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Redistribution through local competition[1]

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Abstract

Small shops located within walking or cycling distance of consumers have, in many communities, been relegated to the status of convenience stores, with high prices and limited product selections. Consumers who don't have cars are thus disadvantaged. Is this a necessary state of affairs?

We develop a model with two kinds of shops (local, and out-of-town) and two kinds of consumer (mobile and immobile). We assume that local shops operate in monopolistic competition, while the market structure for out-of-town shops is a stable oligopoly among large retail chains. We show that policies which raise the net cost (price plus consumer travel costs) of shopping out of town may cause a discontinuous drop in the price level of local shops. The price drop is accompanied by both the entry of new local shops and a reduction of excess capacity in local shops.

We draw the following conclusions from the model: to the extent that local shops serve a poorer clientele, a rise in prices at out-of-town shops will have a progressive distributional effect if it results in the local price reduction predicted here. Moreover, the same measures have the potential to improve allocative efficiency through a combination of reductions in local excess capacity and the internalization of social and environmental costs of automobile use.

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1. Introduction

We have come to think of local shops - shops situated for easy access by foot, bicycle or bus, rather than cars - as having high prices and small selections. We may use them when we run out of something, or because we value the esthetic and social experience of the downtown, the old high street, the corner store; serious modern shopping, however, is elsewhere.

The dominance of large out-of-town shops of course has its costs. For some the local shop is all there is. Without a car, shopping out of town may be prohibitively expensive, whether in terms of time or of cash. If those without cars are, on average, poorer than those with cars, a higher price level at local shops has distributive implications. Out-of-town shopping, with the attendant shift from foot to car, from neighborhood to anonymity, also visits well-known external costs on both the natural and social environments. Even acknowledging such factors, it is tempting to view an attachment to small neighborhood shops as sentimental, impractical in the twenty-first century.

Yet, we are all familiar with areas, in or near the center of even the largest cities, where clusters of small retailers offer goods at prices often *below* those available in suburban malls; Manhattan and London, in the author's experience, both offer numerous examples of this. These shops presumably manage this despite high rents, and despite the awkward logistics of delivering goods to small shops in congested cities. These shops benefit from traffic generated both by other shops, and by commuting and tourism; another way of putting this is that for many consumers, the marginal cost of travel to these shops is low, because the consumers are in town anyway.

In this paper, we develop a model with two kinds of shops (local, and out-of-town) and two kinds of consumer (mobile and immobile). We assume that local shops operate in monopolistic competition, while competition among the companies running out-of-town shops (supermarket chains) is Cournot in the sense that prices are relatively stable. We show that policies which raise the net cost (price plus consumer travel costs) of shopping out of town, may cause a discontinuous drop in the price level of local shops. The price drop is accompanied by both the entry of new local shops and a reduction of excess capacity in local shops.

We draw the following conclusions from the model: to the extent that local shops serve a poorer clientele, a rise in prices at out-of-town shops will have a progressive distributive effect if it results in the local price reduction predicted here. Moreover, the same measures have the potential to improve allocative efficiency through a combination of reductions in local excess capacity and the internalization of social and environmental costs of automobile use.

2. The model

There are N consumers in the local area, of whom some proportion, α, are immobile, and $(1-\alpha)$ are mobile. Mobile consumers have cars. Immobile consumers are restricted to non-automobile transport (foot, bus, bicycle; also for the purposes of this paper, home delivery of goods), which we assume makes out-of-town shopping infeasible.

There are two kinds of shops: local, and out of town. All consumers can reach local shops, while only mobile consumers can reach out-of-town shops. Call the number of local shops *M*.

Local shops are in monopolistic competition equilibrium, with an equilibrium price P^L. Out of town shops are an oligopoly, with a price P^O. The behavior of the out-of-town shops is not modeled in this paper, and P^O is treated as parametric.

