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GLOBAL VERSUS LOCAL COMPETITION

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ABSTRACT

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Global vs. Local Competition*

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March 25, 2002

Abstract

We analyze the impact of increased outside opportnunities brought to consumers by access to a global market on local market performance under monopoly vs. oligopoly. If consumers have to choose once where to shop we show that under all forms of organizing the local market, increased competition from the global market will crowd out variety in the local one. The effect of increased global competition on prices is much less clear. While it yields a price reduction under monopoly, prices may increase under oligopoly. we check the robustness of these results in various extensions and draw consequences on competition and industrial policies.

1 Introduction

What are the effects of increasing global competition on local markets? A common view is that globalization provides a utility increasing outside option to consumers, which constrains their local market participation. One might expect that in this situation increasing global competition unequivocally reduces market power in local markets, thus leading to a price decrease benefiting all consumers. There would thus be little scope for competition

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policy in these markets.[1]However, even in this simple world, an increase in the outside option may induce segmentation between consumers in a way that the demand faced by local suppliers becomes more inelastic, and thus increases their market power.[2]

Increases in global competition also change local incentives to provide quality. That quality comes in many different dimensions; for instance, quality of the commodity itself, quality of service to the customer, quality assurance through reputation, or matching quality as affected by the number of varieties offered. In this paper's analysis, we focus on the last dimension. The analysis should have quite natural implications for the other ones.

Local market structure matters in the provision of that quality. Increased local quality increases local market demand, which may benefit all local traders. Therefore, quality is a collective good, and the (private) incentives to contribute to it vary with local market structure. This introduces a new dimension into any welfare comparison between monopolistic and oligopolistic behavior, and thus even more complicates an evaluation of the disciplining effect of global competition.

In this paper, we focus on the impact of increased outside competition on the trade off between the disciplining effect of competition from oligopoly and the internalization incentive from monopoly on the provision of local quality, and on local prices. Amongst the questions we ask is whether, in the face of increasing global competition, competition policy and even more, industrial policy should restict, or promote the concentration of local market power. We first conclude that local market conditions are not very informative. For instance, we find regimes in which *price-cost-margins increase* when *outside competition increases*. We also observe regimes under which *prices are higher under oligopoly with free entry than under monopoly*. Secondly, we conclude that under a consumer surplus criterion, *oligopoly is preferable to monopoly only if outside competition is weak*, and *monopoly is preferable when outside competition is strong*. These conclusions reflect the fact that monopoly better internalizes positive externalities of the type alluded to above, and thus are quite general. The intensity of global competition thus matters in the determination of prescriptions for competition policy and industrial policy incentives.

Our model is specified for, and can be most easily interpreted within the specific context of competition between internet and local traders in a market for inspection goods. Its reinterpretation for the other aforementioned situa-

[1] Yet demands on local industrial policy buffering the redistribution of economic activity could substantially increase.

[2] This point is made in Legros and Stahl (2002)

tions is natural. Consumers seeking to buy a suitable variant of an inspection commodity are confronted with the alternative to buy in an internet market (e.g. from a continuum of variants offered), or to patronize a local market (with fewer variants offered). The former market is modelled as an outside opportunity utility obtained by consumers. The latter market is organized alternatively by an oligopolistic structure involving specialized firms that sell one variety of a differentiated commodity, or a monopoly selling all variants in that market place.

As customary, commodity variants are specified by locations on the circumference of a Salop-circle (Salop, 1979). Consumers are differentiated by ideal varieties on this circle, as well as by their relative costs of accessing the internet vs. the local retail market. The typical consumer can precisely specify her utility only upon the inspection of the commodity variants, after her access decision to the trading channel. *ex-ante*, that decision is taken on the basis of an expected (indirect) utility criterion. However, *ex-post*, the consumer is faced with very different alternatives before the purchase decision is taken. While many more variants may be sold in the e-commerce channel, she can inspect the variants on sale only in the local market.

Quite naturally, the consumer's expected utility from patronizing the local market increases in the number of variants, and decreases in prices. Thus in a market opened by oligopolistic single variant sellers, entry and price setting decisions confer externalities on all other sellers, as custom increases with an increasing number of variants offered, and decreases in prices. These externalities can be internalized by the monopolist. Consistent with many markets, we assume in our baseline model that prices are not predetermined but are discovered once consumers visit the market. This generates an *ex-post* hold-up problem for consumers that under oligopoly is partially alleviated by price competition. (Obviously, consumers' price anticipations are met in equilibrium). We later analyze variants of the monopoly model that both alleviate the hold-up problem. In the first, we allow the monopolist to pre-announce prices (and to credibly commit to them) before consumers go to the market. In the second, consumers are allowed to switch to the e-commerce trading channel after having found the the suitable variant in the local market. Thus in this case, both the monopolist as well as the oligopolists face *ex-post* competition from e-commerce.

One of the interesting questions arising here is which market organization will provide higher utility to the consumers: the oligopolistic market in which the externality is not internalized but competition exercises its price disciplining force, or the monopolistic market in which the externality is internalized, but monopoly is only constrained by competition from e-commerce. The answer to this question is not only interesting in its own right. It has an obvious bearing on the relative survival of local markets, since the market providing higher utility will do better.

Our results are as follows. Within a comparative statics exercise with respect to the outside utility from consumption via e-commerce, we show that surprisingly, under both forms of organizing the local market, increased competition from e-commerce will crowd out variety, thus unequivocally leading to a quality loss. However, the effect of increased competition on prices is much less clear. While increased global competition *reduces* prices under monopoly, prices *increase* under oligopoly when global competition is weak, and decrease only when it is strong! The effects of an increase in the outside option on local welfare mimic the effects on prices. A direct welfare comparison between the two market forms is possible only under strong global competition. Yet in this situation, monopoly welfare dominates oligopoly.

As to an explanation of these results: The monopolist's market power creates a hold-up problem leading to a relatively high price (equal to the willingness to pay of the "marginal" consumer), that in equilibrium is anticipated by consumers. A larger number of varieties implies more utility for all consumers but also a higher price and, by concavity of the utility function, a reduction in the difference between the inframarginal and the marginal consumers' utilities: it follows that the *ex-ante* surplus of a consumer is a *decreasing* function of the number of varieties.

Now, in response to an increase in outside utility, the monopolist can decide either to decrease the number of varieties in order to slow down the individual variety's loss of (local) market share, or to increase it in order to increase profit per consumer. Which strategy is optimal depends on the tradeoff between the speed at which market share is lost, vs. the speed at which profit per consumer increases. If the distribution of consumer types with respect to relative access costs is log-concave as assumed here, the first strategy is profit maximizing: demand decreases faster than profit per consumer increases when the number of varieties increases. This implies a decrease in the number of varieties (i.e. a crowding out effect) as well as a decrease in prices. It also implies an increase in the welfare of consumers who purchase from the local retail market.

With oligopoly, the ex-post hold-up problem is weakened since firms in the retail market compete for the marginal consumer and will post a price strictly lower than her utility. However, an increase in outside utility implies lower equilibrium profits for a given size of the local market. Hence, in an equilibrium with free entry, variety will go down; but fewer varieties implies less competition *ex-post.* Under concavity of the typical consumer's utility function the second effect implies that prices increase.

It is tempting to assert that the difference between outcomes under monopoly and oligopoly is linked to the difference in the magnitude of the hold-up problem between the two. However, as we show in an extension, this intuition is incorrect. Allowing the monopoly to announce and to commit to prices *before* consumers decide between local and global markets should give maximum liberty to monopoly to commit to low prices ex-post. Nevertheless, the monopolist still tends to reduce variety and prices.

We conclude that it is not so much the hold-up problem that is responsible for the difference in behavior under monopoly and oligopoly, but rather the *nature of competition ex-post* (once consumers are in the local market). The monopolist faces a non-strategic competitor, and the constraint thus imposed in equilibrium is similar to a participation constraint. By contrast, in monopolistic competition firms face *ex-post* strategic competitors and the constraint imposed in equilibrium is similar to an incentive constraint.

For this reason, we finally conider *ex-post* competition in both, the monopoly and the oligopoly model, by allowing consumers to inspect varieties in the local market before deciding to buy the preferred variety in the local vs. the global market. The benefit of inspection is that the consumer can order a specific variety in the global market while she could not without inspection. Here it becomes important to distinguish between the reasons for increases in the expected indirect utility in the global market. If only prices decrease in the global market, the crowding out effect is upheld. If, however, consumers' selection process is improved *ex-ante* in the global market while prices do not decrease too much, the number of varieties in the local monopoly market might increase when the *ex-ante* value of purchasing in the global market is large. Such a regime switch in the comparative statics does not happen in the oligopoly case: Local variety unequivocally decreasesin all cases.

