia through the development of camping tourism. International Journal of Economic Perspectives 4 (3), 525–535.

Hotelling, H., 1929. Stability in competition. The Economic Journal 39 (153), 41–57.

Irmen, A., Thisse, J.-F., 1998. Competition in multi-characteristics spaces: Hotelling was almost right. Journal of Economic Theory 78 (1), 76–102.

Lewis, M., 2008. Price dispersion and competition with differentiated sellers. Journal of Industrial Economics 56 (3), 654–678.

Mariano, R., 2001. Simultaneous equation model estimators: Statistical properties and practical implications. In: Baltagi, B. (Ed.), A Companion to Theoretical Econometrics. Blackwell, pp. 122–143.

Matsa, D. A., 2011. Competition and product quality in the supermarket industry. The Quarterly Journal of Economics 126, 1539–1591.

Mazzeo, M. J., 2003. Competition and service quality in the U.S. airline industry. Review of Industrial Organization 22 (4), 275–296.

Mobley, L. R., 2003. Estimating hospital market pricing. Regional Science and Urban Economics 33 (4), 489–516.

Mobley, L. R., Frech, H. E., Anselin, L., 2009. Spatial interaction, spatial multipliers and hospital competition. International Journal of the Economics of Business 16 (1), 1–17.

Neven, D., Thisse, J.-F., 1990. On quality and variety competition. In: J. J. Gabszewicz, J.-F. R., Wolsey, L. (Eds.), Economic Decision-Making: Games, Econometrics and Optimisation: Contributions in the Honour of Jacques H. Drèze. North-Holland, Amsterdam, pp. 175–199.

Pennerstorfer, D., 2009. Spatial price competition in retail gasoline markets: Evidence from Austria. The Annals of Regional Science 43 (1), 133–158.

Pennerstorfer, D., Weiss, C., 2013. Spatial clustering and market power: Evidence from the retail gasoline market. Regional Science and Urban Economics 43 (4), 661–675.

Pennerstorfer, D., Weiss, C. R., Huber, A., Békési, D., 2017. Experts, reputation and the price of wine, unpublished manuscript.

Roma, P., Martino, G. D., Perrone, G., 2013. What to show on the wine labels: A hedonic analysis of price drivers of Sicilian wines. Applied Economics 45 (19-21), 2765–2778.

Salop, S. C., 1979. Monopolistic competition with outside goods. Bell Journal of Economics 10 (1), 141–156.

Stahl, D. O., 1989. Oligopolistic pricing with sequential consumer search. American Economic Review 79 (4), 700–712.

Staiger, D., Stock, J. H., 1997. Instrumental variables regression with weak instruments. Econometrica 65 (3), 557 – 586.

Statistik Austria, 2013. Tourismus in Österreich 2012: Ergebnisse der Beherbergungsstatistik ('Tourism in Austria 2012'), available online at http://www.statistik.at/web_de/services/publikationen/13/index.html, last accessed 21/10/2013.

Stock, J., Yogo, M., 2005. Testing for weak instruments in linear iv regression. In: Andrews, D., Stock, J. (Eds.), Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg. Cambridge University Press, pp. 80–108.

Stock, J. H., Wright, J. H., Yogo, M., 2002. A survey of weak instruments and weak identification in generalized method of moments. Journal of Business and Economic Statistics 20, 518–529.

Tabuchi, T., 1994. Two-stage two-dimensional spatial competition between two firms. Regional Science and Urban Economics 24 (2), 207 – 227.

Thomadsen, R., 2005. The effect of ownership structure on prices in geographically differentiated industries. RAND Journal of Economics 36 (4), 908–929.

Varian, H. R., 1980. A model of sales. American Economic Review 70, 651–659.

Veendorp, E. C. H., Majeed, A., 1995. Differentiation in a two-dimensional market. Regional Science and Urban Economics 25 (1), 75 – 83.

Wooldridge, J. M., 1995. Score diagnostics for linear models estimated by two stage least squares. In: S., M. G., Phillips, P. C. B., Srinivasan, T. N. (Eds.), In Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C. R. Rao. Blackwell, pp. 66–87.

Appendix A Formal Derivation of Equilibrium Prices and Quality

The demand for firm i, X_i, can be summarized as $X_i = L\left(d_{iz-} + d_{iz+}\right)$. Rearranging (3) gives:

$$b(q_i) - b(q_{i+1}) + u\left(Y - p_i - td_{iz+}\right) - u\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right) = 0 \tag{12}$$