Each mobile shopper *j* pays a net travel cost, c_j, when shopping out of town. The variation in travel costs across mobile consumers may be understood as representing different personal circumstances: whether one already drives for work or the school run, for instance, or the walking distance to the local shops. For simplicity, travel costs are distributed uniformly across the interval $[d, d + e]$, where d is the minimum travel cost and $d + e$ is the maximum. The density of the distribution is given by $1/e$ at all points in the interval. Notice that nothing in the model requires a particular sign for c_j: for some consumers it may be less costly to drive to out of town shops than to walk, cycle or take a bus to local shops.

Also for simplicity, mobile consumers are assumed to choose between doing all shopping locally or all shopping out of town. A mobile consumer j will shop locally if $P^L < P^O + c_j$, and otherwise will shop out of town. If $P^L - P^O > d + e$, then $P^L > P^O + c_j$ for all mobile consumers, and they all shop out of town; conversely, if $P^L - P^O < d$, all mobile consumers shop locally.

Assuming linear demand, each consumer's demand is given by the relation:

$$Q_j = a - bP \tag{1}$$

Let Q^L be the total demand faced by a representative local shop. The demand curve consists of three segments. Where $P^L - P^O > d + e$, and all mobile consumers shop out of town, local demand is

$$Q^L = \alpha(a - bP^L)(N/M)\,. \tag{2a}$$

Where $d + e > P^L - P^O > d$, the proportion of mobile consumers who buy locally varies with P^L, so the local shop's demand curve is

$$Q^L = \left[\alpha(a - bP^L) + \left\{\frac{\left(P^O + (d+e)\right) - P^L}{e}\right\}(1-\alpha)(a - bP^L)\right](N/M)\,; \tag{2b}$$

Finally, where $d > P^L - P^O$ and all consumers shop locally, the local shop's demand curve is

$$Q^L = (a - bP^L)(N/M)\,. \tag{2c}$$

Equation 2b requires some explanation. The term

$$\frac{P^O + (d+e) - P^L}{e} \tag{2b'}$$

represents the proportion of mobile consumers who shop locally, a proportion which changes as P^L changes. When $P^L = P^O + (d+e)$, the lowest local price at which *all* mobile consumers shop out of town, the numerator and the proportion both equal zero. When $P^L = P^O + d$, the local price below which all mobile consumers shop locally, the proportion is 1; we can see this by substituting $P^O + d$ for P^L in the numerator. Under the assumption that the distribution of costs is uniform within the $[d,d+e]$ range, the proportion of those shopping locally is, within the relevant range, a linear function of P^L. However, under the assumption that demand from those consumers who shop in a given area is linear, the demand curve faced by the representative local shop is *not* linear in this range, because a change in price causes both a linear change in the proportion shopping locally, and a linear change in the quantity purchased by each consumer; the interaction of these gives us a quadratic in P^L.

We differentiate 1(a-c) with respect to P^L. When $e < P^L - P^O$ (i.e., when all mobile consumers shop out of town), the slope of the demand curve faced by the local shop is:

$$\frac{\mathrm{d}Q^L}{\mathrm{d}P^L} = -\alpha b(N/M)\,. \tag{3a}$$

When $d + e > P^L - P^O > d$, so that the proportion of mobile consumers who buy locally varies with P^L, the slope of the demand curve is:

$$\frac{\mathrm{d}Q^L}{\mathrm{d}P^L} = -\left\{\alpha b + \frac{1-\alpha}{e}\left[\left(a - bP^L\right) + b\left(P^O + d + e - P^L\right)\right]\right\}(N/M). \tag{3b}$$

Finally, where $d > P^L - P^O$, so that all consumers shop locally, the slope of the local shop's demand curve is:

$$\frac{\mathrm{d}Q^L}{\mathrm{d}P^L} = -b(N/M) \tag{3c}$$

The expressions above apply to segments of a demand curve (Figure 1). 3a gives us the slope of the leftmost segment, 3c that of the rightmost; both are linear and, since $\alpha < 1$, the segment on the left (immobile shoppers only) is steeper. 3b gives the slope of the middle segment, which changes with P^L. Since $P^O + d + e - P^L > 0$ in the domain of this segment, we can see that its slope is negative throughout. The second derivative of 2b is

$$\frac{\mathrm{d}^2 Q^L}{(\mathrm{d}P^L)^2} = \frac{1-\alpha}{e} 2b(N/M) > 0 \tag{4}$$

