Retail Competition, "Big Box" Entry, and Regional Welfare: Theory and Evidence

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Abstract

I use a spatially differentiated model similar to that of Salop (1979) and modified more recently by Norman, Pepall, and Richards (2008) to model local retail competition and to analyze the welfare implications of later entry by a cost-advantaged "fast second" meant to be a large "big box" firm such as Wal-Mart or Home Depot. I show that when the market is contestable the local welfare remains unchanged in the wake of a big box firm's entry. In contrast, when the market is incontestable, local welfare decreases in the wake of big box entry due to a decline in both consumer and producer surplus. In both cases though, the global surplus always increases.

The before- and after- big box entry comparison of local welfare will hold for any symmetric equilibrium whether local firms are forward-looking and anticipate the later big-box entry or myopic, as I assume. Under the myopic assumption however, local retail entry is excessive relative to the optimal case. Therefore, since the anticipation of the "big box" firm's later arrival would depress this excessive entry, that welfare conclusion does not necessarily mean that big box entry should be blocked. Instead, the first-best solution would be a tax-and-transfer scheme that recognizes that "big box" entry is welfare-enhancing globally and then makes sure that everyone benefits. If such a policy is not possible however, then legislation to prohibit "big box" entry may be a sensible second-best policy for regions facing that prospect.

A major implication of my analysis is that local retail firms will exit at the time of the big box firm's entry. It is this loss in competitive pressure that could make local consumers as well as local producers worse off. I test this implication using panel data from 1977-92, along with both a fixed-effects and Instrumental Variables (IV) approach to test the impact of Wal-Mart's entry into a regional market on the number of retail firms operating in that market. As predicted, the number for local firms always declines noticeably in the wake of big box entry.

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1. Introduction

Over the last two decades, chain store franchises, in general, and "big box" discount retailers, in particular have expanded considerably. Wal-Mart, for example, the widely recognized king of the discount retailer market enjoyed annual sales growth of over 7% for over 30 years prior to 2007.[1] Starbucks, the upscale coffee house, increased the number of its U.S. outlets from 84 in 1990, to 1,000 in 1996, and to 10,000 in 2008. Similar, and perhaps even more dramatic growth stories, can be told for K-Mart, Staples, and Home Depot.

The expansion of large chain stores has not come without cost, especially to smaller, local firms. Using data from Iowa communities, Stone (1995) estimated that the arrival of a Wal-Mart establishment led to a 23 percent decline in the number of other retail stores. Jia (2008) estimates that the entrance of either a K-Mart or Wal-Mart store in a county leads to a similar 25 percent decline in the number of small stores. She further finds that had such small stores foreseen such entry, their numbers would decline by nearly 50 percent, as many more would have foreseen that they would not cover their sunk entry cost. Overall, her findings indicate the emergence of super-store discounters explains 37% to 55% of the net change in the number of small discount firms over the 1980's and 1990's. Davis *et al* (2009) estimate that the entry of a Wal-Mart store on the west side of Chicago in 2006 raised the probability of failure and exit over the next two years to about 40 percent for stores in the immediate area, and that this did not fall to the mean of roughly 25 percent until a store was located three miles away. While the results of other studies, e.g., Basker (2005a, 2005b, and 2007) are more mixed, there is little doubt that local business firms view the entry of a large chain or big box store as a major threat to their survival.

[1] See, Jia (2008) and Basker(2007).

As the perceived threat of entry from large chain operators has grown considerably, some communities have tried to protect local firms by passing zoning ordinances or other legislation that prevent such entry. A long-standing example of such restraints is North Dakota's Pharmacy Ownership Law that requires pharmacies to be operated and owned by trained pharmacists, which consequently stands as a major barrier to entry for large chains, such as CVS and Rite-Aid. However, the spread of similar laws has greatly accelerated in recent years. Thus, Turlock, North Carolina enacted a zoning restriction in 2004 banning "discount superstores" larger than 100,000 square feet with only 5 percent of floor space devoted to groceries (Wal-Mart stores are typically 200,000 square feet in size.) In that same year, San Francisco passed an ordinance defining a chain as any company with 12 or more outlets and banned such stores totally from two of its business districts, while imposing strict restrictions on any openings in other districts. In 2005, Miami barred stores with more than 70,000 square feet from operating in its Coconut Grove neighborhood. Numerous other areas from the Sunshine Coast Regional District in British Columbia to Nantucket Island off the Massachusetts coast have enacted similar bans and restrictions.[2] Springdale, Utah may offer the most recent example with its legislation banning "formula restaurants" from opening within the city.

In this brief paper, I investigate the local welfare implications of entry by a large, cost-advantaged chain and the impact of restraining such entry. While previous studies have tried to determine these effects empirically, they have largely done so indirectly by gauging the impact of such entry on local employment or other measures of local economic activity. In particular, such studies do not capture the potential gains to consumers from the lower prices such entry may generate, nor do they evaluate any gains (or losses) from rationalizing the industry's equilibrium structure.

[2] See S. Stowe, "Nantucket Votes to Ban Chain Stores from Downtown" ***New York Times***, 4 April, 2006

To address these issues, I use a standard model of price competition with differentiated products originally introduced by Salop (1979), but modified more recently by Norman, Pepall, and Richards (NPR) (2008) to consider later entry by a "fast second". Unlike NPR however, I treat the entry of the big box store as one with a major cost advantage rather than the brand identity advantage that they assume. This approach recognizes the common finding, e.g., Basker (2007) that the advantage of stores such as Wal-Mart largely reflects their scale economies that translate into a notably reduced marginal cost. I use this model to address formally the following simple question. Given an equilibrium market setting populated by local firms, what is the local welfare impact of entry by a large, big box firm with a cost advantage? I address this issue under two assumptions. In the first case, I assume a form of contestability. Specifically, I assume that although entry by the cost-advantaged big box firm may drive out smaller, local firms, those firms can re-enter the market at their initial location if prices rise above their marginal cost. In the second case, I assume that there is no contestability so that firms forced to exit cannot return to the market at all.

In the next section, I lay out the model and then present the basic results. In Section 3, I briefly introduce extensions of the model and discuss how these might alter the main conclusions. In Section 4, I work out the extensions of the model, and follow it up in Section 5 by analyzing the effects of banning big box entry. Section 6 is another brief discussion regarding possible decisions that could be made in order to increase local consumer and producer welfare. In Section 7, I present some of my own empirical research regarding how Wal-Mart's entry affects the number of retail establishments at the county level.