To calculate partial derivatives of the demand $X_i(.)$, one has to get $\frac{\partial d_{iz+}}{\partial p_i}$ and $\frac{\partial d_{iz+}}{\partial q_i}$ first. $\frac{\partial d_{iz+}}{\partial p_i}$ and $\frac{\partial d_{iz+}}{\partial q_i}$ denote the change in the location (measured by the distance to firm i) of the consumer who is indifferent between buying from firm i or from firm $(i+1)$ due to a change of firm i's price or quality. These terms can be obtained by total differentiating (12). Let M denote the left-hand side of equation (12), then:

$$\begin{aligned}
&\frac{\partial M}{\partial d_{iz+}}\mathtt{d}d_{iz+} + \frac{\partial M}{\partial p_i}\mathtt{d}p_i = \\
&= -t\left[u_y\left(Y - p_i - td_{iz+}\right) + u_y\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right)\right]\ \mathtt{d}d_{iz+} - u_y\left(Y - p_i - td_{iz+}\right)\ \mathtt{d}p_i = 0 \\
&\Rightarrow \frac{\mathtt{d}d_{iz+}}{\mathtt{d}p_i} = -\frac{u_y\left(Y - p_i - td_{iz+}\right)}{t\left[u_y\left(Y - p_i - td_{iz+}\right) + u_y\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right)\right]}
\end{aligned} \tag{13}$$

and:

$$\begin{aligned}
&\frac{\partial M}{\partial d_{iz+}}\ \mathtt{d}d_{iz+} + \frac{\partial M}{\partial q_i}\ \mathtt{d}q_i = \\
&= -t\left[u_y\left(Y - p_i - td_{iz+}\right) + u_y\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right)\right]\ \mathtt{d}d_{iz+} + b_q\mathtt{d}q_i = 0 \\
&\Rightarrow \frac{\mathtt{d}d_{iz+}}{\mathtt{d}q_i} = \frac{b_q}{t\left[u_y\left(Y - p_i - td_{iz+}\right) + u_y\left(Y - p_{i+1} - t\left(\frac{1}{n} - d_{iz+}\right)\right)\right]}
\end{aligned} \tag{14}$$

With consumer density L total demand for firm i can be characterized by $H \equiv \frac{\partial X_i}{\partial p_i} = -\frac{L}{t}\left\{\frac{u_y(Y-p_i-td_{iz+})}{u_y(Y-p_i-td_{iz+})+u_y\left(Y-p_{i+1}-\left(\frac{1}{n}-d_{iz+}\right)\right)} + \frac{u_y(Y-p_i-td_{iz-})}{u_y(Y-p_i-td_{iz-})+u_y\left(Y-p_{i-1}-t\left(\frac{1}{n}-d_{iz-}\right)\right)}\right\} < 0$ and $K \equiv \frac{\partial X_i}{\partial q_i} = \frac{Lb_q}{t}\left\{\frac{1}{u_y(Y-p_i-td_{iz+})+u_y\left(Y-p_{i+1}-t\left(\frac{1}{n}-d_{iz+}\right)\right)} + \frac{1}{u_y(Y-p_i-td_{iz-})+u_y\left(Y-p_{i-1}-t\left(\frac{1}{n}-d_{iz-}\right)\right)}\right\} > 0$. The first-order condition of the profit function (4) can be stated as:

$$\frac{\partial \pi_i}{\partial p_i} = X_i(.) + (p_i - C_X(X_i(.), q_i))\frac{\partial X_i(.)}{\partial p_i} = X_i(.) - (p_i - C_X(X_i(.), q_i))H = 0 \tag{15}$$

and:

$$\begin{aligned}\frac{\partial \pi_i}{\partial q_i} = (p_i - C_X(X_i(.), q_i))\frac{\partial X_i(.)}{\partial q_i} - C_q(X_i(.), q_i) = \\ = (p_i - C_X(X_i(.), q_i))K - C_q(X(.), q_i) = 0\end{aligned} \tag{16}$$

Assuming that both direct competitors on either side of the road charge the same prices and the provide the same quality levels (i.e. $p_i = p_{-i} = p^*$ and $q_i = q_{-i} = q^*$; which is reasonable as the model is symmetric) gives $d_{iz+} = d_{iz-} = \frac{1}{2n}$ and $X_i(.) = X_{-i} = X^* = \frac{L}{n}$. The partial derivatives of the demand $X_i(.)$ simplify to $\frac{\partial X_i}{\partial p_i} = -\frac{L}{t} < 0$ and $\frac{\partial X_i}{\partial q_i} = \frac{Lb_q}{tu_y} > 0$. Equilibrium prices p^* are given by equation (5), while equilibrium quality levels q^* are implicitly characterized by equation (6).

In this model I assumed that firms are distributed equidistantly along the circular market. In equilibrium, however, no firm has an incentive to move its location by a marginal distance in one or the other direction, as the gain in consumers on one side of the road equals the loss on the other side, leaving profits unaltered.

Equilibrium existence requires that it is not profitable for firm i to lower (increase) its price (quality) to poach the consumer located at the location of firm $i+1$ (or $i-1$) – and therefore patronizing all of firm $i+1$'s ($i-1$'s) consumers. With linear transportation costs these conditions hold, as long as the distance between firms is large enough (see Brekke et al. (2010), footnote 15).

Appendix B Descriptive Statistics and Parameter Estimates on Control Variables

Descriptive Statistics

[Table 5]

Parameter Estimates on Control Variables

[Table 6]

Appendix C Additional Sensitivity Analysis

To show that the results are not driven by the respective methodological approach, the specific measures of competition, restrictions on the functional form of the relationships of interest or by the applied weighting scheme to construct the composite quality index, additional estimation experiments have been carried out to evaluate the robustness of the empirical results reported in section 4. Additionally, specific attention will be devoted to the issue of weak instruments. The results of the sensitivity analyses are discussed in the remainder of this section.