so the central segment is convex to the origin. At the left-hand (upper) end of the middle segment, where $P^O + d + e - P^L$ approaches zero, its slope approaches

$$-\left\{\alpha b + \frac{1-\alpha}{e}\left[a - bP^L\right]\right\}(N/M), \tag{3b'}$$

which is flatter than the first segment's $-\alpha b(N/M)$: the curve is kinked where these two segments join, and remains convex to the origin. At the other end of the middle segment, where $P^O + d + e - P^L$ approaches e, the slope approaches

$$-\left\{b+\frac{(1-\alpha)(a-bP^{L})}{e}\right\}(N/M), \qquad (3b'')$$

which is flatter than the third segment's slope of $-b(N/M)$. Thus the curve is kinked here, too, but this time the kink is concave to the origin.

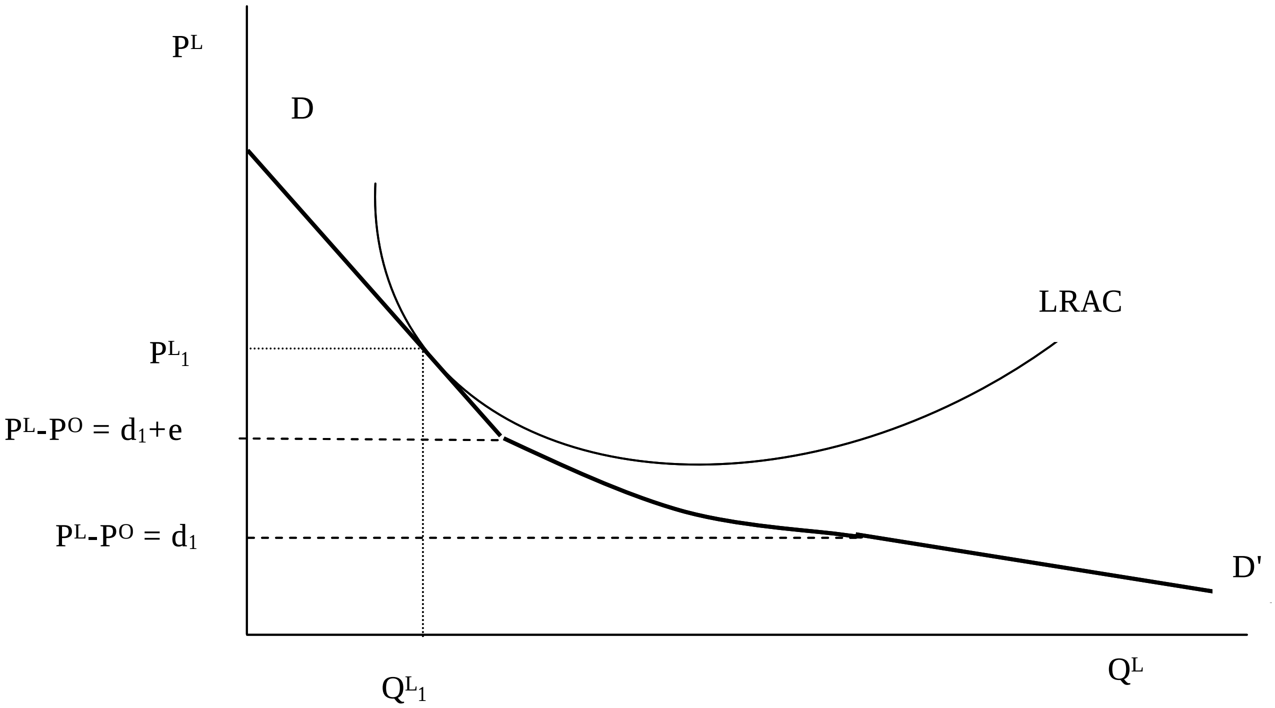

Figure 1
Local monopolistic competition equilibrium with all mobile consumers shopping out of town.