2. Spatial Equilibrium Before and After "Big Box" Entry

My basic model is separated into two periods, each of which in turn has two stages. The setting for this analysis is the local or regional market assumed here to be a product-differentiated, monopolistically competitive industry. These features are captured here by modeling the market as a circle normalized to unit length as in Salop (1979), with a mass of M consumers uniformly distributed around this circle. Consumers are immobile but firms may nevertheless sell to consumers located some distance from the firm by incurring a transport or versioning cost equal to r times the distance to the consumer. This cost is additional to the constant unit cost c of producing the firm's core product that does not have to be transported or, more generally, modified to sell to consumers located, either in geographic or product space, some distance away. Hence, the cost incurred by a firm located at x in providing a product to a consumer located at s is:

$$C(x,s) = c + r|x - s| \tag{1}$$

Each consumer will buy at most one product. For a consumer located at s who buys a product from a firm located at x at price $p(x)$, the net utility is:

$$U(x,s) = V - p(x) \tag{2}$$

For a consumer to buy the good at all, it must be the case that net utility in equation (2) is positive. Each consumer who does buy will then purchase one unit from the firm charging the consumer the lowest price.

In stage 1 of the first period, local entrepreneurial firms enter the market and locate on the circle, with each such location defining that firm's core product. However, entry incurs a one-time sunk cost of $2F$. In the second stage of the first period, the local firms compete in prices. As in NPR, I will assume that it is prohibitively costly for a firm to relocate to a different spot after it has chosen its initial location on the circle. Recall though that in the contestable market case, firms can re-enter costlessly at the same location.

In the third stage of the game, which is the first stage of the second period, a low-cost big box *B*, national competitor such as Wal-Mart decides on entering the local market and local firms decide on exiting. This large firm's cost advantage is reflected in the parameter α satisfying $0 < \alpha < 1$. Thus, the cost incurred by firm *B* located at x_B in providing a product to a consumer located at *s* is:

$$C(x_B, s) = \alpha c + r|x_B - s| \tag{3}$$

In addition, to this operating cost, firm *B* also incurs a sunk cost *F* to operate in the one period remaining in the game. Finally, in the second stage of period 2, firm *B* and the surviving local firms compete in prices for consumer purchases.

2a. The Equilibrium Number of Local Entrants

For now I follow Jia's (2008) initial myopic assumption that the initial entry of local firms in period 1 is done without anticipation of the later entry by the cost-advantaged firm *B*. I will return to this issue later. For now, I simply point out that this may in fact be historically accurate for many regions in which local firms had been long-established before entry by a major national chain was considered a possibility. Also, unlike Norman and Thisse (1996), I assume that the initial entrants do not "fully exploit the entry-deterring advantage of being committed to their locations," such that the equilibrium corresponds to the densest packing of firms, rather than the loosest.

The myopic assumption greatly simplifies the equilibrium entry decision in that the equilibrium number of local entrants n^e now must (assuming symmetry) be a number such that each firm earns an operating profit of F per period so as to cover its initial sunk cost of $2F$.[3] Given that there are n^e firms symmetrically located throughout the market, each firm will have a market share of $1/n^e$. Consider then a firm located at position x with its two nearest rivals located at x-1 and x+1. The maximum price that firm x can charge to any consumer and still make a sale is restricted by the cost incurred by its nearest rival in offering that customer an alternative. The consumer located at x, the same position as the firm, can therefore be charged at most a price $p_{max} = c + r/n^e$. At any higher price, either firm x-1 or x+1 could profitably sell to this consumer. As we consider consumers either to the right or left of x the maximum price that firm x can charge them declines linearly by the factor r times the distance from x. For consumers at the midpoint, between either x-1 and x or x+1 and x, firm x and its rival on either side both incur a cost of $c + r/2n^e$ in versioning their product to reach this consumer. Beyond this point, firm x cannot compete successfully since the closer proximity of consumers to its rivals allows either firm x-1 or firm x+1 to price profitably below firm x's cost.

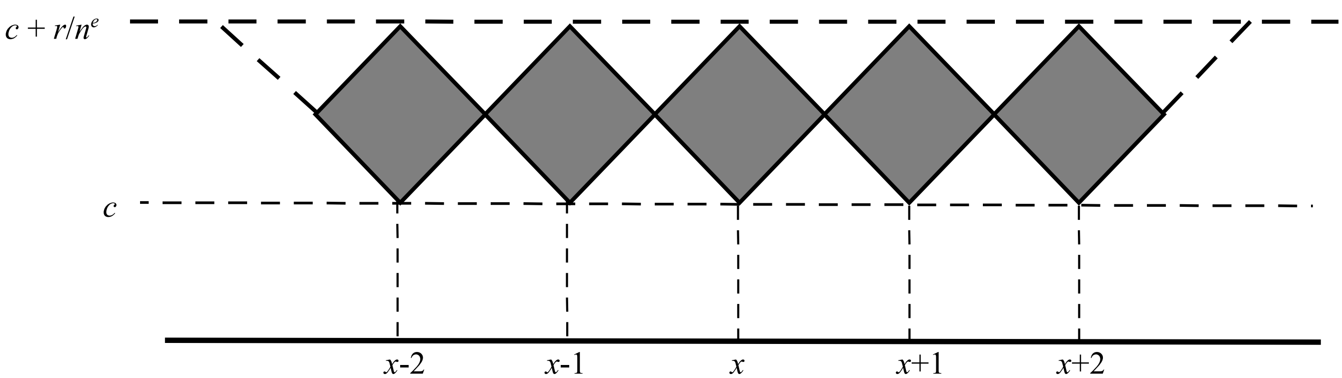
The above means that on either side of its location, firm x's price falls linearly from $p_{max} = c + r/n^e$ to a minimum of $p_{min} = c + r/2n^e$. It follows that the average price per unit $\overline{p}$ that firm x charges is $\overline{p} = c + 3r/4n^e$. It is equally straightforward to show that the average operating cost $\overline{c}$ per unit that firm x incurs is $\overline{c} = c + r/4n^e$. Thus, operating profit per unit for each firm is $\pi_{avg} = r/2n^e$. In a symmetric equilibrium, each firm x serves $1/n^e$ of the M customers in the market so that its total operating profit π_{Total} is given by $\pi_{Total} = rM/2(n^e)^2$ in each of the two market periods. Imposing a zero-profit condition over two periods then implies that twice this amount just covers the sunk entry cost of $2F$. Hence the equilibrium number of initial local entrants in this myopic case is:

[3] I assume no discounting, i.e., the interest rate is zero. This is a mere convenience that does not in any way alter the basic findings of this paper.

$$n^e = \sqrt{\frac{rM}{2F}} \tag{4}$$

The equilibrium is illustrated in Figure 1 (next page). In this figure, the segment of the circle including firms x-1, x, and x+1 has been flattened out. The upward sloping lines of each diamond show the cost of each firm rising as it versions its product to serve consumers farther away. The downward sloping sides of each diamond indicate the maximum price that each firm can charge customers as equal to the cost at which its nearest rival could do the same. Hence, the shaded diamonds represent the operating profit earned by each of the initial entrants. As noted, the zero-profit condition for equilibrium entry requires that this profit just equal F.