The cases discussed are not only interesting conceptually. They also characterize different market arrangements, and for different types of commodities. In particular, our baseline models reflect *markets for non-standardized commodities* such as individually designed fashion goods that are not sold in the internet in identical variants. *ex-ante* price commitment should also not be typical in markets for this type of goods, as prices are not informative without knowledge of the goods' quality characteristics. By contrast, the extended models rather reflect *markets for standardized inspection goods.* Only these can be sold with identical characteristics in both market channels, and price announcements tend to be more informative for this class of commodities.

The fact that outside competition affects the performance of a local market is obviously present in discussions on the role of mail order business (e.g., Michael 1994, Balasubramanian 1998, and Bouckaert 1999) or the impact of electronic commerce on conventional retailing (e.g. Baye and Morgan 2001, Janssen and Moraga 2001, and Ulph and Vulkan 2001). In none of these papers the effect of an increased pressure from outside competition on the evolution of local market performance is analyzed, which is the main focus of our paper. Salop (1979) informally performs comparative statics that can be reinterpreted in light of ours, albeit in a much simpler model and only for the oligopoly case. He obtains a price reaction opposite to the one we derive from our formal analysis. At any rate, the gist of our comparative static analysis is on the comparison of effects on oligopoly and monopoly in different variants of a much more complex and general model.[3]

As such our model belongs to a small theoretical literature on the effect of increasing competition on market performance.[4] These papers adress the disciplining role of competition on incentive provision in firms. Competition is usually measured by the number of competitors. While cast in completely different contexts, these papers show also an ambiguous effect of increased competition on the variables relevant for performance (managerial effort, contractual instruments). However, these models do not feature the comparison of this effect on different market structures.

Finally, Stahl (1982), Gehrig (1998), and Schulz and Stahl (1996) analyse price and variant determination in local markets for inspection goods. Schulz and Stahl compare equilibria under different local market structures. All ignore the role of outside competition.

The rest of the paper is organized as follows. Section 2 contains the description of our model. The results for the baseline monopoly and oligopoly cases are derived in sections 3 and 4, respectively. In section 5, we discuss the case where the monopolist commits *ex-ante* to prices. Section 6 elaborates on *ex-post* competition. In our concluding section 7, we draw implications from our analysis on competition and industrial policies.

2 The Model

Central to our comparative analysis is the ability of different local market structures to substitute price and quality in order to provide at lowest cost to consumers the equilibrium utility called for by outside competition. The

[3]In a paper similarly entitled, Anderson and de Palma (2000) analyse and compare local competition as competition between neighboring firms à la Hotelling or Salop, vs. global competition between brands à la Dixit and Stiglitz. Ghemawat (2001) adresses competition between global firms (such as McDonald's) and local firms (such as neigborhood restaurants), an aspect that is only tangential to our approach.

[4]Early papers are Hart (1983) and Scharfstein (1988). More recent papers are Schmidt (1997), Aghion et al. (1997), (1999).

price-quality tradeoff is conveniently formalized in Salop's (1979) model of product differentiation on the circle.

There is a measure 1 of consumers on a circle of circumference 1. A consumer is identified by a pair (y, θ), where $y \in [0,1]$ is the ideal variety for the consumer and θ is her cost of accessing the local market, net of the access cost to the internet market. Viewed as random variables, y and θ are i.i.d.; y is uniformly distributed and θ has distribution G. We assume that G is log-concave (for instance, a normal cumulative distribution is log-concave) and has a strictly positive density g on $(-\infty, +\infty)$. Note that log-concavity is equivalent to a *decreasing likelihood ratio* $\frac{g}{G}$.[5] Consumers wish to consume at most one unit of the commodity. If a consumer with ideal variety y consumes variety $\widehat{y}$ where $|y - \widehat{y}| = x$, his utility gross of the price p paid is given by $h(x)$, where h is a strictly decreasing and strictly concave function with $h'(0) = 0$.

There are two types of firms active in the local market, that are considered in two different variants of the model. In the first variant, a monopolist offers m variants. In the second, there are m specialized producers offering one variant each.

The timing of events is as follows:[6]

- The number m of varieties is set in the local market (by a monopolist or by oligopolists).
- Consumers learn their relative cost θ of going to the local market.
- Consumers anticipate that the expected utility from purchasing from the global market is u; we assume that u has range $(-\infty, h(0))$. Hence, if $u = -\infty$, the global market is not attractive for any consumer, while if $u = h(0)$, the local market will cease to exist since all consumers strictly prefer the global market for any pair (m, p) on the local market.
- Consumers observe the number m of varieties in the local market. For convenience m is treated as a continuous variable.
- Consumers decide whether to go to the local market or to buy from the global market.
- Prices p are set in the local market.

[5] By example, consumers living in central cities close to local retailers, but illiterate in the use of computers are characterized by large negative values of θ.

[6] We will modify the timing in the extensions to allow for prices to be set ex-ante, or to allow consumers to purchase in the global market after having searched in the local market.

- Nature draws y and consumers who go local learn, by trying different varieties and comparing prices, the variety-price pair that maximizes their utility.

The assumption that consumers learn about their best variety only after they have committed to buy from one market place captures the idea that consumers can discriminate among varieties only by inspection; this inspection is only possible in the local market (e.g., by going into stores and trying on clothing). In the last section, we allow for the possibility for a consumer to first inspect varieties in the local market and then buy the preferred variety in the global market.

The *ex-ante* utility of a consumer who purchases from the global market is exogenously given by $u = \underline{h} - q$, where $\underline{h}$ is the expected gross utility and q is the expected price in the global market. For our purpose, the precise specification of the global market is not crucial because we assume that there is no strategic response of the global market to *local* changes in the local market.

In the local market, there is a fixed cost $F \geq 0$ to introduce a new variety and a marginal cost $c \geq 0$ per unit sold. F may refer to the cost of leasing shopping space. [7] We make the standard assumption that varieties are always symmetrically located on the circle.[8] Consumers choose their mode of shopping anticipating the equilibrium prices in the local market. Because the consumers learn their ideal variety *after* having decided where to shop, each consumer has the same *ex-ante* expected utility (before the access cost and prices) from shopping in the local market. Thus, there exists in equilibrium a trigger value $\tilde{\theta}(m)$ such that all consumers with cost less than this value shop in the local market, and consumers with cost greater than this value shop in the global market.[9]

Now, since θ and y are i.i.d. and since the marginal cost is constant, the strategic behavior of firms is independent of the mass of consumers. It is therefore enough to find the continuation equilibria for a mass one of con-

[7] Thus, when introducing m variants, the monopolist incurs a fixed cost mF. In order to facilitate the comparison with the oligopolistic outcome, we ignore economies of scale in fixed costs the monopolist undoubtedly enjoys. As we will see later, the introduction of economies of scope will only reinforce our result that under stiff global competition, local monopoly yields higher consumer utility than oligopoly.

[8] This assumption involves some loss of generality in the oligopoly case. However, it is without loss of generality in the monopoly case.

[9] Note that a necessary condition for the retail market to attract a positive mass of consumers is that if price is equal to marginal cost and if all varieties are sold, i.e., if $\theta^{\infty} = \lim_{m \to \infty} \tilde{\theta}(m) = h(0) - \int_0^1 h(x)\, dx - c + q$, we have $G(\theta^{\infty}) > 0$. Stronger conditions are in fact necessary in order for the retail market to break even.

sumers, i.e., to find the symmetric equilibrium price $p(m)$ and the symmetric maximal acceptable distance $x(m)$ between the ideal point of a consumer and a given variety. Two regimes are *a-priori* possible in equilibrium. In the first regime, the price is large enough that some consumers decide not to consume after having learned their ideal variety. We will say that the market is *not covered.* In the second regime, the price is low enough so that all consumers find it optimal to consume some variety. We will say that the market is *covered.*

To simplify, we assume that it is not possible to cover the market with only one variety; if only one variety is offered in the market, the consumer whose ideal variety is farthest away, i.e. at a distance of $1/2$, has utility $h\left(\frac{1}{2}\right)$ from purchasing that variety. Since the price must be at least equal to c for the firm to break even, the market is not covered whenever

$$h\left(\frac{1}{2}\right) < c. \tag{1}$$

For the local market, we consider two organizational structures, a multi-product monopoly and an oligopoly with free entry involving single product firms. We will be interested in comparing the performance of each structure as the global market becomes a stronger competitor, i.e., as u increases.