3. Comparative statics

Assuming free entry and exit by local shops with u-shaped long-run average cost curves, the monopolistic competition equilibrium may lie on any of the three segments of the curve. We are particularly interested in the question of whether the equilibrium lies on the first segment or the middle one. Figure 1 shows the first of these, the low volume, high price equilibrium for a representative local shop.

From equation 2b it should be clear that changes in P^O and d have the same effect on the position of the middle segment of the local shop's demand curve; that they have the same effect reflects the fact that, for the purposes of this model, both are simply changes in the net cost of shopping out of town. We study this effect with reference to an increase in d, which is to say a positive shock to the out-of-town travel costs of mobile consumers. Differentiating 2b with respect to d gives us:

$$\frac{\mathrm{d}Q^L}{\mathrm{d}d} = \frac{(1-\alpha)(a-bP^L)}{e}(N/M) > 0. \tag{5}$$

So, an increase in travel costs raises local demand; since the second derivative is zero, we see that under the assumptions of the model this rise is linear.

Turning to the effect of a change in d (or P^O) on the slope of the demand curve, we differentiate (3b) with respect to d to obtain:

$$\frac{\partial Q^L}{\partial d \partial P^L} = -b\frac{1-\alpha}{e}(N/M) < 0. \tag{6}$$

Thus, a positive shock to d not only shifts the curve out, but also flattens it. From (4) we see that a shock to d has no effect on the curvature of the curve. The shift in the local shop's demand curve following a positive shock to d is shown in Figure 2 as the shift from DD' to DD".

If the initial equilibrium is in the first segment (only immobile consumers purchase from local shops), an outward shift and flattening of the second segment will affect the equilibrium for the representative local shop only if it raises the second segment far enough that it crosses the shop's average cost curve. When this happens, the change is discontinuous, with the equilibrium tipping from high prices and low volumes to low prices and high volumes in local shops. The dynamics of the tipping process are illustrated in Figures 2 and 3. The outward shift of the demand curve makes positive profits available to shops charging lower prices (Figure 2). New local shops will then enter. The new entry divides local trade among more shops, shifting the demand curve for the representative local shop to the left, until a new equilibrium is reached: this is the shift, shown in Figure 3, from DD" to D*D**. The entry of additional local shops will, of course, raise the price elasticity of demand, further flattening all segments of the demand curve; this change is reflected neither in our equations nor our figures, but doing so would only amplify our results.