Figure 1
Local Market Equilibrium Before Big Box Firm Entry



2b. The Impact of Entry By a Cost Advantaged Firm

I now consider the impact of entry by a cost-advantaged firm B whose location on the circle is labeled x_B. I examine this case first for the setting of a contestable market in which any local firms that exit in the wake of firm B's entry can re-enter costlessly. I then consider the case of market incontestability, in which such re-entry is not possible, so that exited firms cease to have any influence on market outcomes.

Case 1: Big Box Entry in a Contestable Market

The distinctive feature of a contestable market is that even if it is possible for firm B to price in such a way that one or more local rivals are driven from the market, the potential entry of those rivals still exerts significant influence on firm B's pricing. This limits the ability of firm B to exploit any market power it has. As a result, contestability also makes it less likely that entry will be profitable for firm B in the first place.

In considering its entry, firm B has two product location choices. It may either locate in between two existing local firms or locate at the same spot as an existing firm. In the contestable market case, the balance of two forces determines this choice. By locating at the same spot x as an initial firm, firm B's cost advantage allows it to steal all of firm x's customers as well as some from firms located at either x or x+1 (and possibly beyond). Thus, a same-spot location has the advantage that it maximizes firm B's market size. Unfortunately, same-spot location also maximizes the price discipline that firm B faces stemming from the ability of displaced firms such as firm x to re-enter whenever firm B's price exceeds firm x's marginal cost by more than $(1-\alpha)c$. Thus, the choice between same-spot and in-between locations is one that trades off a small price-cost margin applied over a relatively large market against a higher price-cost margin applied over a relatively small market. I show in the Appendix that the influence of these two factors alternates as one considers different ranges of the parameter α. In what follows, I assume same-spot entry for firm B. However, it is easy to show that the main welfare result of this paper is the same if firm B instead chooses an in-between location.

Given that firm B enters at the same spot as an existing regional firm, it is easy to see why such entry may not be profitable. By assumption, the existing firm x is just earning an operating profit of $rM/2(n^e)^2 = F$, and this amount is possible because firm x is $1/n^e$ distance from its closest competitor in either direction allowing it to charge a maximum price of $c + r/n^e$ to consumers located right at x and earn a profit of r/n^e from such sales. In contrast, firm B can never charge more than c to such customers, thereby restricting its profit from such sales to $(1-\alpha)c$. Of course, firm x's profit per sale will slowly decline and reach zero as it ultimately sells to consumers $1/2n^e$ units away, while firm B's margin will be maintained at $(1-\alpha)c$ throughout this distance. Nevertheless, for sufficiently large values of α, it is clear that the price discipline imposed by firm x's potential re-entry will prevent firm B from earning enough to cover its sunk entry cost.[4]

The central concern in this paper is the impact of firm B's entry on local or regional welfare at the time that such entry occurs. So, I now consider what happens when B does enter although as I have just shown, it may not. Following the standard convention, I define local welfare as the sum of the surplus realized by local consumers and producers. A little consideration then yields the following result.

Proposition 1: If the domestic market is contestable and local firms can costlessly re-enter in response to any profit opportunity, firm B's entry will generate an increase in local consumer welfare and an offsetting decrease in local producer welfare with the result that total regional welfare is unchanged.

Proof: Contestability implies that the maximum price on any sale made by firm B located a distance d from the nearest location of an initial local firm is: $p_{max} = c + rd$, namely the cost incurred by the nearest local firm in servicing that consumer. This is true whether or not the nearest local firm is still active in the market. Prior to that sale, the price paid by this consumer was $p = c + r(d + \varepsilon)$, where $d + \varepsilon$ is the distance of the second-closest initial local firm. Thus, on all sales made by firm B, the local consumer surplus rises by $r\varepsilon$, while local producer surplus falls by the same amount. On sales made by a local firm that survives firm B's entry, one of

[4]Such discipline is not present in the incontestable market case. In that setting, firm B will enter for any α satisfying $0 \leq \alpha < 1$.

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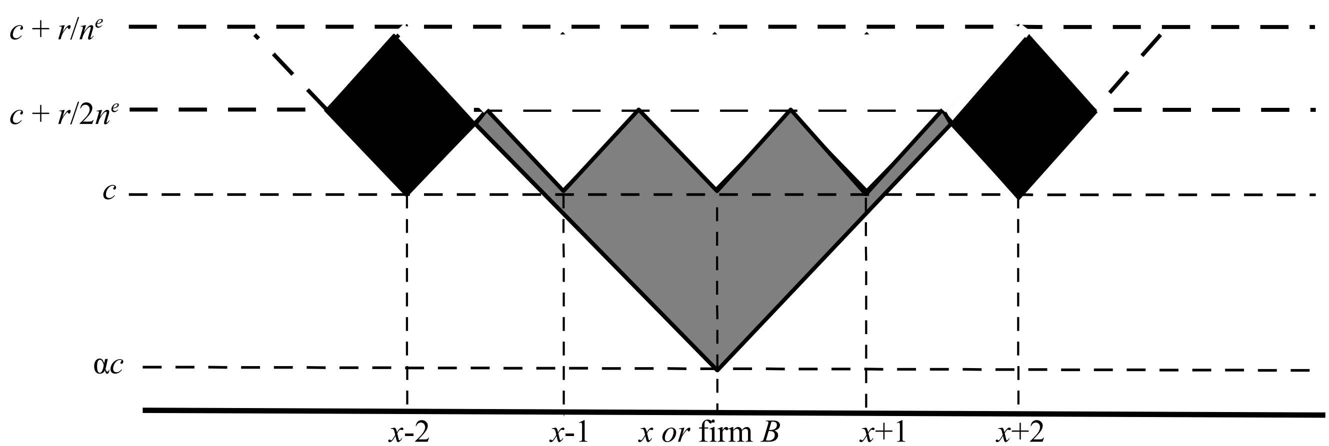
two possible outcomes must occur. One is that the survivor's lowest cost competitor on either side is another surviving initial entrant. In this case, the price set by such a firm after firm *B*'s entry—and therefore the post-entry consumer and producer surplus—remain unchanged on all the firm's sales. The other possibility is that the surviving firm's lowest cost rival on one or both sides (if it is the lone survivor) is firm *B*. Denote the surviving local firm as firm *x*. In this case, the price charged by firm *x* to any consumer it serves cannot exceed $\alpha c + rd_B$ where d_B is the consumer's distance from firm *B*'s location. Prior to firm *B*'s entry, the price to this same consumer was $c + rd_{x+1}$ where d_{x+1} is the distance to the nearest initial local entrant.   Hence, the price decline and therefore the gain in consumer surplus if firm *x* continues to serve this consumer is $(1–\alpha)c + r(d_{x+1} – d_B)$. If d_x is firm *x*'s distance from this consumer, its profit from this sale is $r(d_{x+1} – d_x)$ before firm *B*'s entry and $(\alpha–1)c + r(d_B – d_x)$ afterwards. Thus, on any sale to a consumer for whom surviving local firm *x* competes directly with the big box entrant firm *B*, its profit loss is $(1–\alpha)c + r(d_{x+1} – d_B)$, which is exactly the consumer surplus gain. Therefore, the total local surplus is unchanged.