3 Market Responses to Global Competition

3.1 Properties of the Profit Function

The residual demand facing the local market depends on the level of surplus that it offers customers. This *ex-ante* surplus is a function of the number m of varieties that will be offered, which can be thought as an indicator of quality, and of the price p that consumers will pay. The monopoly chooses m to maximize *ex-ante* profits, while he sets p to maximize *ex-post* profits, i.e., once customers are in the shop. The oligopoly with free entry introduces competition *ex-ante* and *ex-post*: *ex-post*, the symmetric price p is the non-cooperative equilibrium of a differentiated oligopoly while teh number of variables, i.e., firms m is set *ex-ante* so as to make entry and exit unprofitable. These differences in commitment between the two market structures are apparent in the reduced form profit functions of the industry.

In this section we derive general properties of a profit function assuming *full commitment* on varieties and prices; properties that will be key in deriving the comparative static results for the equilibria under each market structure.

Given a pair (m, p), a consumer has an expected utility of $2m \int_0^{\frac{1}{2m}} h(x)\,dx - p - \theta$ of shopping locally while he has an expected utility of $u = \underline{h} - q$ of shopping globally. The demand the local market will attract is the measure of consumers whose relative cost of shopping locally is less than

$$\tilde{\theta}(m, p) = 2m \int_0^{\frac{1}{2m}} h(x)\,dx - p - u. \tag{2}$$

We say that the market is *covered* if $p \leq h\left(\frac{1}{2m}\right)$. Let us restrict attention to pairs (m, p) for which the market is covered; we will verify later that the covering condition is always satisfied. When the covering condition is just satisfied, i.e., when $p = h\left(\frac{1}{2m}\right)$, the expected utlity to local consumers is

$$H(m) = 2m \int_0^{\frac{1}{2m}} h(x)\,dx - h\left(\frac{1}{2m}\right). \tag{3}$$

This surplus H will play a central role in the ensuing analysis. While it is difficult to sign the first derivative of H, we can show by an indirect argument that H is a strictly decreasing and convex function.

Lemma 1 *H is a strictly decreasing and convex function.*

The expected profit of the local industry is then $\pi(m, p) = G\left(\tilde{\theta}(m, p)\right)(p - c) - mF$. It is convenient to make a change of variable. Let $v = 2m \int_0^{\frac{1}{2m}} h(x)\,dx - p - u$ be the net (of θ) surplus of local consumers. Then $p = H(m) + h\left(\frac{1}{2m}\right) - v - u$, and the profit can be rewritten as

$$\pi(m, v) = G(v)\left(H(m) + h\left(\frac{1}{2m}\right) - v - u - c\right) - mF \tag{4}$$

while the covering condition $p \leq h\left(\frac{1}{2m}\right)$ can be written as

$$m \geq H^{-1}(v + u).$$

Lemma 2 *(i) $\pi(m, v)$ is concave in m.*

(ii) For each m, π is single-peaked in v, i.e., has a unique extremum that is a maximum.

If we represent the graphs of $\pi_m = 0$ and of $\pi_v = 0$ in (v, m) space, both of these graphs are increasing. Indeed, since $\frac{H(m)}{m}$ is a decreasing function of m, when m increases, it is necessary that v increases in order to satisfy (15). Since $H(m) + h\left(\frac{1}{2m}\right)$ is increasing in m, it is necessary that v increases in order to satisfy (22). We can show that for a given u these graphs intersect only once and moreover that the graph of $\pi_v = 0$ intersects the graph of $\pi_m = 0$ from below.

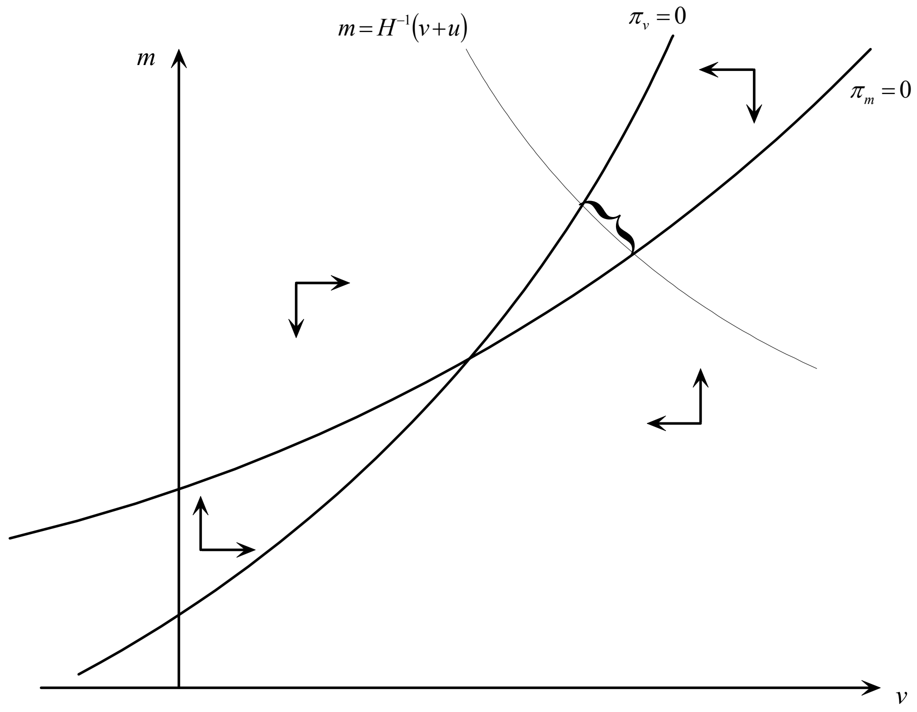

Figure 1: Directions of increasing industry profits

Lemma 3 *(i) if* $\pi_m(m,v) = 0$ *then* $(\hat{m} - m)\,\pi_m(\hat{m},v) < 0$ *and* $(\hat{v} - v)\,\pi_m(m,\hat{v}) > 0$;

(ii) if $\pi_v(m,v) = 0$ *then* $(\hat{m} - m)\,\pi_v(\hat{m},v) > 0$ *and* $(\hat{v} - v)\,\pi_v(m,\hat{v}) < 0$;

(iii) The graph of $\pi_v = 0$ *intersects the graph of* $\pi_m = 0$ *only once and "from below": if* (m,v) *satisfies* $\pi_m = \pi_v = 0$, *then when* $\hat{v} < v$, $\pi_v(\hat{m},\hat{v}) = 0 \Rightarrow \pi_m(\hat{m},\hat{v}) > 0$ *and when* $\hat{v} > v$, $\pi_v(\hat{m},\hat{v}) = 0 \Rightarrow \pi_m(\hat{m},\hat{v}) < 0$.

These properties are represented in Figure 1 where the arrows indicate the direction of increasing industry profits. (The bracketed part of the curve $m = H^{-1}(v+u)$ will play a role later in the paper.)

3.2 Monopoly

Once m is fixed, the problem of the monopolist is to choose *ex-post* the price that maximizes his profit; since the mass of customers shopping locally is set at this point, this is equivalent to choose the segment of the market that he wants to serve. By symmetry, the monopoly chooses $x \leq \frac{1}{2m}$ to maximize

$x\left(h\left(x\right)-c\right)$. Let x^* be the unconstrained optimum

$$h\left(x^*\right)-c+xh'\left(x^*\right)=0, \tag{5}$$

and let $m^*=\frac{1}{2x^*}$. We assume that fixed costs are small enough so that when a measure one of consumers buy from the local market and when $m=m^*$, the monopoly makes positive profits, i.e.,

$$x^*\left(h\left(x^*\right)-c\right)>\frac{F}{2}. \tag{6}$$

If $m<m^*$, the monopoly would find it optimal to set ex-post $p=h\left(\frac{1}{2m^*}\right)>h\left(\frac{1}{2m}\right)$ (remember that h is decreasing). In this case the $\theta=0$ consumer has an expected utility of $u^L=2m\int_0^{1/2m^*}\left[h\left(x\right)-h\left(\frac{1}{2m^*}\right)\right]dx$. *ex-ante* all types $\theta\leq u^L-u$ prefer to go to the local market and the *ex-ante* profit of the monopoly is

$$\pi\left(m\right)=G\left(u^L-u\right)\left(h\left(\frac{1}{2m^*}\right)-c\right)\frac{m}{m^*}-mF.$$

As long as $m<m^*$, π is the profit function in a neighborhood of m. Assuming that $\pi\left(m\right)\geq0$, the marginal profit is

$$\pi'\left(m\right)=\left(2\int_0^{1/2m^*}\left[h\left(x\right)-h\left(\frac{1}{2m^*}\right)\right]dx\right)g\left(u^L-u\right)\left(h\left(\frac{1}{2m^*}\right)-c\right)\frac{m}{m^*}+\frac{\pi\left(m\right)}{m}.$$

Since $h\left(x\right)>h\left(\frac{1}{2m^*}\right)$ when $x<\frac{1}{2m^*}$, $\pi'\left(m\right)>0$ and the monopoly wants to increase the segment of the market that he serves. This proves that the market is covered.