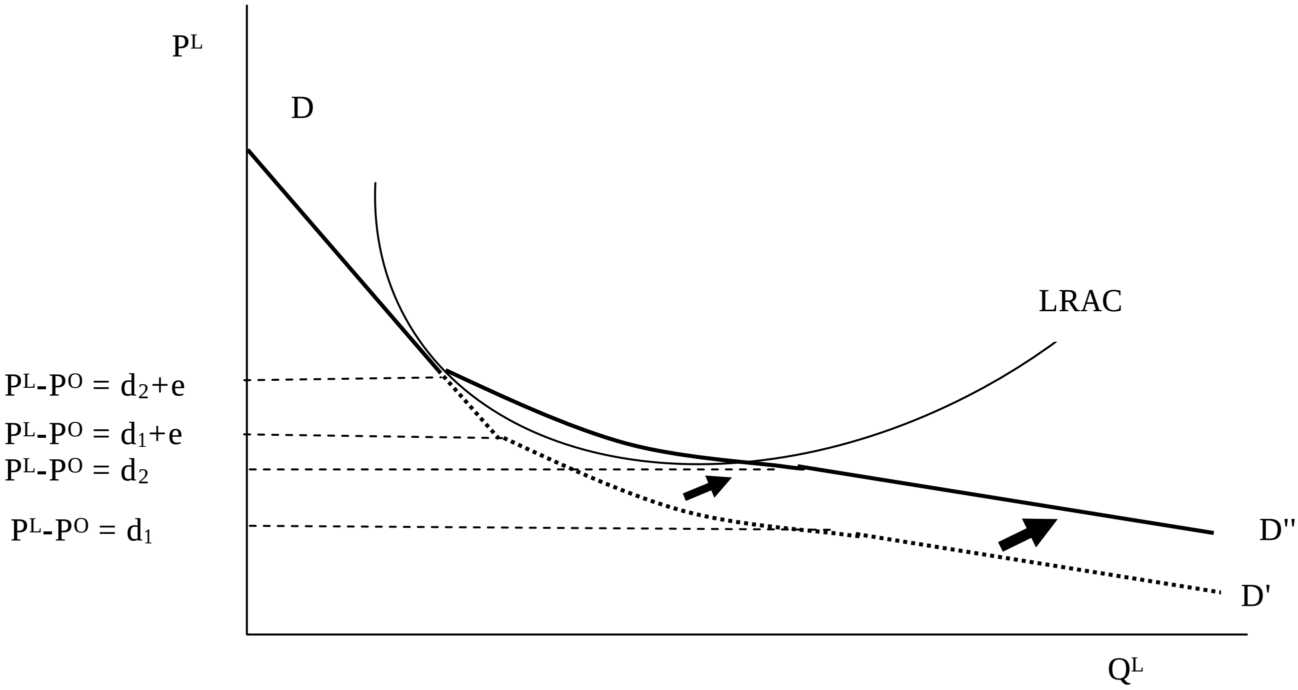

Figure 2
Rise in minimum travel cost for mobile shoppers from d_1 to d_2 shifts local demand curve, creating profit opportunities for local shops at lower price levels.

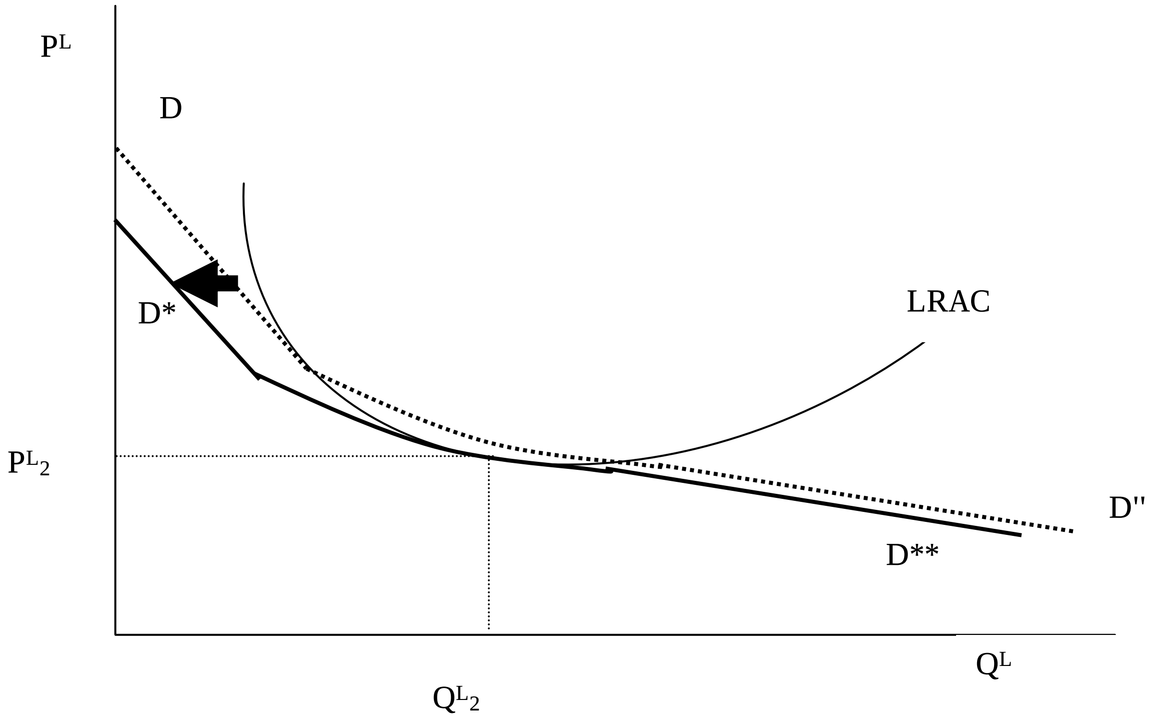

Figure 3
Entry of new local shops shifts demand curve for typical local shop to the left. New monopolistic competition equilibrium at lower price ($P^L{}_2$) and higher capacity utilization ($Q^L{}_2$) for the typical local shop.