Figure 2 shows the pattern of prices after the entry of the big box firm *B* in the case in which some initial local firms survive. In the figure, the light-shaded area represents the operating

Figure 2
Market Pricing Equilibrium After Big Box Entry When the Market is Contestable



profit earned by firm *B* which, as drawn, has driven three local firms from the market—the one originally located at firm *B*'s entry point and the one to either side of that point. The dark-shaded area shows the profit of the surviving local firms. Contestability means that the potential competition from these three firms limits firm *B* from ever pricing above their cost.

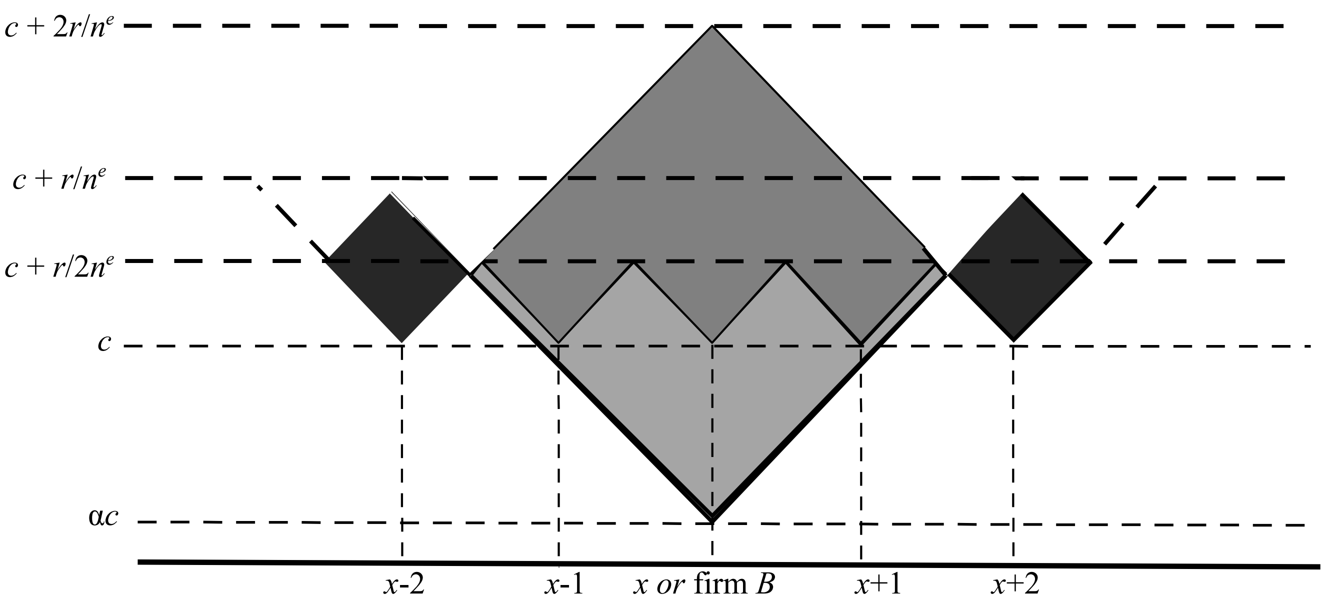
Case 2: Big Box Entry in an Incontestable Market

As noted above, when the market is incontestable, firm *B* will enter for any degree of cost advantage $0 \leq \alpha < 1$. This is because for entry to be profitable, firm *B* must earn an operating profit sufficient to cover its sunk cost *F*. However, for any value of α in the permitted range of zero to one, this requirement will always be met because with $\alpha < 1$, firm *B* can always profitably price below one of the local firms and steal *all* of that firm's customers. Yet, we already know that that displaced firm would have earned an operating profit of *F* by virtue of the zero-profit entry condition requiring that it earn *F* in each period to cover its initial sunk cost. Hence, if a regional firm with everywhere higher cost can earn an operating profit of *F* selling to all of its M/n^e customers, then firm *B* that has lower cost can displace that firm and do at least as well. Thus, entry is more likely if the market is incontestable.

However, not only is firm *B*'s entry more likely, it will also be more damaging to the regional economy in a setting of market incontestability. In the absence of potential competition from displaced (exited) local firms, the only constraint on firm *B*'s prices in the product space that these firms enter is the cost of delivering an alternative product from the nearest surviving firm. This will obviously be a weaker restraint than would be reentry. Thus, firm *B*'s prices will be higher in an incontestable market than in a contestable one. The pricing outcome that prevails now is shown in Figure 3 (next page). This figure is the same as Figure 2 except that now, since the nearest local firm is $2/n^e$ units away, the maximum price the big box firm *B* can charge is equal to $c + 2r/n^e$. For the case again where firm *B* drives three local firms out of business, Figure 3 (next page) shows the profit for the two nearest local firms as dark-shaded regions. The light-shaded region is firm *B*'s profit when the market is contestable as in Figure 2. The medium-shaded region is the additional profit that firm *B* gets when the market is incontestable because in the region in which local firms have exited, it can charge much higher prices. The above arguments, lead to the following proposition.