Weak Instruments: While the instruments excluded from the price equation are jointly significant in all specifications and two out of three of these variables are significantly different from zero in the main specification, one may still worry about the explanatory power of the instrumental variables. I therefore apply a limited information maximum likelihood (LIML) or Fuller's modified LIML estimator (Fuller-k) estimator instead of the 2SLS procedure in most cases, as these techniques are less sensitive to weak instruments. In the main empirical specification, information on the nationalities of tourists is used to identify the effect of product quality, but in a rather aggregated way to keep the model simple and to facilitate the interpretation of the results. In this sensitivity analysis these variables are included in a more detailed way. The share of tourists from Northern European countries is divided in tourists from UK and Ireland on the one hand, and from Scandinavian and Baltic countries on the other hand. The share of tourists from Germany (plus Switzerland), France (plus Monaco and Luxembourg), Belgium and the Netherlands are included as additional variables in the quality equation.[32] Tourists from Southern Europe are divided in tourists from the Iberian countries Spain and Portugal, from the successor states of Yugoslavia as well as from Greece (plus Malta). The reference category in this sensitivity analysis is therefore the share of tourists from Austria instead of the share of tourists from all Western European countries.

The regression results including a larger number of instruments are reported in Table 7. The results regarding the instrumental variables in the price equation are qualitatively similar to the main regressions: The parameter estimates on the share of Scandinavian or British (and Irish) tourists are again positive and quite large, but only the estimated coefficient on Scandinavian tourists is significantly different from zero (at the 5%-level). The parameter estimate on Eastern European tourists is negative, albeit not significantly different from zero. Tourists from Germany (plus Switzerland), France (plus Monaco and Luxembourg) and the Netherlands are found to have a positive impact on product quality. Despite the moderate size of the coefficients on the share of tourists from Germany and the Netherlands

[32] Interestingly, the share of Dutch tourists is found to significantly influence prices directly and is therefore also included in the price regression.

the parameter estimates are significantly different from zero at least at the 10%-level. A rationale for this result is that German and Dutch tourists are the two largest groups of foreign tourists, and the regional variation of these two variables is therefore quite large.

[Table 7]

The Hanson J tests are again not rejected at any reasonable significance levels, suggesting that the instruments are valid, even if they are included in a more disaggregated way. The F-statistic on the joint significance of all instruments takes a value of 2.46. The hypothesis that all excluded instruments are jointly equal to zero is therefore rejected at the 1%-significance level, suggesting that the model is identified. Note that the critical values reported in Stock and Yogo (2005), reprinted in the notes of Table 7, are much smaller compared to the main specifications (see Table 2), because the critical values tend to decrease with the number of instruments when using LIML or Fuller-k (see Stock et al., 2002, and Stock and Yogo, 2005). Note that the critical values are based on the assumption of i.i.d. errors and have to be interpreted with caution when being compared to the (cluster robust) Kleibergen-Paap Wald rk F statistic (see Baum et al., 2007, for a discussion).

The results regarding the parameters of interest are only moderately affected by including a larger number of instruments: The number of competitors within two miles' distance is again found to have a significantly positive impact on product quality, whereas the parameter estimate on the number of rivals between two and four miles' distance is positive, but not significantly different from zero. As in the main specifications the effect of competition on prices is significantly negative. The point estimates are of similare size compared to the main results, reported in Table 2. The effect of product quality on prices is again significantly positive (at least at the 10%-level). The point estimates are a bit smaller when 2SLS is used and somewhat larger when LIML and Fuller-k are applied, but the differences to the main specifications are again not statistically significant.

Categorical Data: The measure of product quality used in the analysis is based on categorical (ordinal) data, because the variable is a composite index based on an (at least to some extent qualitative) evaluation of two dimensions of product quality (sanitary accessories and tent/trailer pitches). Throughout the empirical analysis this measure is treated as cardinal data. This approach is justified, as the measure is reasonably small-scale (ranging from 2 to 10). In this sensitivity analysis the quality equation is re-estimated using an ordered probit model to account for the discrete nature of the variable. The results are summarized in Table 8. The parameter estimates of the measure of competition vary slightly by a statistically insignificant amount. The number of rivals within a two miles' distance significantly increases firms' quality levels, whereas the parameter estimate on the number of competitors between two and four miles distance is again positive, but not significantly different from zero.

[Table 8]

Alternative Measures of Competition: As the ways to define local markets and to calculate the variables measuring the intensity of local competition are to some extent arbitrary I use the (logarithm of the) distance to the next competitor, or the (logarithm of the) average distance to the two or three closest rivals as alternative measures of the intensity competition.[33] These results are summarized in Table 9. The regressions including the average distance to the two or three closest competitors give the expected results: A larger distance to the closest rivals – associated with less fierce competition – has a negative influence on product quality and, conditional on product quality, a positive effect on prices. Again, higher quality is associated with higher prices, and a larger share of tourists from Northern (Eastern) European countries has statistically significant positive (negative) effect on product quality. The effect of the distance to the next rival on price and quality takes the expected sign, but is (surprisingly) much weaker and statistically not different from zero.