The new equilibrium must be at a lower price level, due to the shape of the long-run average cost curve. Moreover, the representative local shop is operating on a larger scale, *and* there are more local shops. Thus, an increase in the costs associated of out-of-town shopping by mobile consumers benefits immobile consumers.

Within the range $d + e > P^L - P^O > d$, further rises in the cost of out-of-town shopping would lead to further reductions in local prices. Unlike the step-change illustrated above, however, here we will see incremental price reductions in response to incremental cost increases.

4. Policy implications

Our model assumes that among the consumers in an area served by one set of competing local shops, some have cars and some do not. The distributional implications which we will draw from the model rest on the further assumption that those who have cars are, on average, richer than those who do not. This entails an assumption of income heterogeneity within a local urban market, in the sense that within that market high and low income groups co-exist. It thus differs from models of the Alonso (1964) type, in which a city's residents are sorted and segregated spatially into internally homogeneous wealth or income groups, the poorest in the center and so on. Our model is a reasonable approximation of many European, East Asian and Australasian cities, if not for many North American ones.

Bearing these assumptions in mind we see that, in the case where the local equilibrium tips from the first segment of the demand curve to the middle one, our model has an important distributional implication: poor consumers become better off in the market where the tipping occurs, because prices in the local shops they depend on fall. Various policies, discussed below, may cause this tipping (or the reverse) to occur.

To draw any practical conclusions from the model, however, we need to recognize that no urban area has a *single* local market: each urban area has more than one, and some have a great many. Even if we assume homogeneity in the out-of-town market and within each local market in some urban area, there is no reason to expect that the demand curves and cost curves, together with travel costs for mobile consumers from that market, will all be the same in each local market. Therefore, a positive shock to travel costs and/or out-of-town prices which affects the entire urban area may tip some local markets from a high-price to a low-price equilibrium, while leaving others unaffected. In any that are not affected, immobile consumers experience no change and mobile consumers bear higher costs.

In this light, it might seem that securing redistribution by raising the net cost of out-of-town shopping would be quite costly in terms of allocative efficiency, and that if redistribution were our goal we would be better off turning to taxes and cash transfers. This may, in fact, be the case, but before concluding that it is, we should revisit the following points.

First, the tipping is discontinuous: at some point, a small change in the net cost of shopping out-of-town triggers a step change in local prices. An implication of this discontinuity is that the rise in net out-of-town costs necessary to gain the benefits of tipping, might not be very large.

Second, in markets which tip to the low-price equilibrium, excess capacity is reduced. In the short run this is presumably mirrored by increased excess capacity in out-of-town shops; the reduction in local excess capacity is, however, a long-run equilibrium condition. In cases where the model presented here is relevant, a substantial proportion of the difference between out-of-town and local prices will be due, not to differences in logistical efficiency inherent in the two modes of delivery, but to high excess capacity in local shops.

Third, there are policies which affect the relative cost of shopping out of town and which can be calibrated to a particular local area, such as parking controls. The total provision of parking in a neighborhood, the mix of resident, customer and employee parking, and the price (in permits, hourly fees, fines and, in cases of congestion, time required to find a space) of each type, all will affect the relative cost of local and out-of-town shopping. These factors could, in principle, be adjusted in separately in each town, village or neighborhood, to bring its shops past the tipping point.

Finally, the progressive redistribution occurs as a result of a process which also reduces the externalities from motor vehicle traffic, notably carbon emissions (Ruth 2006); *and* which produces positive social externalities by re-invigorating local shopping districts, one of the elusive desiderata of generations of urban policy (Evans 1999). Indeed, an explicit policy of this nature, which restricts the development of out-of-town retail centers for exactly these reasons (Policy Planning Guidance 6, or PPG6) has recently been introduced in the UK (Office of the Deputy Prime Minister 1999). Our model provides a justification for, and explanation of, such a policy, by showing that it has distributional consequences.