Lemma 4 *There exists m^* such that if the monopoly enters the local sector, it chooses a number of varieties greater than m^* and the market is covered.*

Therefore, a monopoly will choose m *ex-ante* in order to cover its market ex-post, i.e., $m\geq m^*$ and $p=h\left(\frac{1}{2m}\right)$. This implies that the (symmetric) price *increases* in the number of variants as it is determined from the total utility of the "marginal" consumer. The expected consumer surplus (net of θ) from purchasing from the local market is then given by (3), or $H\left(m\right)\equiv2m\int_0^{\frac{1}{2m}}\left[h\left(x\right)-h\left(\frac{1}{2m}\right)\right]dx$. Hence, from Lemma 1, the surplus of consumers is *decreasing* in the number of varieties. While consumers value more varieties, the reservation price of the marginal consumer is also increasing in the number of varieties. Since the monopoly will set a price equal to the reservation price of the marginal consumer, and since this reservation price is concave increasing in the number of varieties, infra-marginal consumers have less surplus when the value to the marginal consumer increases.

The hold-up problem prevents the monopoly from *separating the price decision from the variety decision* and therefore creates a one-to-one relationship between the decision to give more surplus to the consumers and the decision to decrease varieties. Whether or not the monopoly will effectively decide to give more surplus to the consumers in response to an increase in their outside option u depends on the relative effects on the demand and on the profit per consumer.

The monopoly chooses m to solve

$$\max_m G\left(H\left(m\right)-u\right)\left(h\left(\frac{1}{2m}\right)-c\right)-mF \qquad \text{(P0)}$$
$$m \geq m^*.$$

We are interested by the comparative statics of a solution $m^M\left(u\right)$ with respect to u. Ignoring the constraint $m \geq m^*$, the first order condition yields

$$H'\left(m\right)g\left(H\left(m\right)-u\right)\left(h\left(\frac{1}{2m}\right)-c\right)-G\left(H\left(m\right)-u\right)\frac{h'\left(\frac{1}{2m}\right)}{2m^2}-F=0. \quad (7)$$

For an interior solution $m > m^*$, the second order condition is satisfied and the implicit function theorem implies that the sign of $\frac{dm^M(u)}{du}$ is

$$\frac{dm^M\left(u\right)}{du} \propto -H'\left(m\right)g'\left(H\left(m\right)-u\right)\left(h\left(\frac{1}{2m}\right)-c\right)+g\left(H\left(m\right)-u\right)\frac{h'\left(\frac{1}{2m}\right)}{2m^2}.$$

Using (7),

$$\frac{h'\left(\frac{1}{2m}\right)}{2m^2}=H'\left(m\right)\frac{g\left(H\left(m\right)-u\right)}{G\left(H\left(m\right)-u\right)}\left(h\left(\frac{1}{2m}\right)-c\right)-\frac{F}{G\left(H\left(m\right)-u\right)}$$

which upon substitution in the previous expression yields

$$\frac{dm^M\left(u\right)}{du} \propto -H'\left(h-c\right)\left[g'-\frac{g^2}{G}\right]-\frac{g}{G}F.$$

By log-concavity of G, $g'-\frac{g^2}{G}<0$. From Lemma 1, the first term in the sum is negative and therefore $\frac{dm^M(u)}{du}$ is negative. Since the price is an increasing function of the number of varieties the unconstrained maximum number of varieties $m^M\left(u\right)$ is strictly decreasing in u. Now, as long as $m^M\left(u\right) \geq m^*$, $m^M\left(u\right)$ is the solution to P0, otherwise the solution is to set $m=m^*$. If the constraint binds at some u, it binds for all $\hat{u} > u$ and therefore the monopoly does not adjust his prices or the varieties offered when u is large enough. Whether or not the constraint binds depends on the value of $m^M(h(0))$. Our reasoning so far is local; a "global" proof that varieties decrease as u increases is provided in the Appendix.

Proposition 5 *As u increases, the monopolist offers less varieties and the local price decreases.*

(i) If $m^M(h(0)) \geq m^*$, the monopoly optimizes by choosing for any u a number of varieties $m^M(u)$, strictly decreasing with u.

(ii) If $m^M(h(0)) < m^*$, there exists $u^* \in (-\infty, h(0))$ such that for all $u < u^*$ the solution is $m^M(u)$, and for all $u \geq u^*$ the solution is m^*.

The surplus of consumers is *decreasing* in the number of varieties offered. If the monopoly wants to give more utility to his consumers, he needs to decrease the number of varieties. Faced with a stronger competitor in the form of a larger u, the monopolist will trade off the compensating demand effect needed not to lose consumers, which is equal to the variation of u, with the resulting loss in profits when these consumers show up in his shops. The proposition shows that the demand effect dominates, i.e., that the monopoly will offer a larger surplus to his consumers and thus decrease varieties and increase prices.

3.3 Oligopoly with Free Entry

We identify a variety with a firm (think of many independent shop owners). Relative to the monopoly situation, there is now an *ex-post competitive effect*. This new effect prevents the local market from extracting too much rent from the consumers.

We focus on the symmetric free-entry equilibrium. Once m is fixed, the ex-post price is determined by standard competition on the circle. Let $p(m)$ be the ex-post equilibrium price corresponding to m firms. Replicating arguments for the monopoly case, we can show that m is always chosen in such a way that the market is covered.

Lemma 6 *In a free-entry equilibrium, the equilibrium number of firms m is such that the ex-post equilibrium price is $p(m) \leq h\left(\frac{1}{2m}\right)$, i.e., the market is covered.*

From now on we can assume that $m \geq m^*$. Let $p(m) \leq h\left(\frac{1}{2m}\right)$ be a candidate symmetric price equilibrium when there are m symmetrically located firms. If i and j are two adjacent firms on the circle, a necessary and sufficient condition for equilibrium is that firm i does not gain by deviating to price $p \neq p(m)$. Measuring distances with respect to firm j, the marginal consumer is at a distance x where

$$h(x) - p = h\left(\frac{1}{m} - x\right) - p(m).$$

Firm $i's$ ex-post payoff is $\left(h(x) - h\left(\frac{1}{m} - x\right) + p(m) - c\right)x$. Simple computations show that this function is locally concave in p at $p = p(m)$,[10] and the first order condition for $p = p(m)$ to maximize this function is

$$\begin{aligned} p(m) &= c - \frac{x}{dx/dp} \\ &= c - \frac{h'\left(\frac{1}{2m}\right)}{m}. \end{aligned} \tag{8}$$

Note that the equilibrium price is a *decreasing* function of the number of varities:

$$\begin{aligned} \frac{dp(m)}{dm} &\propto \frac{h''\left(\frac{1}{2m}\right)}{2m} + h'\left(\frac{1}{2m}\right) \\ &< 0. \end{aligned} \tag{9}$$

Hence, decreasing the number of varieties will increase the equilibrium price,

as long as the equilibrium price is given by (8): while the utility of each consumer decreases, the competition for marginal consumers is less intense. Here the price is related to the *marginal* utility of the "marginal" consumer, and by strict concavity this marginal utility decreases with the number of varieties. By contrast, in the monopoly case the price-cost margin was related to the *total* utility of the "marginal" consumer and this utility is increasing in the number of varieties.

Since the market must be covered, we still need to verify that the covering condition is satisfied at this price, i.e., that $h\left(\frac{1}{2m}\right) \geq c - \frac{h'\left(\frac{1}{2m}\right)}{m}$. Let $\underline{m}$ be the unique solution of the equation

$$h\left(\frac{1}{2\underline{m}}\right) = c - \frac{h'\left(\frac{1}{2\underline{m}}\right)}{\underline{m}}. \tag{10}$$

[10] Indeed, $\pi''(p) = 2\frac{dz}{dp} + (p-c)\frac{d^2z}{dp^2}$. Now, $\frac{d^2z}{dp^2} \propto -\frac{dz}{dp}\left\{h''(z) - h''\left(\frac{1}{m} - z\right)\right\}$ where the right hand side equal to zero at $p = p(m)$ since $z(p(m), p(m)) = \frac{1}{2m}$. The implicit function theorem implies that $\frac{dz}{dp} = \frac{1}{h'(z) + h'\left(\frac{1}{m} - z\right)} < 0$ and it follows that profits are locally concave at $p = p(m)$.