[Table 9]

Functional Form: This part of the sensitivity analysis addresses the functional form of the relationship between the measures of competition and firms' choice variables (price and quality). In this specification I use dummy variables indicating the number of competitors within a distance of two miles instead of restricting the influence of competition on prices and quality to be linear. The results are reported in Table 10 and illustrated in Figure 4 and Figure 5.[34] Firms facing one competitor do not set different price and quality levels than firms without rivals: The sizes of both coefficients are very small. With two competitors the estimated parameters take the expected signs and increase in (absolute) value, but remain statistically insignificant. The estimated coefficients further increase in (absolute) size for three or more than three rivals. These results support the main findings, but indicate that it does not make much difference if camping sites have one rival or none at all. An explanation for this finding could be that collusive outcomes are likely if there is only one competitor close by, but are difficult to maintain if the number of rivals increases. This explanation is also supported by the result that the distance to the closest competitor does not influence firms' price and quality choices.

[33] These concepts are, among others, applied by Thomadsen (2005) or Firgo et al. (2015), who use the distance to the nearest neighbor, and by Gravelle et al. (2016), who use the distance to the third nearest neighbor (in their main specification). If the distance to the next, second or third next rival is larger than 10 miles the respective distance is set to 10. Given the localized nature of competition in this market any further increase in spatial differentiation is not expected to change the intensity of competition.

[34] Observations with no competitors within a two-miles distance serve as the reference category. Camping sites with more than three competitors are grouped in one class because the number of observations with more than four rivals is rather small.

[Table 10]

[Figure 4]

[Figure 5]

Composite Quality Index: The measure of product quality is a composite index based on quality ratings in two different categories, namely sanitary accessories and tent/trailer pitches. A composite index calculated by simply taking the sum of these two ratings is based on the assumption that both categories are equally important and are (therefore) weighted equally. In this final sensitivity analysis the relative weights of these two categories will be determined endogenously.

To do so I start with an auxiliary regression and include the two categories of product quality (sanitary accessories and tent/trailer pitches) separately in the regressions. These results are summarized in column one to three in Table 11. Very close competitors (within a distance of two miles) are found to have a significant positive not only on the composite quality index, but also on each quality category. The estimated coefficients of the two quality indicators in the price regression are positive, as expected. The point estimates of both quality indices in the price equation are 2.3 (sanitary accessories) and 4.2 (tent/trailer pitches) and are therefore similar to the effect of the composite quality index (with a point estimate of 4.0 in column 2 of Table 2). While both parameter estimates are not significantly different from zero, Wald tests suggest that (i) both parameters are jointly significant and (ii) the parameter estimates are not significantly different from each other.[35] These results therefore support the approach taken throughout the empirical analysis by using a composite quality index based on equal weights for both quality categories.

The parameter estimates of the two quality indices in the price equation (summarized in column 1) are used to construct a composite quality index based on endogenous weights, where the quality of tent/trailer pitches get a higher weight than the quality of sanitary accessories.[36] The regression results using this alternative measure of a composite quality indicator are reported in column 4 and 5 of Table 11. The results are very similar compared to the main specification reported in Table 2, suggesting that the results are not sensitive to a particular weighting scheme, despite an only moderate correlation between the two dimensions of product quality (of about 0.5).

[35] The test statistic is 12.57 ($p = 0.002$) for the null hypothesis that both coefficients are jointly zero and 0.03 ($p = 0.856$) that both coefficients are the same. The tests are χ^2 distributed with two degrees and one degree of freedom, respectively.

[36] This composite quality index is rescaled such that the measure of quality ranges from zero to 10. The weights are therefore $\frac{2.3 \times 2}{2.3+4.2}$ for the quality rating of tent/trailer pitches and $\frac{4.2 \times 2}{2.3+4.2}$ for the rating of sanitary accessories.

[Table 11]

Generally, the sensitivity analyses support the main findings of the article, namely that competition has a positive impact on product quality and (conditional on quality) a restraining effect on prices. Note that the results are not driven by differences between rural and urban areas because district fixed effects, included in all empirical specifications, control (at least to a large extent) for these differences.