Proposition 2: If the domestic market is incontestable and local firms cannot re-enter after they have exited from the market, firm *B*'s entry will lead to a decrease in the surplus of both local consumers and local producers. Therefore, it must lead to a decrease in overall local welfare.

Figure 3
Market Pricing Equilibrium After Big Box Entry When the Market is Incontestable



Proof: Price competition with versioning means that any consumers who still purchase from a surviving initial local entrant *x*, must fall within one of the two cases described by the contestability outcome. Either they purchase from local firms who are essentially unaffected by firm *B*'s entry and therefore continue to pay the same price as before, leaving the local consumer and producer surplus unchanged, or they pay a price that is now constrained by competition from firm *B* with the result that their consumer surplus gain is exactly offset by the local firm's producer surplus loss. However, consumers who used to buy from a local firm but who now buy from firm *B* now pay higher prices as the only constraint on the price they pay is the competitive pressure from a surviving local firm that may be located a considerable distance away. On such sales by firm *B*, the surplus for local consumers falls from its pre-entry level and the local producer surplus is eliminated entirely. Hence, the total surplus declines.

3. Discussion

Up to this point, I have shown that if the domestic market is contestable and local firms can costlessly re-enter in response to any profit opportunity, firm *B's* entry will not have an impact on the total regional welfare. It will though lead to a net increase in local consumer welfare at the expense of local producers. However, if the domestic market is incontestable and local firms cannot re-enter after they have exited the market, firm *B*'s entry will lead to a decrease in overall local welfare through a decrease in consumer surplus and a complete elimination of producer surplus. Since the best possible outcome under these two scenarios results in the overall local surplus remaining unchanged, and since that outcome relies on the somewhat unlikely case of complete contestability, there may be a presumption that firm *B*'s entry will typically lead to an overall decline in regional welfare.

There are though some clarifications that should be applied to the foregoing conclusion. First, although I have assumed myopic behavior for the local firms, the welfare comparison that I have made so far does not rely on that assumption. The arguments about pricing before and after *B*'s entry are accurate for any number of initial local entrants grouped in a symmetric equilibrium whether they anticipated firm *B*'s entry or not. In other words, viewed only at the time of that it happens, firm *B*'s entry either reduces or, at best, leaves unchanged the local regional welfare.

However, the myopic behavior that I have assumed will generally lead to more than the efficient number of local firms. Assuming a local sunk cost of $2F$, the optimum local entry if no big box entry is foreseen is equal to the maximum of social welfare *W(n)*, given by:

$W(n) = -4Mn\int_0^{1/2n} rx^{\beta}\,dx - 2nF$. As in Salop (1979), β = 1 means that the versioning costs are linear. So, for this model, the social welfare reduces to: $W(n) = -r/2n - 2nF$. Maximizing this social welfare function by taking the derivative of *W(n)* with respect to *n* and setting it equal to 0, reveals that the socially optimal number of local entrants is:

$$n^* = \sqrt{\frac{rM}{4F}} \tag{5}$$

Thus, the number of local entrants n^e under the myopic assumption is approximately 41% greater than the socially optimal number of local entrants.

If local firms anticipated firm *B*'s entry however, the actual number that would initially enter would be reduced. Entrepreneurial firms with foresight would take into account the probability of the fast second locating in their region of the product space and the negative impact that the location choice would have on their operating profit. This raises the possibility that a potential benefit of firm *B*'s entry is that it lowers the initial number of local entrants to a level closer to the efficient amount.[5] Because Propositions 1 and 2 apply for *any* number of initial entrants, it remains true that local welfare will either stay the same or fall at the time of firm *B*'s entry. That though is a different issue from the question of what local welfare would be from the start if firm *B*'s entry was anticipated.

[5] Note that the prospect of firm *B*'s entry could actually worsen the inefficiency by pushing the number of local entrants too low and even further away from the efficient amount in the opposite direction.

A third point is that although firm *B*'s entry at best leaves local welfare unchanged, it is important to note that firm *B*'s entry raises total welfare globally when its own profits are included in the total. This opens up the possibility of a first-best policy that taxes firm *B* in a manner such that enough of firm *B*'s profits can be redistributed to locals to make up for the regional welfare loss. One such option could be to transfer revenues from firm *B* to local firms via subsidization. A further complication with this strategy though is that subsidizing firms so that they can stay or re-enter the market will reduce firm *B*'s profit, which is the source of the subsidization funds. Thus, any policy of subsidizing local firms will require careful design to achieve first-best results. Jia (2008) reaches this same conclusion based on her empirical investigation of the effects of Wal-Mart entry on local markets. In this connection, it is noteworthy that the model developed above does not necessarily imply that if such subsidization were put in place local employment would change very much. The benefits of such subsidization may stem primarily from the price pressure of *potential* re-entry of local firms, not necessarily their actual entry.

4. Local Firm Entry When Later Big Box Entry is Anticipated

As mentioned above, the economic experiment considered so far concerns what happens when the big box firm *B* enters into an already established market of local firms. Because rational local entrepreneurs will anticipate firm *B*'s later entry when they themselves first enter the market, this will lower the initial number of such entrants, which may be beneficial given that, as shown above, there will be inefficiently too many local entrants in the absence of such expectations. Thus, to understand the welfare effect of local laws that ban big box entry, we need to consider this beneficial effect by examining the market both when firm *B*'s later entry is expected and when it is prevented. In this section, I present this analysis.

To keep the problem tractable I make a number of simplifying assumptions. It is easy to show that these do not affect the basic conclusions of the analysis. First, I maintain my earlier assumption that when firm *B* enters, it does so at the same spot as an existing firm. Second, while to some extent I ignore the integer constraint on the number of early entrants, I will assume that that number of such entrants is odd whenever I work with that number explicitly.

