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The Quality-Income effect and the selection of location ☆

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ABSTRACT

We analyze a location-choice model with two vertically differentiated firms and two regions with different consumer income. We find that the high-quality producer settles in the poor region and the low-quality one in the rich region when income disparities are sufficiently high and goods are differentiated enough. This apparently counter-intuitive result is not determined by technology or size issues; rather, it relies on the relationship between regional income disparities and product quality, which we call the "Quality-Income effect."

1. Introduction

The analysis of firms' locational choices hinges on a trade-off between centrifugal and centripetal forces. Centrifugal forces are related to competitive pressure, which leads firms to locate further away from one another to obtain more room for their products. Centripetal forces can take two forms. They may arise from technological issues; locations with a favorable cost environment tend to attract all firms. The other source of centripetal force is location size. A larger location is more attractive because of the so-called Home Market Effect (HME).

When studying locational patterns, economic literature usually analyzes the trade-offs between competition and technology alone (e.g. Belleflamme et al., 2000), or competition and technology plus HME (e.g. Laussel and Paul, 2007).[1] Management literature, however, has observed the importance of both demand size and consumers' preferences in determining location choices. According to Porter (1998, p. 327, italics added):

> "[Locational] Advantage arises from having *sophisticated and demanding local customers*, or customers with *unusually intense needs for specialized varieties also in demand elsewhere*."

In this paper we use this observation as our starting point, enabling us to shed light on a new centripetal force determining location. In particular, we focus on the demand side of the market to show how the relationship between consumers' income and product quality influences the locational choices of oligopolistic firms. Dealing with income alone would not suffice as income could represent another measure of a region's size in the HME approach. Instead, our model's specificity lies in the interaction between vertical product quality and income (Gabszewicz and Thisse, 1979; Shaked and Sutton, 1982) in selecting location. We show that when goods are sufficiently differentiated and income disparities are significant, high quality producers are less keen on settling in a rich region than low quality ones, since the demand for their products is less distorted by transport costs. Instead, by choosing a poorer region high-quality producers better exploit this location's lower willingness to pay, while the opposite holds for low-quality firms. We call this mechanism the "Quality-Income (QI) effect." To analyze this effect, we consider a game of duopoly in which each firm produces one variant (high or low quality) of a vertically differentiated good and chooses to locate in one of two regions with different resident income. Once located in a region, firms compete in prices on both the "domestic" and the "foreign" markets. We characterize the set of subgame perfect Nash equilibria of this two-stage game. Equilibrium locations are the result of a centripetal

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[1] We refer to these papers for excellent surveys of the literature on firm location.

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force due to the fact that residents in one region have a higher income (and therefore a higher willingness to pay for quality), and a centrifugal force due to competitive pressure. We characterize locational patterns as a function of the degree of vertical differentiation and income disparity.

We find that the centrifugal force always outweighs the centripetal one, thus firms always choose to settle in different regions; however, we show that the equilibrium in which the high-quality producer settles in the rich region and the low-quality firm in the poor one is obtained only if product differentiation and income disparity are small. By contrast, when the quality gap between the two varieties is large and one region is significantly richer than the other, the high-quality producer chooses the poor region and the low-quality firm settles in the rich one. This apparently counterintuitive result is determined by the QI effect and can be explained as follows. A firm located in the poor region is subject to the distortive effect of transport costs in the rich region; this negative effect, however, is less so for the high quality firm since it "imposes" transport costs on the rich consumers who value quality more and are thus less affected by this distortion. Transport costs influence the choice of the consumer indifferent between purchasing one unit of the high- or low-quality good, which has an impact on the size of each firms' demands in the region they export to. Furthermore, in the case of the low-quality producer transport costs influence the consumer indifferent between consuming one unit of the low-quality good and refraining from consumption. This "double distortion" explains why the low-quality firm selects the rich region, which, in turn, leads the high-quality firm to escape competition in this region by locating in the poor one. In other words, the overall burden arising from transport costs distortion in the richer region is lower for the high-quality firm than for the low-quality one.[2]

Our model's structure is formally related to Belleflamme et al. (2000), who investigate the impact of localization economies on firm locations. Their model consists of two identical regions with location externalities operating at the production level only if firms locate in the same region. In their model equilibrium locations arise as a balance between a centripetal force stemming from location externalities and a centrifugal force deriving from firm rivalry and product market competition. Our model shares their two-region structure, the firms' strategic behavior and competition as a centrifugal force. The centripetal force in Belleflamme et al. (2000), however, originates on the supply side and consists of cost-reduction externalities, whereas in our model it originates on the demand side.