Appendix D Tables and Figures Reported in the Appendices

Table 5: Descriptive Statistics on all Variables used in the Regression Analysis

Variable	# of Obs.	Mean	Std. Dev.	Min	Max
Price (p^*)	551	31.92	6.54	16.58	57.82
Quality (q^*)	551	6.00	1.91	2	10
Intensity of competition (n)					
# rival firms within 2 miles	551	0.87	1.69	0	10
# rival firms (0 - 2 miles) with similar quality	551	0.29	0.71	0	4
# rival firms between 2 and 4 miles	551	0.95	1.47	0	9
# rival firms (2 - 4 miles) with similar quality	551	0.38	0.76	0	4
Identification of product quality					
Share of tourists Eastern Europe	546	0.03	0.04	0	0.35
Share of tourists Northern Europe	546	0.04	0.06	0	0.40
Share of tourists Southern Europe	546	0.04	0.04	0	0.51
Endogeneity of competition					
Potential settlement space (within 1 mile, share)	551	0.54	0.22	0	1
Altitude (in 100 meters)	551	5.73	2.39	1.13	13.15
Heterogeneity in demand (L)					
# of overnight stays (over local residents)	548	51.47	71.71	0	391.88
Distance to tourist information (in miles)	551	2.29	2.49	0.01	18.88
# hotels					
within 1 mile	551	8.30	14.58	0	80
between 1 and 2 miles	551	11.46	17.33	0	101
between 2 and 3 miles	551	12.07	18.39	0	128
between 3 and 4 miles	551	11.84	20.31	0	166
# guesthouses					
within 1 mile	551	2.51	3.12	0	20
between 1 and 2 miles	551	3.27	3.92	0	26
between 2 and 3 miles	551	3.97	4.82	0	31
between 3 and 4 miles	551	4.90	5.98	0	37
# restaurants					
within 1 mile	551	1.93	3.25	0	19
between 1 and 2 miles	551	3.07	6.17	0	62
between 2 and 3 miles	551	4.40	12.53	0	108
between 3 and 4 miles	551	6.31	20.56	0	172
# bars/cafes					
within 1 mile	551	1.33	2.71	0	18
between 1 and 2 miles	551	2.07	3.87	0	21
between 2 and 3 miles	551	3.32	8.61	0	81
between 3 and 4 miles	551	4.29	13.75	0	117
Differences in Production Costs (C) *and other forms of product differentiation*					
Size of camping site (# of pitches)	551	145.23	113.87	30	780
Additional services:					
Naturists	551	0.03	0.16	0	1
Families	551	0.16	0.37	0	1
Health treatments	551	0.03	0.16	0	1
Spa	551	0.09	0.29	0	1
Winter camping	551	0.40	0.49	0	1
Horse riding	551	0.06	0.23	0	1
Water trekking	551	0.11	0.32	0	1
Caravan owners	551	0.11	0.31	0	1
Location:					
next to a lake	551	0.31	0.46	0	1
extraordinary or nice view	551	0.74	0.44	0	1

Table 6: Regression Results on other included Variables

Method	Price 2SLS (continued)		Price LIML (continued)		Price Fuller-*k* (continued)		Quality OLS (continued)		Price (red.) OLS (continued)		Price LIML (continued)		Quality OLS (continued)	
Heterogeneity in demand (L)														
# overnight stays over population	-0.002	(0.007)	-0.001	(0.007)	-0.001	(0.007)	-0.002	(0.002)	-0.008[c]	(0.005)	0.000	(0.008)	-0.001	(0.002)
distance tourist information	-0.676[a]	(0.231)	-0.724[a]	(0.264)	-0.698[a]	(0.245)	0.131	(0.084)	-0.205	(0.222)	-0.725[b]	(0.290)	0.110	(0.076)
# hotels														
within 1 mile	0.020	(0.041)	0.018	(0.044)	0.019	(0.042)	0.004	(0.011)	0.035	(0.028)	0.004	(0.049)	0.006	(0.013)
between 1 and 2 miles	-0.029	(0.042)	-0.035	(0.046)	-0.032	(0.044)	0.017[c]	(0.010)	0.035	(0.022)	-0.042	(0.048)	0.013	(0.011)
between 2 and 3 miles	0.117[a]	(0.044)	0.123[a]	(0.048)	0.120[a]	(0.046)	-0.015	(0.009)	0.059[b]	(0.029)	0.106[b]	(0.047)	-0.007	(0.009)
between 3 and 4 miles	0.017	(0.031)	0.015	(0.033)	0.016	(0.032)	0.001	(0.007)	0.024	(0.025)	0.029	(0.036)	0.001	(0.008)
# guesthouses														
within 1 mile	-0.494[c]	(0.256)	-0.546[c]	(0.288)	-0.518[c]	(0.271)	0.125[b]	(0.056)	-0.046	(0.135)	-0.543	(0.335)	0.115[c]	(0.059)
between 1 and 2 miles	-0.480[b]	(0.210)	-0.511[b]	(0.233)	-0.494[b]	(0.220)	0.073	(0.054)	-0.235[c]	(0.137)	-0.570[c]	(0.335)	0.123[b]	(0.058)
between 2 and 3 miles	-0.541[a]	(0.189)	-0.575[a]	(0.210)	-0.557[a]	(0.199)	0.091[b]	(0.044)	-0.204	(0.126)	-0.548[b]	(0.272)	0.105[b]	(0.051)
between 3 and 4 miles	-0.115	(0.134)	-0.123	(0.144)	-0.119	(0.139)	0.025	(0.039)	-0.016	(0.099)	-0.145	(0.150)	0.015	(0.042)
# restaurants														
within 1 mile	0.681[a]	(0.264)	0.708[b]	(0.287)	0.693[b]	(0.274)	-0.075	(0.064)	0.399[c]	(0.211)	0.537[c]	(0.279)	-0.019	(0.083)
between 1 and 2 miles	0.480[b]	(0.227)	0.495[b]	(0.246)	0.487[b]	(0.235)	-0.041	(0.061)	0.346[b]	(0.150)	0.695[b]	(0.333)	-0.100	(0.069)
between 2 and 3 miles	0.114	(0.163)	0.109	(0.175)	0.112	(0.169)	0.005	(0.043)	0.129	(0.123)	0.190	(0.191)	-0.028	(0.051)
between 3 and 4 miles	-0.081	(0.178)	-0.058	(0.192)	-0.070	(0.184)	-0.051	(0.036)	-0.265[b]	(0.132)	-0.116	(0.195)	-0.019	(0.040)
# bars/cafes														
within 1 mile	-0.549[b]	(0.278)	-0.534[c]	(0.295)	-0.542[c]	(0.286)	-0.024	(0.069)	-0.605[a]	(0.235)	-0.307	(0.362)	-0.091	(0.088)
between 1 and 2 miles	-0.039	(0.248)	-0.031	(0.266)	-0.035	(0.256)	-0.028	(0.069)	-0.136	(0.188)	-0.216	(0.282)	0.002	(0.078)
between 2 and 3 miles	-0.046	(0.200)	-0.051	(0.215)	-0.048	(0.207)	0.020	(0.054)	0.038	(0.131)	-0.188	(0.266)	0.065	(0.059)
between 3 and 4 miles	0.058	(0.241)	0.037	(0.256)	0.048	(0.248)	0.044	(0.050)	0.202	(0.188)	0.129	(0.255)	-0.001	(0.055)
Differences in Production Costs (C) and other forms of product differentiation														
Size of camping site (# of pitches)	0.004	(0.004)	0.004	(0.005)	0.004	(0.004)	0.001	(0.002)	0.007[c]	(0.004)	-0.002	(0.010)	0.005[a]	(0.002)
Additional services:														
Nudists	2.409	(1.949)	2.679	(2.095)	2.533	(2.010)	-0.670	(0.722)	-0.109	(2.944)				
Families	-1.636	(2.085)	-2.190	(2.457)	-1.890	(2.251)	1.342[a]	(0.431)	3.153[a]	(0.906)				
Health treatments	-9.530[c]	(4.903)	-10.841[c]	(5.659)	-10.132[c]	(5.237)	3.421[a]	(0.573)	3.024	(2.140)				
Spa	2.968[b]	(1.444)	2.827[c]	(1.571)	2.903[c]	(1.501)	0.391	(0.427)	4.514[a]	(1.079)				
Winter camping	-0.661	(1.585)	-1.018	(1.785)	-0.825	(1.674)	0.898[b]	(0.451)	2.860[a]	(0.935)				
Horse riding	-1.519	(1.398)	-1.657	(1.558)	-1.582	(1.470)	0.479	(0.566)	0.200	(1.381)				
Water trekking	-1.836	(1.247)	-2.029	(1.379)	-1.925	(1.306)	0.634	(0.420)	0.432	(1.040)				
Caravan owners	-1.444	(1.740)	-1.792	(1.958)	-1.604	(1.837)	0.957[a]	(0.366)	1.935[b]	(0.927)				
Location:														
next to a lake	2.314[b]	(1.101)	2.438[b]	(1.197)	2.371[b]	(1.144)	-0.352	(0.349)	1.028	(0.805)	3.245[a]	(1.244)	-0.374	(0.355)
extraordinary or nice view	-2.533[c]	(1.481)	-2.916[c]	(1.689)	-2.709[c]	(1.572)	0.913[a]	(0.351)	0.979	(0.945)	-3.646	(2.366)	1.004[a]	(0.383)