It may be useful to review a range of transport and land use policies in terms of which equilibrium they favor for local shops. In general, policies which reduce the cost of automobile transport to out-of-town shops favor the high-price, low-volume local equilibrium. Such policies include measures which reserve parking spaces for residents, whether on-street or by allowing (or requiring) the provision of off-street resident parking: ease of coming and going in a car is a reduction in the cost of travel by automobile. Moreover, priority parking for residents may come at the expense of parking for local shops; although *driving* to local shops is not addressed explicitly in the model presented here, some provision for customer parking at local shops can be a factor in competing for mobile consumers, to the benefit of immobile consumers in the area. These issues have long been understood by those concerned with the *survival* of neighborhood and town-center retail businesses. The point made here is that in addition to the survival of such businesses, the prices charged by these businesses is at issue.

Similar issues arise in connection with the control of traffic congestion. Measures to manage traffic congestion often focus on reducing automobile trips to town centers (Green, Jones, and Delucci 1977; Quinet and Vickerman 2004; Atzema, Rietveld, and Shefer 2005). The points to be aware of here are (i) to the extent that what we are calling local shops are located in areas targeted for congestion-reduction, reducing congestion can have the effect of reducing (for mobile consumers) the relative cost of travel to out-if-town shops; (ii) even outside of the areas subject to congestion-reduction policies, if these policies succeed in reducing road overall road traffic, the effect may be a reduction (again, only for mobile consumers) of the cost of traveling out-of-town. On the other hand, traffic management policies which focus not on congested areas per se, but on reducing the overall *level* of automobile traffic within a given region, would in many cases raise the relative cost of shopping out of town. Again, this issue is well understood by retailers, such as those in and around the congestion-charging zone of central London. Policy interventions on behalf of such businesses have, understandably, focused on the problem of the survival of their businesses, on their *availability* to immobile consumers, and on their employment levels. Again, the contribution of this paper is to show that the same factors that threat the survival of such businesses can raise the prices they charge.

5. Limitations, and future research.

The model presented here is highly stylized: there are two types of consumer; two types of shop; for mobile consumers, an all-or-nothing choice between local and out-of-town; a uniform distribution of travel costs across mobile consumers; no choice beyond the local shops for immobile consumers; and a parametric out-of-town price. We believe that this simple model does the job of supporting our central arguments: firstly, that in a local monopolistically competitive market with one class of consumers who have an outside option and another class who do not, a change in the net costs of using the outside option can bring about a discontinuous adjustment in the local price / capacity-utilization equilibrium; secondly, that if the consumers without the outside option are also poorer than those with the outside option, then the change in the net costs of using the outside option has distributional consequences.

For an assessment of the empirical relevance of the model, and for an estimate magnitude of the welfare effects (including effects on the wealthier / mobile consumers, not addressed here), we would need a more complete and flexible specification. The binary mobile-immobile distinction made in the present model seems the least problematic, since it is based on the fact of access (or not) to an automobile. On the other hand, the distribution of travel costs within the mobile group could be modeled in a number of different ways: are the results affected if costs are distributed logistically, say, or Poisson? Is there an empirical basis for choosing a distribution of costs? The linearity of demand might also be relaxed. An explicit model of the out-of-town retail oligopoly and conditions under which its pricing might respond to those of local shops, is also needed, along with a formalization of the welfare model.

The present model is silent on the question of product variety; intuitively, tipping to the low-price local equilibrium, involving as it does both higher per-retailer sales volumes and the entry of new retailers, should lead to increased variety. Would this be borne out in a Dixit-Stiglitz (1977) type variant of the present model?

The model should be empirically relevant where two conditions apply: first, where non-automobile oriented shops are located in a neighborhood in which both car-owning and non-car-owning households are a significant presence; second, where these retailers are close enough to the tipping point hypothesized here, that small changes in the real cost of shopping out-of-town could cause a step-change in equilibrium prices and capacity utilization. For the hypothesized distributional effect to be important, the neighborhoods in question would have to be significantly heterogeneous as regards household wealth, and have wealth positively correlated with car ownership. While the model appears applicable to many European, East Asian and Australasian cities, the effects predicted in the model need empirical verification and measurement.

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