Observe that by (5), $\underline{m} > m^*$. It follows that when m is in the interval $[m^*, \underline{m}]$, the oligopolistic firms will set the monopoly price, and thus the oligopoly will behave as a zero-profit monopoly.

The equilibrium price, and the surplus given to consumers depend on the number of varieties present on the market. Equilibrium prices are

$$p(m) = \begin{cases} h\left(\frac{1}{2m}\right) & \text{if } m \in [m^*, \underline{m}] \\ c - \frac{h'\left(\frac{1}{2m}\right)}{m} & \text{if } m \geq \underline{m}. \end{cases}$$

The expected utility of a consumer entering the local market when $m \geq \underline{m}$ is then

$$\begin{aligned} \hat{H}(m) &= 2m \int_0^{\frac{1}{2m}} h(x)\, dx + \frac{h'\left(\frac{1}{2m}\right)}{m} - c \\ &= H(m) + \frac{h'\left(\frac{1}{2m}\right)}{m} + h\left(\frac{1}{2m}\right) - c \end{aligned}$$

Simple computations show that $\hat{H}(m)$ is increasing in m.[11] This is in sharp contrast with the monopoly case since it suggests that in order to give more utility to the consumers the local market should *increase* the number of varieties sold. Note that since $\hat{H}(\underline{m}) = H(\underline{m})$, for all $m > \underline{m}$, $\hat{H}(m) > H(m)$. Hence, because of ex-post competition when $m \geq \underline{m}$ the oligopoly can, *for the same number of varieties,* provide a larger surplus to the consumers since the *ex-post* price is smaller than under monopoly. However, what ultimately determines consumers' surplus is the *equilibrium* number of varieties that the oligopoly will eventually coordinate on. As we will see it might happen that the overall surplus offered under oligopoly is smaller than under monopoly.

Given m and the anticipated value of $p(m)$, the demand falling on the local market is $G(\theta(m;u))$, where $\theta(m;u) = \hat{H}(m) - u$ when $m \geq \underline{m}$ and $\theta(m;u) = H(m) - u$ when $m \in [m^*, \underline{m}]$. Finally the *ex-ante* equilibrium profit of a firm net of the entry cost F is

$$\pi(m;u) = \frac{G(\theta(m;u))}{m}(p(m) - c).$$

An *oligopoly equilibrium* is then defined by a number of firms m^O such that

$$\pi\left(m^O;u\right) = F \text{ and } \pi_m\left(m^O;u\right) \leq 0,$$

[11] Indeed, $\hat{H}'(m) = \left\{2\int_0^{\frac{1}{2m}} h(x)\, dx - \frac{h\left(\frac{1}{2m}\right)}{m}\right\} - \frac{\frac{h''\left(\frac{1}{2m}\right)}{2m} + h'\left(\frac{1}{2m}\right)}{2m^2}$, the term in brackets is positive since $h' < 0$ and the last term is negative since $h' < 0$ and $h'' < 0$.

i.e., firms make nonnegative profits and no additional firm wants to enter.

An equilibrium can exist only if $\max_m \pi(m;u) \geq F$. This condition is also sufficient for existence. Indeed, if $\max_m \pi(m;u) < F$, no firm wants to enter. Suppose now that $\max_m \pi(m;u) \geq F$. Since π is continuous in m, $\pi(0;u) = 0$ and $\lim_{m\to\infty} \pi(m;u) = 0$, there exists m such that $\pi(m;u) = F$ and $\pi_m(m;u) < 0$. If $\max_m \pi(m;u) = F$, choose the largest value of m such that $\pi(m;u) = \bar{\pi}(u)$.

Lemma 7 *Let $\bar{\pi}(u) = \max_m \pi(m;u)$. An equilibrium exists in the oligopoly model if, and only if, $\bar{\pi}(u) \geq F$.*

Intuitively, the equilibrium condition $\pi'(m) \leq 0$ states that the per-firm demand (i.e., the mass $\frac{G(\theta(m;u))}{m}$) elasticity is less than the (absolute value) of the price-cost margin elasticity. The price-cost margin elasticity captures the direct strategic effect of entry while the demand elasticity captures the consumers' response to entry anticipating this strategic effect. As we have shown, the demand elasticity is positive (more varieties and lower prices make the local market more attractive) while the price-cost margin elasticity is negative (more competition decreases prices *ex-post*).

Assume that the equilibrium is $m > \underline{m}$; the following conditions must hold[12]

$$G(\theta(m;u))\left(-h'\left(\frac{1}{2m}\right)\right) = m^2 F \tag{11}$$

$$\theta_m g(\theta(m;u))\left(-h'\left(\frac{1}{2m}\right)\right) + G(\theta(m;u))\left(\frac{h''\left(\frac{1}{2m}\right)}{2m^2} + \frac{2h'\left(\frac{1}{2m}\right)}{m}\right) \leq 0 \tag{12}$$

$$m \geq \underline{m}. \tag{13}$$

(11) is the zero profit condition, (12) is the free entry condition $\Pi_m(m;u) \leq 0$[13] and (13) is the bound defined in (10) insuring that the market is covered.

The implicit function theorem applied to (11) implies that at the equilibrium value $m^O(u)$,

$$\frac{dm^O(u)}{du} = -\frac{\Pi_u(m^O;u)}{\Pi_m(m^O;u)}.$$

From (12), the denominator is non-positive. Hence, since $\Pi_u(m;u) = -g(\theta(m;u))\left(-h'\left(\frac{1}{2m}\right)\right) < 0$, it follows that

$$\frac{dm^O(u)}{du} < 0. \tag{14}$$

[12]Note that $\Pi_m(m;u) = \pi(m;u) - F + m\pi_m(m;u)$ and therefore $\Pi_m(m;u) \leq 0$ is equivalent to $\pi_m(m;u) \leq 0$ when $\pi(m;u) = F$.

[13]After making use of (11) to substitute for mF.

Now,

$$\frac{dp\left(u\right)}{du}=\frac{dm\left(u\right)}{du}\frac{dp\left(m\right)}{dm}.$$

Therefore, (14) and (9) yield $\frac{dp(u)}{du}>0$.

If the equilibrium number of varieties is $m^{O}\in\left[m^{*},\underline{m}\right]$, profits are equal to zero at the monopoly price

$$G\left(H\left(m^{O}\right)-u\right)\left(h\left(\frac{1}{2m^{o}}\right)-c\right)=m^{O}F.$$

The left hand side is decreasing in u; hence, since the marginal oligopoly profit must be negative, the equilibrium number of varieties decreases when u increases. Because the monopoly price is increasing in m, the equilibrium price also decreases when u increases.

Proposition 8 *In a free entry oligopolistic equilibrium, as u increases, the number of varieties decreases. There exists a cutoff global market utility u^{o} such that for all $u<u^{o}$ local prices increase, and for all $u>u^{o}$ prices decrease in u. In the latter case the oligopoly behaves like a zero-profit monopoly.*

3.4 Welfare

We are interested in comparing welfare under the two market structures. If the expected utility of local consumers is S when the outside option is u, the expected consumer surplus is

$$\begin{aligned}CS\left(S,u\right) &= G\left(S-u\right)S+\left(1-G\left(S-u\right)\right)u\\ &= u+G\left(S-u\right)\left(S-u\right).\end{aligned}$$

Under monopoly, consumer plus producer surplus is $W\left(H(m^{M}(u)),u\right)=CS(S,u)+\pi^{M}(u)$ where $m^{M}(u)$ and $\pi^{M}(u)$ are the optimal number of varieties and monopolistic profits, respectively, when the outside option is u. Under oligopoly, as oligopolistic profits are zero undrer free entry, welfare is $W\left(\hat{H}(m^{O}),u\right)$ when $u<u^{o}$, and $W\left(H(m^{O}),u\right)$ when $u>u^{o}$, where m^{O} is the corresponding oligopolistic equilibrium number of varieties.

It is only possible to give general welfare comparisons in this relatively general model if u is sufficiently large. Recall that if $u>u^{o}$, the oligopoly behaves like a zero-profit monopoly and oligopolistic firms set a price equal to the value of the marginal consumer. Since the no-entry condition implies that the marginal profit is decreasing at m^{O}, in this regime, the monopoly offers a lower number of varieties than the oligopoly. It then follows from Lemma 1 that the local consumer surplus (when the monopoly price is charged ex-post) is decreasing in the number of varieties. Therefore the monopoly profitably offers higher local consumer surplus and also has a larger market share than the oligopoly. Since consumers obtain a fixed expected utility by shopping on the local market, we deduct that total consumer surplus is higher with monopoly.