Notes: Regressions include fixed district and fixed time effects. Standard errors are reported in brackets and are clustered at the camping site level.[a] ([b]) [[c]] denote significant parameter estimates at the 1% (5%) [10%] significance levels.

Table 7: Regression Results with more Excluded Instruments

	Price		Price		Price		Quality (reduced form)		Price	
Method	2SLS		LIML		Fuller-k		OLS		OLS	
Quality	3.230	***	6.539	*	6.230	*				
	(0.890)		(3.708)		(3.345)					
# rival firms within 2 miles	-1.069	***	-1.900	*	-1.823	**	0.240	***	-0.222	
	(0.325)		(1.002)		(0.914)		(0.088)		(0.186)	
# rival firms	-0.607	**	-0.764		-0.749		0.057		-0.311	
between 2 and 4 miles	(0.290)		(0.543)		(0.516)		(0.095)		(0.224)	
Share tourists Italy							-0.168		-1.470	
							(2.493)		(6.229)	
Share tourists Spain							-59.727		-448.689	***
and Portugal							(46.159)		(113.262)	
Share tourists former							-10.822		80.098	
Yugoslavia							(37.556)		(101.031)	
Share tourists Greece							12.661	**	-54.655	***
and Malta							(5.753)		(12.700)	
Share tourists Scandinavia							8.211	**	40.212	***
and Baltic States							(3.680)		(10.601)	
Share tourists UK							5.862		13.537	*
and Ireland							(3.636)		(7.920)	
Share tourists Eastern Europe							-2.221		-17.908	**
							(2.459)		(7.271)	
Share tourists Germany							2.793	*	9.755	***
and Switzerland							(1.524)		(3.548)	
Share tourists France,							12.316	*	28.777	
Monaco and Luxembourg							(6.386)		(19.016)	
Share tourists Belgium							-2.898		-17.165	
							(3.364)		(10.996)	
Share tourists Netherlands	-10.498	***	-15.952		-15.442	*	2.764	**	-2.628	
	(3.951)		(9.949)		(9.218)		(1.351)		(3.320)	
constant							3.916	***	26.860	***
							(1.100)		(2.164)	
N	546		546		546		546		546	
R^2	0.356						0.697		0.816	
log-likelihood			-1,815.197		-1,789.852					
Joint-significance of	2.46		2.46		2.46					
instruments $F(10, 230)$	(p = 0.008)		(p = 0.008)		(p = 0.008)					
Hansen J test	11.96		4.12		4.48					
on overidentification $\chi^2(9)$	(p = 0.216)		(p = 0.903)		(p = 0.877)					
AR test on significance	7.96		7.96		7.96					
of quality $F(10)$	(p = 0.000)		(p = 0.000)		(p = 0.000)					