4a *Local Firm Survival in the Wake of Big-Box Entry*

Imagine that firm *B* locates at the same spot as one of the n^e initial entrants, where n^e is an odd integer. In order to eliminate the *j* nearest rivals to its right (moving clockwise), firm *B* must be able to price below *c* at each of these rival's base location. That is, we must have:

$$\alpha c + \frac{rj}{n^e} \leq c \quad \text{or} \quad \alpha \leq 1 - \frac{rj}{n^e c} \tag{6}$$

Equation (6) establishes an upper bound on α for firm *B* to eliminate *j* firms to its right. There is of course a lower bound necessary to insure that it eliminates no more than *j* firms. This is:

$$1 - \frac{r(j+1)}{n^e c} \leq c \tag{7}$$

As α moves from its upper bound to its lower one, firm *B* will continue to displace *j* firms to its right while becoming more profitable and more and more threatening to the next surviving entrant $(j+1)/n^e$ units away. Obviously, if n^e was large or if it was continuous, the upper and lower bound would converge. In what follows, I basically use this large or continuous idea and therefore use the upper bound value of α to make things simple. Effectively, this limits the profitability of firm *B* and increases the profitability of the entrants, but it does not change the basic nature of my conclusions.

It is obvious that firm *B* eliminates the firm that was located where firm *B* entered. However, if firm *B* eliminates *j* firms to its right, it will also eliminate *j* firms to its left. So, the total number of firms eliminated by firm *B* is $2j + 1$ as long as $n^e > 2j + 1$. As I just noted, I use the upper bound value for *j* and that means that we can write:

(8)

The number of first entrants that survive firm *B*'s entry is n^s. This is given by:

$$n^s = n^e - (2j+1) = n^e\left[1 - \frac{2(1-\alpha)c}{r}\right] - 1 \qquad (9)$$

Therefore the second-period survival rate for local entrants is:

(10)

4b Expected Profit and Equilibrium Entry: The Incontestable Market Case

When the market is incontestable, firm *B* can enter for any value of $\alpha < 1$, i.e., over the entire range of α. Therefore, the initial local firms will expect that firm *B* will have a value of α equal to its average value or. Further, assuming this pushes the upper limit necessary to eliminate *j* local firms in either direction from the spot firm *B* enters means that at the location of the *j*th firm, firm *B*'s unit cost is equal to *c*. Therefore, since everyone has the same versioning cost, the local firm *j*+1 units away faces the same competition from firm *B* as it did from the local firm that used to be next to it. Obviously, this is also true of all the local firms that survive and that are not directly up against firm *B*. Thus, in the incontestable markets case, every surviving firm will earn the same profit after firm *B*'s entry as it did before that entry and the only real question is whether or not it survives.

Denote each entrant's first period operating profit as π_1. Given that is the survival rate for any local entrant, expected survival rate is $S(\overline{\alpha}, n^e, c, r)$, the equilibrium number of entrants in the incontestable market case then satisfies

(11)

where $\pi_1 = rM/2(n^e)^2$. Note that when $S(\alpha, n^e, c, r) = 0$ this zero profit equation says that $\pi_1 = 2F$, in which case, the number of initial entrants would fall to the efficient level of equation (5). This is one of the beneficial effects of big box entry that I talked about earlier. It helps get rid of at least some of the excess number of local firms that would otherwise enter. For values of $S(\overline{\alpha}, n^e, c, r) > 0$, we must have

(12)

It is readily apparent that equation (12) is cubic in n^e and therefore has three solutions. One of these is negative, one is a positive fraction typically less than 0.5, and one is a positive term greater than 1. Clearly, the value of is critical. For this paper, I assume that α is distributed uniformly between 0.8 and 1, so that $\overline{\alpha} = 0.9$. In other words, I assume that firm *B* has a ten percent base cost advantage. This will imply a less than a ten percent advantage overall since firm *B* and the early entrants all share the same versioning cost. Something on the order of ten percent or less seems reasonable in light of the evidence from Wal-Mart studies.[6]

Also crucial is the ratio of the base cost *c* to the versioning cost *r*; and the ratio of the sunk cost parameter *F* to the market density *M*. From equation (10), we can see that with high values of *c*/*r* above 5, will automatically make the probability of survival equal to zero. However, to limit the chances of this, I have to put some restriction on *c* since I have already restricted *r* to

[6] See, e.g., Bernstein, Bivens, and Dube (2006).

satisfy $0 < r < 1$. In the analysis below, I set $c = 1$, so that the ratio of c/r is totally determined by the value of r.

In Table a and b below, I show the number of firms that enter the market under various scenarios for the case of $M/F = 200$ and the case of $M/F = 500$. In each table, the first column shows the assumed inverse cost ratio, r/c. The second column shows the number of firms that would enter in the myopic case where firms do not anticipate later entry by firm *B*. The third column shows the number of local firms that enter when they do anticipate firm *B*'s entry. Finally, the last column shows the number of firms that survive after firm *B*'s entry. In all cases, I round the number of firms to the nearest integer value.

Table (a)
$M/F = 200$

r/c	n^e(myopic)	n^e(forward-looking)	# of Survivors
0.1	3	2	0
0.2	4	3	0
0.3	5	4	0
0.4	6	5	2
0.5	7	7	3
0.6	8	7	4
0.7	8	8	5
0.8	9	8	5
0.9	10	9	6

Table (b)
$M/F = 500$

r/c	n^e(myopic)	n^e(forward-looking)	# of Survivors
0.1	5	4	0

0.2	7	6	0
0.3	9	8	2
0.4	10	9	4
0.5	11	10	5
0.6	12	11	6
0.7	13	12	8
0.8	14	13	9
0.9	15	14	10

We can see a few patterns in these tables. First, the anticipation of firm *B*'s later entry obviously depresses initial local entry. When versioning is relatively cheap, in other words for low values of r/c, the effect is on the order of 20 to 30 percent because a low value of r/c means that when firm *B* enters it will be able to afford to sell to even customers who are far away. However, this affect is softened when the density of the market population, M/F is high.

Second, firm *B*'s entry usually takes out a large number of local firms. Again, this effect is more powerful for low values of r/c. In fact, when r/c is between 0.1 and 0.3, firm *B*'s entry will eliminate all of the initial local entrants. Even when r/c is high though, *B*'s entry still usually knocks out at least 30 percent of the local firms.

5. Welfare Implications of Banning Big Box Entry

Now that we have examined the market both when firm *B*'s later entry is expected and when it is prevented, we can start to analyze the welfare effects that may arise when laws are passed to prevent big box entry. Although we know that local welfare definitely decreases in the wake of the big box firm's entry, the fact that such entry would push the number of local firms down and closer to an optimal level means those laws preventing big box entry may not improve local welfare.