Proposition 9 *There is a* $u^M < u^0$ *such that for all* $u \geq u^M$ *the monopoly generates* larger welfare than the oligopoly.

This result is surprising especially in view of the fact that in the baseline version of our model used here, consumers are caught in a hold-up situation under monpoly more than under oligopoly, as for any given m the monopolist sets higher prices *ex-post* than the oligopolists do.

4 Extensions

4.1 Monopoly : The Value of Pre-Announcing Prices

Assuming that the monopoly cannot commit to prices is an extreme assumption; coupons, folders, general advertisement suggest that some level of *ex-ante* commitment is feasible. Here we make the other extreme assumption that the monopoly can perfectly commit *ex-ante*, i.e. before consumers decide between the two market structures, to a pair (m, p), where p is the price at which any of the m varieties sells in the local market. The analysis of section 3.1 applies and the consumer indifferent between shopping locally and globally is given by (2)

$$\tilde{\theta}(m,p) = 2m \int_0^{\frac{1}{2m}} h(x)\,dx - p - u.$$

Note that $\tilde{\theta}$ is linear in p (in fact $\tilde{\theta}_p = -1$) and that

$$\begin{aligned}\tilde{\theta}_m(m,p) &= 2\int_0^{\frac{1}{2m}} h(x)\,dx - \frac{h\left(\frac{1}{2m}\right)}{m} \\ &= \frac{H(m)}{m}\end{aligned}$$

is positive and decreasing in m (since H is decreasing in m).

Here also the monopoly chooses optimally to cover the market.

Lemma 10 *If the monopoly enters the local market, the market is covered.*

Hence $p \leq h\left(\frac{1}{2m}\right)$, and after making the change of variable suggested in Section 3.1, the problem of the monopoly reduces to[14]

$$\max_{m,v} \pi(m,v) = G(v)\left(H(m) + h\left(\frac{1}{2m}\right) - v - u - c\right) - mF \qquad \text{(P')}$$
$$m \geq H^{-1}(v+u).$$

The solution can be in one of two regimes: either the constraint is binding, in which case the solution coincides with that of the monopoly model considered before; or the constraint is not binding in which case the two first order conditions $\pi_m = 0$ and $\pi_v = 0$ are satisfied.

As long as we are in the first regime, our previous comparative statics results apply, that is as u increases, varieties and price decrease.

Consider now the non binding regime. The first order conditions imply

$$\pi_m = 0 : G(v)\frac{H(m)}{m} - F = 0 \qquad (15)$$
$$\pi_v = 0 : g(v)\left(H(m) + h\left(\frac{1}{2m}\right) - v - u - c\right) - G(v) = 0. \qquad (16)$$

As u increases, the graph of $\pi_m = 0$ does not change, while the graph of $\pi_v = 0$ moves to the left. Hence, if we are in a regime in which the covering constraint is not binding, v and m will decrease. Hence, locally we recover the earlier results.

Now a potential difficulty is when there is a regime change, i.e., when we go from a situation in which the constraint binds to a situation in which the constraint does not bind. When the constraint binds we are back to the earlier monopoly problem and by Lemma 3, we can deduct that this optimum must be in the region $\pi_v \leq 0$ and $\pi_m \leq 0$, as represented by the bracketed part of the curve $m = H^{-1}(v+u)$ in Figure 1. In fact, the optimum is in the regime of binding constraint if, and only if, the graph of $m = H^{-1}(v+u)$ intersects the area defined by $\pi_v \leq 0$ and $\pi_m \leq 0$. As u increases the graph of $m = H^{-1}(v+u)$ moves to the left and locally the property is preserved; we therefore retain the same comparative statics. If the graph of $m = H^{-1}(v+u)$ moves to the left "faster" than the graph of

[14] Since H is decreasing and convex, H^{-1} is also decreasing and convex. Hence, the constraint can be written $H(m) \leq v + u$ or $m \geq H^{-1}(v+u)$. Note that the "covering" constraint $m \geq H^{-1}(v+u)$ *does not* impose that $m \geq m^*$ since the monopoly can adjust the price in order to satisfy the constraint.

$\pi_v = 0$ then we enter the second regime where the covering constraint is not binding.

It is simple to show that as u is small ($u \to -\infty$), there is no value for the monopoly to pre-announce prices, i.e., to reduce the hold-up problem, while for u large ($u \to h(0)$) there is value to pre-announcing prices.

Proposition 11 *For u sufficiently large (small) there is (no) value to pre-announcing prices.*

Observe finally that our earlier welfare comparison of monopoly vs. oligopoly is naturally upheld under the present generalization.

4.2 Ex-Post Competition from the global market

The initial comparative static results could have suggested that the difference in monopolistic and oligopolistic responses were due to the fact that consumers are caught in a hold-up problem under monopoly, while less so under oligopoly. However, as we have shown in the previous section, we obtain qualitatively the same comparative statics even if the monopoly can eliminate the hold-up. The difference between the two organizational forms is therefore due to the nature of the competition rather than due to the magnitude of the hold-up problem.

For both of the monopoly cases considered, the nature of outside competition was similar to an *individual rationality* constraint imposed on the monopoly. For the oligopoly, there was also this (*ex-ante*) individual rationality constraint but also an (*ex-post*) *incentive compatibility* constraint, since neighboring firms compete for "marginal" consumers.

This suggests that the main difference in comparative statics between the two market forms is due to the nature of *ex-post* competition. We therefore introduce *ex-post* competition by allowing consumers to leave the local market after inspection, and to purchase the selected commodity variant in the global market. For instance, while it is difficult to describe *ex-ante* the characteristics of a running shoe, it is possible after having tried on different shoes in a store to identify the exact model and size that is best; it is then easy to order such an item from the global market. Observe, however, that this arbitrage option is open only for completely standardized inspection commodities.

To analyze this model and avoid trivialities, it is necessary to distinguish between the cost of accessing the local market denoted by α, and the cost of accessing the global market, that we denote by β.[15] We assume that α has distribution G (log-concave) and, for simplicity, that β is a constant.

The new timing is as follows.

- Consumers learn α and observe the number of varieties in the local market;
- If the consumer shops on the global market his expected utility is $u = \underline{h} - q - \beta$;
- If the consumer goes to the local market, he learns by sampling the m varieties which variety gives him the "best fit" $h(x)$;
  - he can then buy this variety on the local market and his utility is $h(x) - p - \alpha$, or
  - he can buy this variety from the global market and his utility is $h(x) - q - \alpha - \beta$.

There are now three options open to consumers:

1. Buy from the global market immediately: surplus is u;
2. Stay in the local market: *ex-post* surplus is $h(x) - p - \alpha$;
3. Inspect in the local market but buy from the global market: if the best fit is $h(x)$, the *ex-post* surplus is $h(x) - q - \beta - \alpha$ since the consumer has to pay access costs to both markets.

The share of the local market is the mass of consumers choosing the second option. Note that the choice between 2 and 3 depends on whether β is larger or smaller than $p - q$: if $\beta < p - q$, all consumers purchase from the global market. Hence for consumers to shop locally at all, we need

$$\beta \geq p - q.^{16} \tag{17}$$

This is a simple representation of *ex-post* price competition from the global market. Clearly in equilibrium this constraint is satisfied. From an

[15] Hence $\alpha - \beta$ corresponds to the opportunity cost θ of shopping locally in the previous sections of the paper.

[16] In this case, no consumers will buy ex-post from the global market; this is due to the assumption that the cost β is common to all consumers.

ex-ante perspective, the consumers who decide to go to the local market are those whose type is

$$\alpha - \beta \leq \tilde{\theta}(m, p(m), u) = 2m \int_0^{1/2m} h(x)\, dx - p(m) - u,$$

where $p(m)$ is the price that the consumers anticipate on the local market.

In the *monopoly case without commitment*, consumers should anticipate in equilibrium a price

$$p(m) = \min\left\{\beta + q, h\left(\frac{1}{2m}\right)\right\}.$$

Once the customers show up in the local market, the monopolist chooses the price. The problem is then

$$\max_m G\left(\left(\tilde{\theta}(m, p(m), u)\right)\right)(p(m) - c) - mF.$$

If the solution is in the region $\left\{m : \beta + q > h\left(\frac{1}{2m}\right)\right\}$, the solution is identical to that before, and so the comparative static results remain also unchanged. If the solution is in the region $\left\{m : \beta + q \leq h\left(\frac{1}{2m}\right)\right\}$, note that $\tilde{\theta}(m, \beta + q, u) = H(m) + h\left(\frac{1}{2m}\right) - \underline{h}$. Hence, the first order condition is

$$\frac{H(m)}{m} g\left(\tilde{\theta}(m, \beta + q, u)\right)(\beta + q - c) = F.$$

Here we must distinguish between the two different sources for the increase in u: either the global market allows for better search and inspection and thus $\underline{h}$ increases; or the expected total price $(\beta + q)$ decreases. If the improvement is due to lower costs, we get

$$\frac{dm}{d(\beta + q)} \propto \frac{H(m)}{m} g\left(H(m) + h\left(\frac{1}{2m}\right) - \underline{h}\right)$$

which is strictly positive. Hence, varieties unambiguously decrease as $\beta + q$ decreases. Hence the previous result of crowding out of local varieties is upheld.