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, the size of the camping site, whether the camping site is located next to a lake or characterized by a nice view, information on additional services, as well as fixed district and fixed time effects. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage quality regression corresponds to the Kleibergen-Paap Wald F statistic. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameter on quality differs from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum estimator bias of 10% (20%) [30%] are 11.49 (6.61) [4.86] for 2SLS and 3.52 (3.07) [2.79] for Fuller-k. The respective critical value for the maximum Wald test size distortion of 10% (20%) are 38.54 (14.78) for 2SLS, 3.68 (2.46) for LIML and 3.12 (2.74) for Fuller-k. Critical values for the maximum estimator bias for LIML are not available. All reported critical values are based on the assumption of i.i.d. errors.

Table 8: Regression Results using Alternative Estimation Techniques

Method	Quality ordered probit	
# rival firms within 2 miles	0.236	***
	(0.072)	
# rival firms between 2 and 4 miles	0.078	
	(0.072)	
Share tourists Eastern Europe	-3.739	*
	(1.985)	
Share tourists Northern Europe	4.180	**
	(1.896)	
Share tourists Southern Europe	-1.658	
	(1.765)	
N	546	
Pseudo-R^2	0.288	
Pseudo log-likelihood	-789.107	
Joint-significance of instruments $\chi^2(3)$	12.11	
	(p = 0.007)	

Notes: Regression includes the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, the size of the camping site, whether the camping site is located next to a lake or characterized by a nice view, information on additional services, as well as fixed district and fixed time effects. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels.

Table 9: Regression Results using Alternative Measures of Competition

Method	Price LIML	Quality OLS	Price LIML	Quality OLS	Price LIML	Quality OLS
Quality	3.568 ***		3.533 ***		3.987 ***	
	(1.247)		(1.211)		(1.310)	
Distance to closest rivals (in logs)	0.607	-0.146				
	(0.402)	(0.123)				
Average distance 2 closest rivals (in logs)			2.066 ***	-0.516 ***		
			(0.788)	(0.163)		
Average distance 3 closest rivals (in logs)					2.940 ***	-0.606 ***
					(1.042)	(0.192)
Share tourists Eastern Europe		-4.350 *		-4.909 **		-4.388 **
		(2.270)		(2.221)		(2.145)
Share tourists Northern Europe		4.416 *		4.498 **		3.998 *
		(2.320)		(2.167)		(2.117)
Share tourists Southern Europe		-1.993		-1.024		-1.338
		(2.308)		(2.184)		(2.169)
constant		5.310 ***		5.808 ***		6.043 ***
		(1.018)		(1.008)		(1.025)
N	546	546	546	546	546	546
R^2		0.660		0.677		0.677
log-likelihood	-1,579.150		-1,560.753		-1,602.579	
Joint-significance of instruments $F(3, 230)$	3.54	(p = 0.015)	3.79	(p = 0.011)	3.27	(p = 0.022)
Hansen J test on overidentification $\chi^2(2)$	0.36	(p = 0.837)	1.16	(p = 0.561)	0.76	(p = 0.683)
AR test on significance of quality $F(3)$	4.45	(p = 0.005)	4.55	(p = 0.004)	4.73	(p = 0.003)

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, the size of the camping site, whether the camping site is located next to a lake or characterized by a nice view, information on additional services, as well as fixed district and fixed time effects. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage quality regression corresponds to the Kleibergen-Paap Wald rk F statistic. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameter on quality differs from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum Wald test size distortion of 10% (20%) are 6.46 (3.69) and are based on the assumption of i.i.d. errors. Critical values for the maximum estimator bias for LIML are not available.

Table 10: Regression Results with Non-Linear Effects of Competition

Method	Price LIML		Quality OLS	
Quality	3.649	***		
	(1.279)			
1 rival firm within 2 miles	-0.212		-0.131	
	(1.037)		(0.349)	
2 rival firms within 2 miles	-2.506		0.468	
	(1.937)		(0.613)	
3 rival firms within 2 miles	-4.769	**	0.803	*
	(1.993)		(0.479)	
4 or more rival firms within 2 miles	-5.861	**	1.344	**
	(2.585)		(0.606)	
Share of tourists Eastern Europe			-3.600	
			(2.309)	
Share of tourists Northern Europe			4.545	**
			(2.192)	
Share of tourists Southern Europe			-2.066	
			(2.246)	
constant			4.982	***
			(0.964)	
N	546		546	
R^2			0.673	
log-likelihood	-1,574.824			
Joint-significance of instruments $F(3, 230)$	3.16		(p = 0.026)	
Hansen J test on overidentification $\chi^2(2)$	0.59		(p = 0.746)	
AR test on significance of quality $F(3)$	4.32		(p = 0.005)	

Notes: Regression includes the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, the size of the camping site, whether the camping site is located next to a lake or characterized by a nice view, information on additional services, as well as fixed district and fixed time effects. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The F test statistic on the joint significance of all excluded instruments in the first-stage quality regression corresponds to the Kleibergen-Paap Wald rk F statistic. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameter on quality differs from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum Wald test size distortion of 10% (20%) are 6.46 (3.69) and are based on the assumption of i.i.d. errors. Critical values for the maximum estimator bias for LIML are not available.