In order to determine the welfare implication of banning big box entry, I will consider two separate cases. First, I will consider the case in which big box entry is banned, and therefore the local entrepreneurial entrants will act according to the myopic assumption. That is, they will enter in the first period without considering the possibility of a big box firm's later entry. For the second case, I will assume that the market is incontestable, and that there is no law in place that bans big box entry. Thus, local entrepreneurial entrants will rationally anticipate later entry by a big box firm when making the initial entry decision. I will then calculate the total producer and total consumer surplus using the same constraints on the inverse cost ratio and market density to sunk cost ratio that are used in Table a and b above.

Case 1: Local Producer and Consumer Surplus without Big Box Entry

From our earlier analysis under the myopic assumption, we know that in a symmetric equilibrium, each local firm earns an operating profit of $\pi_{Total} = rM/2(n^e)^2$ in each of the two market periods. Since there are n^e number of firms earning the same profit each period, total local producer surplus per period is:

$$\pi^{(Ban)} = rM/2n^{e(\text{myopic})} \qquad (13)$$

Remember also from earlier that a consumer at location s who buys the product from a firm located at x, pays a price $p(x)$ and gains a net utility $U(x,s) = V - p(x)$. Since the average price per unit $\bar{p}$ that firm x can charge is $\bar{p} = c + 3r / 4n^e$ the average utility per unit can be re-expressed as $\overline{U} = V - \left[c + 3r/4n^e\right]$. Given M customers, the total consumer surplus per period is:

$$CS^{(Ban)} = M\,[V\text{-}\ [c+3r/4n^{e\,(myopic)}]] \qquad (14)$$

Since total producer and consumer surplus are both proportional to the market density M, I will normalize the sunk cost, F to 1 so that the ratio of the sunk cost parameter to the market density is determined solely by M.

Case 2: Total Producer and Consumer Surplus Anticipating Big Box Entry

For the first period the consumer and producer surplus are the same as in the previous case, except the equilibrium number of entrants is now given by equation (12). I will formally express the first period local consumer and local producer surplus for this case as $CS_1^{(BigBox)} = M\ [V - [c+3r/4n^{e\ (forward\text{-}looking)}]]$ and $\pi_1^{(BigBox)} = rM/2n^{e(forward\text{-}looking)}$, respectively. For the second period, each local firm that survives, including the local firms that have to compete directly with firm *B*, will earn the same profit as in period 1. Therefore, in the incontestable market case, the local producer surplus in period 2 is $\pi_2^{(BigBox)} = S(\alpha,n^e,c,r) * rM/2n^{e(forward\text{-}looking)}$, where the factor survival rate can now be thought of as the proportion of the market in which customers are still buying from local producers. Thus, the total producer surplus for the two periods is:

$$\pi_{\text{total}}^{(BigBox)} = rM/2n^{e(forward\text{-}looking)}[\ 1 + S(\alpha,n^e,c,r)\ ] \qquad (15)$$

Similarly, it is easy to show that the total local consumer surplus for customers that are located between two local firms can be expressed as $CS_{2,\text{local}} = M*S(\alpha,n^e,c,r)\ [V - [c+3r/4n^{e\ (forward\text{-}looking)}]]$. Since there is a need to constrain the consumer reservation price in order to ensure complete market coverage for the big box firm in the case where there are no survivors in the second period, I refer the reader to the appendix for a complete derivation of consumer surplus for customers located within firm *B*'s produce space. For now assume that total consumer surplus for consumers being served by firm *B* is $CS_{2,BigBox} = M\left(1 - S\left(\alpha, n^e, c, r\right)\right) * \left[V - \left[c + \left[\left(n^e - n^s + 2\right)/2n^e\right]r\right]\right]$, where $(1 - S(\alpha,n^e,c,r))$ is the market share of the big box firm. Also, assume that the consumer's reservation price, V = 1.5. The total producer surplus for the incontestable market case can now be expressed as equation (16):

$$CS_{Total}^{BigBox} = M * \left(S\left(\alpha, n^e, c, r\right) + 1\right)\left[V - \left[c + 3r/4n^{e(forward-looking)}\right]\right] + M * \left(1 - S\left(\alpha, n^e, c, r\right)\right)\left[V - \left[c + \left[\left(n^e - n^s + 2\right)/4n^e\right]r\right]\right]$$

Note that in the case where there are no survivors in the second period, the above equation is no longer valid. Instead, equation (16) would reduce to $CS_{Total}^{BigBox} = M\left[V - \left[c + 3r/4n^{e(\,forward-looking\,)}\right]\right]$.

In Table c and d below, I show the total producer and consumer surplus for a range of inverse cost ratios for the cases of *M*/*F* = 200 and *M*/*F* = 500. In each table, the first column shows the assumed inverse cost ratio, *r/c*. The following three columns show the producer, consumer, and total local surplus for the myopic case where big box entry is banned. Similarly, the final three columns show the producer, consumer, and total local surplus when firm *B's* entry is anticipated and the market is incontestable. In all cases, I round the welfare results to the nearest integer value.

Table (c)
M/*F* = 200

r/c	$Producer^{(Ban)}$	$Consumer^{(Ban)}$	$Total^{(Ban)}$	$Producer^{(BigBox)}$	$Consumer^{(BigBox)}$	$Total^{(BigBox)}$
0.1	7	190	197	5	93	98
0.2	10	185	195	7	90	97
0.3	12	182	194	8	89	96
0.4	13	180	193	9	173	182
0.5	14	179	193	10	172	183
0.6	15	178	193	13	171	184
0.7	18	174	191	14	170	185
0.8	18	173	191	16	166	183
0.9	18	173	191	17	167	183

Table (d)
M/*F* = 500

r/c	$Producer^{(Ban)}$	$Consumer^{(Ban)}$	$Total^{(Ban)}$	$Producer^{(BigBox)}$	$Consumer^{(BigBox)}$	$Total^{(BigBox)}$

0.1	10	485	495	6	241	247
0.2	14	479	493	8	238	246
0.3	17	475	492	12	454	466
0.4	20	470	490	16	454	470
0.5	23	466	489	19	450	469
0.6	25	463	488	21	447	468
0.7	27	460	487	24	449	473
0.8	29	457	486	26	447	473
0.9	30	455	485	28	445	472

We can see from these tables that banning big box entry leads to both increased local producer and consumer surplus. Even though anticipation of a big box firm's entry into the local economy depresses the amount of initial entrants closer to the optimal level, the surplus gained in the first period is more than offset by a decline in surplus for both producers and consumers in the second period. This is especially true when versioning costs are low, and when the market density is high. Under all of the scenarios above, total local surplus is higher when big box entry is banned.