However, if there is an improvement in inspection on the global market, then

$$\frac{dm}{d\underline{h}} \propto -g'\left(\tilde{\theta}(m, \beta + q, u)\right)$$

can be positive if $g' < 0$, which typically happens when $\tilde{\theta}$ is large, that is when u is large.

In this subcase only we thus have an inverted U-shaped pattern with respect to the monopolist's reaction in providing variety to an increase in the outside option: if the global market offers low utility to consumers, the monopoly responds to its increase by decreasing varieties and prices, whilst if the global market offers high utility, the local monopoly will shift to variety competition and will offer more varieties.

Note that for the *oligopolistically structured local market* the logic is the same as before: allowing consumers to inspect varieties in the local market before arbitraging between the local and the global market will create even more *ex-post* competition and thus decrease oligopoly profits. There will be less varieties in response to a stronger global market, as firms will be pressed to exit.

All of this leaves unchanged our earlier welfare result.

5 Conclusion

The analysis of our baseline model has shown that, independently of the market structure, an intensification of global competition will crowd out varieties in the local market. Comparing the effects of a stronger global market on monopoly and oligopoly prices, we have found that while prices will decrease under monopoly, they will increase under oligopoly when global competition is weak, and decrease only when global competition is strong. The main intuition is that the oligopoly can partially commit to low prices because there is *ex-post* competition between firms. However, under oligopoly fewer varieties decrease competition *ex-post* and therefore yield to higher prices. When we allow the monopoly to pre-announce prices we find that the monopoly will not use the option of committing when the global market is a weak competitor but will use the option otherwise; yet comparative statics on prices and varieties are similar to the case where the monopoly cannot pre-announce prices.

We then allow consumers to benefit from information obtained in the local market before shopping in the global market. In this case, the local market is subject to *ex-post* price competition.We show that our results on variety are upheld in general. In particular, variety decreases under oligopoly and for most of the monopoly case. *Only if* the global market becomes a strong competitor due to an improvement in inspection quality, the optimal response of the monopoly might be to increase the number of varieties. Clearly, prices will decrease in either case under direct price competition.

Hence, prices are generally poor indicators of local market performance. The local market substitutes price and quality in order to provide consumers with given levels of utility. Different market structures face different constraints, in particular commitment to prices and ability to limit the number of varieties, and therefore substitute price-quality in different ways. When quality becomes the relevant competitive variable – say because price competition is already tight – welfare maximization should favor the market structure that is most able to compete on the quality dimension. In particular, in our model, the monopoly is better able to compete in varieties which leads to the result that monopoly is welfare preferable when the outside option is valuable.

This has consequences for merger control and for industrial policy. Welfare as generated in our market situation may be considered to depend on the degree of concentration, call it *conc*, in the local market and the magnitude of potential competition, call it *comp*. In our model, we can think of $comp = u$, where u is the outside option.

Competition policy usually assumes that the equilibrium welfare $W\,(conc, comp)$ is decreasing in *conc* and is increasing in *comp*: higher concentration yields price distortions that decrease welfare while larger potential competition creates competitive pressure and leads to an increase in welfare. This idea is applied in typical merger guidelines that first, ask for an evaluation of the local market power, and second, if there is little market power authorize the merger, otherwise evaluate more carefully the effects of increasing concentration. Supported by formal analyses of imperfect competition models with homogenous goods the assumption implicit in this evaluation is that, absent efficiency gains, increased concentration generates a welfare loss. More specifically, the rule presumes that the equilibrium welfare function $W\,(conc, comp)$ satisfies a decreasing difference condition

$$\begin{aligned}[conc > conc'] \,\&\, [comp > comp'] &\Rightarrow \\ W\,(conc', comp) - W(conc, comp) &< W\,(conc', comp') - W(conc, comp'),\end{aligned}$$

i.e., that welfare losses from incresead concentration are smaller if (potential) competition is stronger. Our analysis supports this rule, but points out that $W\,(conc, comp)$ is not necessarily decreasing in *conc*: this is true only for low values of *comp*; for larger values of *comp*, welfare is actually *greater* with more concentration (monopoly) than with less concentration (oligopoly). By pointing out a benefit from larger concentration when *comp* is small, we reaffirm the general rule of authorizing mergers when potential competition is important. At the same time we underline an absolute benefit to concentration, namely the ability to better internalize externalities of the type we discuss in this paper. When price competition is dampened, this effect is likely to be significant and should therefore be part of an efficiency defense.

Finally, our analysis has direct implications for industrial policy, i.e., for the *active support* of small versus large firms. In our model, when global competition is weak, supporting small firms might be a good idea, while when global competition is strong, supporting small firms and therefore slowing concentration in the local market might lead to welfare losses.

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6 Appendix

6.1 Proof of Lemma 1

Simple computations lead to

$$\begin{aligned}
H(m) &> 0 && (18)\\
\lim_{m\to\infty} H(m) &= 0 && (19)\\
H'(m) &= 2\int_0^{\frac{1}{2m}} h(x)\,dx - \frac{1}{m}h\left(\frac{1}{2m}\right) + \frac{1}{2m^2}h'\left(\frac{1}{2m}\right) && (20)\\
H''(m) &= -\frac{1}{2m^3}\left(h'\left(\frac{1}{2m}\right) + \frac{1}{2m}h''\left(\frac{1}{2m}\right)\right). && (21)
\end{aligned}$$

Since h is decreasing, $h(x) > h\left(\frac{1}{2m}\right)$ when $x \in \left(0, \frac{1}{2m}\right)$, hence (18) follows. Since h is decreasing and concave, $H'' > 0$ in (21) and H is strictly convex. Since $H > 0$, (19) and (20) are compatible with H convex only if $H'(m) < 0$.

6.2 Proof of Lemma 2

(i) $\pi_{mm} \propto G(v)\, h'(1/2m) < 0$.

(ii) Note that

$$\pi_v(m, v) = g(v)\left\{H(m) + h\left(\frac{1}{2m}\right) - u - c - \left[\frac{G(v)}{g(v)} + v\right]\right\}. \tag{22}$$

By log-concavity the term in brackets is increasing in v. Hence, if there is v such that $\pi_v(m, v) = 0$, this value is unique and furthermore π_v is positive for smaller values and negative for larger values. This proves the result.

6.3 Proof of Lemma 3

(i) and (ii) follow directly from the discussion in the text. For instance, since $\pi_m = G(v)\frac{H(m)}{m} - F$, if $\pi_m(m, v) = 0$, then for $\hat{m} > m$, $\frac{H(\hat{m})}{\hat{m}} < \frac{H(m)}{m}$ and $\pi_m(\hat{m}, v) < 0$ and $\hat{v} > v$, $G(\hat{v}) > G(v)$ and $\pi(m, \hat{v}) > 0$.

We prove (iii) in a series of steps.

Step 1: We show that at a local maximum the graph of $\pi_v = 0$ interesects the graph of $\pi_m = 0$ from below. Since the function $\frac{H(m)}{m}$ is strictly decreasing, it has an inverse function Φ that is also strictly decreasing. The first order condition $\pi_m = 0$ can be then written as

$$m = \Phi\left(\frac{F}{G(v)}\right).$$

Since this is a necessary condition for an interior solution, we can substitute this expression for m in the profit function and we have the new problem

$$\max_v \hat{\pi}(v) = G(v)\left(h\left(\frac{1}{2\Phi\left(\frac{F}{G(v)}\right)}\right) - v - u - c\right),$$

where $\hat{\pi}$ is a function of v only while π is a function of m and v.

It follows that

$$\begin{aligned}
\hat{\pi}_v(v) &= g(v)\left(h\left(\frac{1}{2\Phi\left(\frac{F}{G(v)}\right)}\right)-v-u-c\right)\\
&\quad +G(v)\left(\frac{Fg(v)}{2G^2(v)}\frac{\Phi'\left(\frac{F}{G(v)}\right)}{\Phi^2\left(\frac{F}{G(v)}\right)}h'\left(\frac{1}{2\Phi\left(\frac{F}{G(v)}\right)}\right)-1\right).
\end{aligned}$$

If the monopoly makes positive profits, the first term in the sum is positive. The second term is positive or negative.[17] Assuming an interior local optimum, $\hat{\pi}_{vv} < 0$, and differentiating the first order condition $\hat{\pi}_v(v) = 0$ yields $\frac{dv}{du} = \frac{g(v)}{\hat{\pi}_{vv}(v)} < 0$. Hence *locally* if u increases the optimal value of v decreases.