Table 11: Regression Results using Alternative Weights for Composite Quality Index

	Price	Quality (sanitary accessories)	Quality (tent/trailer pitches)	Price	Quality (weighted)
Method	Fuller-k	OLS	OLS	Fuller-k	OLS
Quality	2.286				
(sanitary accessories)	(6.940)				
Quality	4.241				
(tent/trailer pitches)	(4.050)				
Quality (weighted)				3.461 ***	
				(1.106)	
# rival firms	-1.074	0.144 **	0.108 **	-1.122 ***	0.241 ***
within 2 miles	(0.703)	(0.060)	(0.047)	(0.374)	(0.086)
# rival firms	-0.751 **	0.027	0.045	-0.766 **	0.077
between 2 and 4 miles	(0.311)	(0.050)	(0.055)	(0.333)	(0.091)
Share tourists		-1.778	-2.292		-4.224 *
Eastern Europe		(1.339)	(1.469)		(2.316)
Share tourists		1.126	3.160 **		4.895 **
Northern Europe		(1.307)	(1.341)		(2.231)
Share tourists		-0.370	-0.967		-1.516
Southern Europe		(1.427)	(1.597)		(2.315)
constant		3.153 ***	1.832 ***		4.590 ***
		(0.628)	(0.448)		(0.931)
N	546	546	546	546	546
R^2		0.617	0.630		0.670
log-likelihood	-1,539.594			-1,560.689	
Joint-significance of instruments	$F(3, 230)$				
first-stage regression on	1.03				
quality (sanitary)	(p = 0.382)				
first-stage regression on	3.53				
quality (tent/trailer)	(p = 0.016)				
first-stage regression on				3.50	
quality (weighted)				(p = 0.016)	
Hansen J test on	$\chi^2(1)$			$\chi^2(2)$	
overidentification	1.61			1.52	
	(p = 0.204)			(p = 0.468)	
AR test on significance of	4.94			4.94	
endogenous regressors $F(3)$	(p = 0.002)			(p = 0.002)	

Notes: All regressions include the number of overnight stays in the municipality, the distance to the next tourist information, the number of hotels, guesthouses, restaurants and bars/cafes within critical distance bands, the size of the camping site, whether the camping site is located next to a lake or characterized by a nice view, information on additional services, as well as fixed district and fixed time effects. The constant and district fixed effects are partialled out in the price regressions to ensure that the estimated covariance matrix of moment conditions has full rank. Standard errors are reported in brackets and are based on standard errors that are clustered at the camping site level. * (**) [***] denote significant parameter estimates at the 10% (5%) [1%] significance levels. The Anderson-Rubin (AR) statistic tests the null hypothesis that the parameters on quality differ from zero in the price regression and that the excluded instruments are valid instruments. The Stock and Yogo (2005) critical values for the maximum estimator bias of 10% (20%) [30%] are 8.96 (7.18) [6.15] for the first specification (column one to three) and 7.90 (6.61) [5.60] for the second specification (column four and five). The respective critical value for the maximum Wald test size distortion of 10% (20%) are 8.39 (6.79) for the first and 7.18 (5.87) for the second specification. All reported critical values are based on the assumption of i.i.d. errors.

Figure 4: Non-Linear Effects of Competition on Prices

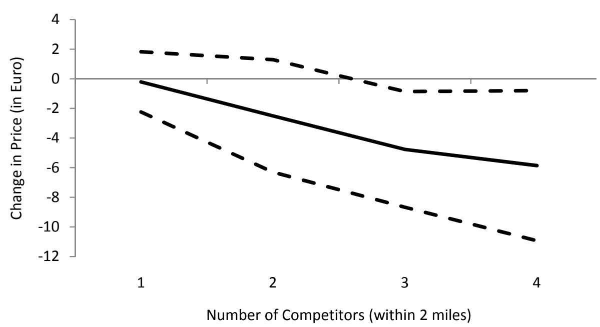
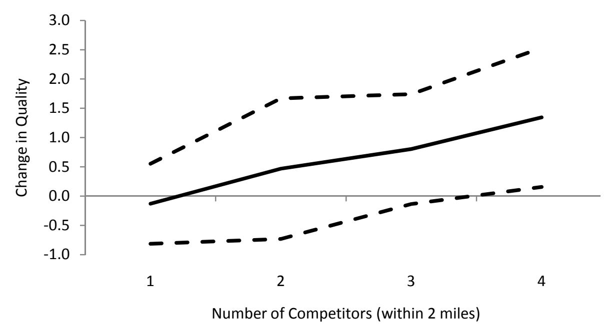


Figure 5: Non-Linear Effects of Competition on Product Quality



Notes: The solid lines denote the average effect of the number of competitors on prices (left figure) and quality (right figure) and the dotted lines indicate the 95%-confidence bands. The results are based on the parameter estimates summarized in Table 10.