Production location and the pattern of trade in a two-region world are also the focus of a recent paper by Laussel and Paul (2007) that analyze the interaction between the HME and the wage differential effect in a model of monopolistic competition with countries differing in size.

Our work is also connected to literature dealing with international trade in quality-differentiated commodities. Linder (1961) points out that product quality is a determinant of trade patterns and stresses the importance of the relationship between a country's income and product quality in production decisions. Over the last decades an increasing amount of literature has explored the links between trade flows and vertical product quality, see for example Flam and Helpman (1987), Hallak (2006), Baldwin and Harrigan (2007), Hummels (2007a, 2007b), Sutton (2007), Hallak and Schott (2008), Khandelwal (2008). In our paper, however, trade patterns are determined by strategic location choices, while the aforementioned literature focuses on the features of trade patterns themselves.

Finally, our paper relates to recent research exploring the role of "preference externalities" whereby the number of consumer groups sharing the same preferences (identified by characteristics such as race, income, age) in a region influences the spectrum of differentiated products supplied to that region (Waldfogel, 2003; George and Waldfogel, 2003).

The rest of the paper is organized as follows: Section 2 describes the model, Section 3 provides equilibrium analysis, Section 4 discusses the results, and Section 5 provides a short conclusion.

2. The model

Consider two locations, R and P. Two firms each produce one of the two variants (h for high-quality and l for low-quality) of a vertically differentiated good. Firms locate in one of the two regions, their product qualities are assigned at the outset and cannot be modified. Let the first element of the couple (jz) represent the location choice of firm-h and the second that of firm-l. There are four possible locational configurations: (RP), (PR), (RR) and (PP). In the first two configurations firms disperse, whereas in the last two they agglomerate.

Regions are inhabited by a continuum of consumers. Consumers are immobile, and each buys at most one unit of the good. Goods can be shipped across regions at a constant unit transport cost t, borne by consumers and independent of the direction of trade.[3] Markets are segmented, and each firm practices price-discrimination between markets.

Regions differ in their population's willingness to pay for quality: consumers are distributed uniformly according to their quality appreciation θ over $[0, \bar{\theta}]$ in region R, with $\bar{\theta} \geqslant 1$, and over $[0, 1]$ in region P. Consumers' masses are normalized to 1 in both regions. Since a consumer's higher willingness to pay is commonly interpreted as a larger income of that agent, region R is *richer* than region P.[4] In the following, we use $\bar{\theta}$ as a measure of income disparity between locations.

Consumers are characterized by a utility function *à la* Mussa and Rosen (1978). Suppose that good $i \in \{h, l\}$ is produced in region $j \in \{R, P\}$, then the utility of consumer θ is:

$$u = \begin{cases} \theta k_i - p_i^j & \text{if the consumer resides in region } j \text{ and} \\ & \text{buys a unit of good } i, \\ \theta k_i - p_i^z - t & \text{if the consumer resides in region} \\ & z \in \{R, P\},\ z \neq j \text{ and buys a unit of good } i, \\ 0 & \text{if the consumer does not buy any product.} \end{cases} \tag{1}$$

The price charged by firm i in region j (resp. region z) is p_i^j (resp. p_i^z), k_i represents the quality level of good i, with $k_h > k_l$.

Following the standard marginal consumer approach, let θ_0^m identify the consumer residing in region m ($m \in \{R, P\}$) that is indifferent between buying and not buying one unit of the low-quality product. Similarly, let θ_1^m identify the consumer residing in region m that is indifferent between buying one unit of the low-quality product and one unit of the high-quality one.

Consider the case (RP) first. In region R, the solution to the following equation:

[2] Throughout the paper we generically use the term "region" to refer to the geographic unit of analysis, placing our exposition within a "trade" context. This term, however, should not be taken literally. For instance, adopting an urban economics perspective, a "region" could denote a neighborhood within a city; in this perspective, this present paper analyzes how income differences among a city's neighborhoods influence the location of vertically differentiated retailers. Section 4 discusses this point further.

[3] Hummels and Skiba (2004) find strong evidence in favor of unit transport costs against iceberg costs. In Section 4.1 we discuss the application of this alternative modeling assumption to our analysis.

[4] See Tirole (1988), p. 97.