Now, by construction, a solution to $\hat{\pi}_v = 0$ solves $\pi_m = \pi_v = 0$, i.e., the optimal v is found at the intersection of the graphs of $\pi_m = 0$ and $\pi_v = 0$.

Assume that the graph of $\pi_v = 0$ intersects the graph of $\pi_m = 0$ from above. Since when u increases the graph of $\pi_v = 0$ moves to the left, the intersection shifts to the right, that is the optimal v increases as u increases which contradicts the previous observation. Hence at an interior optimum the graph of π_v must intersect the graph of π_m from below.

Step 2: We show that there is no local minimum.

From Lemma 10, whenever the graphs of $\pi_m = 0$ and $\pi_v = 0$ intersect, the point (m, v) is a maximum.

Step 3: We show that there is a unique local maximum.

From the previous two steps, the graph of $\pi_v = 0$ cannot intersect the graph of $\pi_m = 0$ from above. Hence, the graph of $\pi_v = 0$ can "cut" the graph of $\pi_m = 0$ only once, and possibly be tangent *to* the graph of $\pi_m = 0$ at other points, e.g., we could have a situation like in the figure below where there are two local maxima. However, this case is not possible because by increasing u we shift the graph $\pi_v = 0$ upward and therefore we generate a situation where the graph of $\pi_v = 0$ interesects the graph of $\pi_m = 0$ from above. The same reasoning prevents a situation in which the two graphs are tangent at a unique point.

[17] A solution—i.e., where $\pi_v \leq 0$—exists. Indeed, we cannot have $\pi_v > 0$ everywhere for then $v = h(0)$ would be the solution, and this is possible only if $u = 0$, $m = \infty$ and $p = 0$, which is incompatible with positive profits.

6.4 Proof of Proposition 5

The global argument

Let $u > \hat{u}$ and assume that the optimal solution for u is m and the optimal solution for $\hat{u}$ is $\hat{m}$. Assume by way of contradiction that $m > \hat{m}$. Let $v = H(m)$, $\hat{v} = H(\hat{m})$, $h = h\left(\frac{1}{2m}\right)$ and $\hat{h} = h\left(\frac{1}{2\hat{m}}\right)$. By Lemma 2, $v < \hat{v}$ and since h is a decreasing function $h > \hat{h}$.

Since $v < \hat{v}$ and $u > \hat{u}$, log-concavity of G implies

$$\log G(v - \hat{u}) - \log G(v - u) > \log G(\hat{v} - \hat{u}) - \log G(\hat{v} - u),$$

adding $\log h - \log h$ to the left hand side and adding $\log \hat{h} - \log \hat{h}$ to the right hand side we preserve the inequality and obtain

$$\log G(v - \hat{u})\,h - \log G(v - u)\,h > \log G(\hat{v} - \hat{u})\,\hat{h} - \log G(\hat{v} - u)\,\hat{h}. \quad (23)$$

Revealed preferences imply

$$G(v - u)\,h - mF \geq G(\hat{v} - u)\,\hat{h} - \hat{m}F \quad (24)$$
$$G(\hat{v} - \hat{u})\,\hat{h} - \hat{m}F \geq G(v - \hat{u})\,h - mF. \quad (25)$$

Since $m > \hat{m}$, (24) implies

$$G(v - u)\,h > G(\hat{v} - u)\,\hat{h} \quad (26)$$

and by adding (24) and (25) and rearranging we have

$$0 \leq G(v - \hat{u})\,h - G(v - u)\,h \leq G(\hat{v} - \hat{u})\,\hat{h} - G(\hat{v} - u)\,\hat{h}. \quad (27)$$

Let $\delta \geq 0$ be equal to the difference between the right and left hand sides of (27). Since log is a concave function, (26) implies

$$\begin{aligned}\log G(v - \hat{u})\,h - \log G(v - u)\,h &< \log\left\{G(\hat{v} - \hat{u})\,\hat{h} - \delta\right\} - \log G(\hat{v} - u)\,\hat{h} \\ &\leq \log G(\hat{v} - \hat{u})\,\hat{h} - \log G(\hat{v} - u)\,\hat{h}\end{aligned}$$

which contradicts (23). This proves that when $u > \hat{u}$, the optimal value of m decreases.

Proof of (i) and (ii)

In the absence of the global market ($u \to -\infty$), the unconstrained optimum solves

$$-h'\left(\frac{1}{2m}\right) = 2m^2 F.$$

From (5), $-h'(x^*) = \frac{h(x^*)-c}{x^*}$. From (6), $\frac{h(x^*)-c}{x^*} > \frac{F}{2x^{*2}}$; therefore, $-h'(x^*) > \frac{F}{2x^{*2}}$. Since the left hand side is increasing in x (follows from $h' < 0$ and $h'' < 0$) and the right hand side is decreasing in x, the first order condition can be satisfied at $x < x^*$, i.e., at $m > \frac{1}{2x^*}$. Hence, when the global market is not a serious competitor ($u \to -\infty$), the solution to P0 is to set $m^*(u)$, i.e., the constraint $m \geq \frac{1}{2x^*}$ does not bind.

(i) If $m^*(h(0)) \geq \frac{1}{2x^*}$, $m^*(u) > \frac{1}{2x^*}$ for all u since m^* is decreasing in u.

(ii) If $m^*(h(0)) < \frac{1}{2x^*}$, since $m^*(-\infty) > \frac{1}{2x^*}$, the constraint does not bind for low values of u and by monotony of m^* there exists a unique value u^* such that the constraint binds if and only if $u \geq u^*$.

6.5 Proof of Lemma 6

Clearly if there exists a symmetric price equilibrium $p(m)$ for which the market is not covered, the consumer whose ideal type is in the middle of an arc between two varieties prefers not to consume any variety, i.e.,

$$h\left(\frac{1}{2m}\right) - p(m) < 0. \tag{28}$$

Now, if the market is not covered, each seller enjoys monopoly power on his natural market, i.e., the set of consumers for which $h\left(\frac{1}{2m}\right) \geq p(m)$. A necessary and sufficient condition is then that the maximum monopoly profit is attained at a price satisfying (28). A necessary and sufficient condition for a symmetric price equilibrium for which the market is not covered is then that $m^* > m$. In this case the price is $h\left(\frac{1}{2m^*}\right)$. Replicating the rest of the argument for the monopoly case shows a contradiction.

6.6 Proof of Lemma 10

Suppose that $p > h\left(\frac{1}{2m}\right)$. The profit of the monopoly is

$$\pi = G\left(\tilde{\theta}(m,p)\right)(p-c)\,2mh^{-1}(p) - mF$$

where $2mh^{-1}(p) < 1$ since $p > h\left(\frac{1}{2m}\right)$. Differentiating with respect to m yields

$$\begin{aligned}\pi_m &= \tilde{\theta}_m(m,p)\,g\left(\tilde{\theta}(m,p)\right)(p-c)\,2mh^{-1}(p) + 2G\left(\tilde{\theta}(m,p)\right)x(p) - F \\ &= \tilde{\theta}_m(m,p)\,g\left(\tilde{\theta}(m,p)\right)(p-c)\,2mh^{-1}(p) + \frac{\pi}{m}.\end{aligned}$$

Since $\tilde{\theta}_m > 0$, as long as $\pi \geq 0$, $\pi_m > 0$ (indeed $\pi \geq 0$ implies that $p > c$ when $F > 0$).

6.7 Proof of Proposition 11

There is no value to pre-announcing prices if the constraint in (P') binds, i.e., if $\pi_v \left(m, H\left(m\right) - u\right) < 0$. Now,

$$\pi_v = g\left(v\right)\left(H\left(m\right) + h\left(\frac{1}{2m}\right) - v - u - c\right) - G\left(v\right)$$

as $u \to -\infty$, $v \to +\infty$ (since $v + u \geq 0$). Now, by log-concavity of G, as $v \to +\infty$, $g\left(v\right) \to 0$. Since $H + h - v - u - c$ is bounded above, the first term on the right hand side goes to zero as u goes to $-\infty$ while $G\left(v\right) \to 1$. Hence for any m, $\pi_v < 0$ which proves the result. A corresponding argument applies to showing that as $u \to h(0)$ there is value to announcing prices.