The results above suggest that without any type of first-best policy in place that taxes firm *B* in a manner such that enough of firm its profits can be redistributed to locals to make up for the regional welfare loss, banning the big box retailer from entering may be the second-best policy dependent upon the degree of contestability. In the next section, we will weigh the big box firm's profit against the regional welfare under the incontestable market in order to determine if a subsidy policy is feasible given the market constraints.

6. First-Best Policy Analysis

From the derivation of consumer surplus under firm *B* we know that the average price a consumer pays firm *B* is $\overline{p} = c + r[(n^e - n^s + 2)/4n^e]$. We also know that the minimum price that the big box firm B is willing to charge equals its maximum cost, $C_{max} = \bar{\alpha} c + r/2[1- S(\alpha,n^e,c,r)]$.

Since the minimum cost that firm B incurs to serve a customer at its own location equals $\bar{\alpha} c$, its average cost is just $\bar{C} = \bar{\alpha} c + r/4[1- S(\alpha,n^e,c,r)]$. Thus, the big box firm's total profit is:

$$\pi_{\text{BigBox}} = M[1 - S(\alpha,n^e,c,r)][c(1-\bar{\alpha}) + r[(n^e - n^s + 2)/4n^e] - r/4[1- S(\alpha,n^e,c,r)]] \quad (17)$$

This of course is assuming that there are survivors. If there are no survivors, the big box firm will charge each customer its reservation price. Thus, the average price will be V, and the average cost that the big box incurs will be $\bar{C} = \bar{\alpha} c + r/4$. Therefore, the profit for firm B in this case will be $\pi_{\text{nosurvivors}} = M^*[V-[\bar{\alpha} c + r/4]$.

Using the same assumptions for $\bar{\alpha}$, c, r; and M as earlier, I show in Table e the big box firm's profit for the case of $M/F = 200$ alongside some of the results from my previous welfare analysis. Similar results can be shown for the case of $M/F = 500$. I also show in the last two columns the global welfare for the incontestable market case, and the percentage of the big box firm's profit that would have to be taxed and re-distributed to locals to make up for the reduction in regional welfare.

Table (e)
M/F = 200

r/c	*Total*$^{(Ban)}$	*Total*$^{(BigBox)}$	*Profit*$^{(FirmB)}$	*Global Welfare*	*"Tax Rate"*
0.1	197	98	115	213	86%

0.2	195	97	110	207	89%
0.3	194	96	105	201	93%
0.4	193	182	18	200	63%
0.5	193	183	16	198	66%
0.6	193	184	12	196	69%
0.7	191	185	11	196	71%
0.8	191	183	11	194	77%
0.9	191	183	10	193	77%

From Table e above, we can see that in the case where there are no surviving initial entrants, approximately 85-90% of the big box firm's profits would have to be re-distributed to the community in order to make up for the regional welfare loss. Also, as the versioning cost parameter increases, the *"tax rate"* on the big box firm increases significantly. This is because the big box firm profit's drops more rapidly as a function of the versioning cost than does the regional welfare loss. Thus, the results suggest that a first-best policy does not seem feasible because the amount of firm *B's* profit that would have to be re-distributed is so large that it would most likely deter the big box firm's entry to begin with. Therefore, for county business officials it seems that, given the results of my welfare analysis, banning the big box firm from entering may be the best (and possibly most convenient) policy so long as the market is incontestable. In later works on this topic, I will consider what the best policy would be under the contestable market case.

7. Empirical Analysis

Although in theory the negative impacts of a big box firm's entry is apparent, in the absence of specific knowledge of consumer utility functions, it is not easy of course to test the impact of a big box firm's entry on the local surplus. However, it is possible to check the consistency of the model with other observable consequences of the establishment of a big box firm on the regional economy. Thus, I now turn to a brief empirical analysis designed to investigate the validity of the spatial competition model developed above.

For this purpose, I focus on the predicted effect that the entry of a big box firm in a local economy will lead to the exit of many local firms. Specifically, I use panel data at the county level from 1977 to 2006, to investigate what happens to the number of local retailers when a particular big box firm, Wal-Mart, enters the market. Both Stone (1995) and Jia (2008), among others, have studied this issue. My development of further empirical evidence therefore is both a way to check their results as well as a way to test my own model. Note that although Wal-Mart's first store opened in 1962, the 1977 starting point of my data covers by far the bulk of Wal-Mart's extraordinary growth.

Data Description

As noted, the panel data cover the years, 1977-2006, the most recent year for which complete data are available. Although Wal-Mart's first store opened in 1962, the years used here cover by far the bulk of Wal-Mart's extraordinary growth. Therefore, little information is lost by not including the initial period.

Similar to Neumark et al. (2007), I gather annual retail establishment data from the U.S. Census Bureau's County Business Patterns (CBP).[7] Rather than use both the retail sector and the general merchandise subsector, I restrict my analysis to retail because this seems the most appropriate in terms of the model developed above, which focuses on the market of final sales to consumers. It also seems more appropriate in terms of inferring any similar implications for entry by other big box firms that almost exclusively sell to final consumers.

I next merge the CBP data with intercensal population estimates from the U.S. Census Bureau, and county-level per-capita income estimates from the Regional Economic Information System (REIS) provided by the U.S. Bureau of Economic Analysis (BEA).[8,9] Finally, I merge

[7] Downloaded from http://fisher.lib.virginia.edu/collections/stats/cbp/county.html
[8] Downloaded from http://www.census.gov/popest/archives/2000s/vintage_2001/CO-EST2001-12/CO-EST2001-12.html
[9] Downloaded from http://www.bea.gov/regional/docs/cd.cfm

these data with the opening dates and locations of Wal-Mart stores from 1962-2006.[10] After restricting the data set to 1977-1995 for reasons discussed in a later section, and excluding Alaska and Hawaii, the full sample includes 1,826 Wal-Mart locations in 1,337 of the 3,051 counties with unsuppressed CBP data. Table 1 provides the summary statistics for this data set:

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Population	77,999	256,915	379	9,064,197
Number of Retail Establishments per 100,000 residents	645.42	756.93	5.78	47,588.24
Per Capita Personal Income	16,780.45	3,907.01	5,487.10	61,705.80
Number of Wal-Mart Stores (for counties with stores)	1.31	.91	1	17

Methodology

I use the data just described to estimate three alternative specifications of the impact of Wal-Mart's entry on local retail establishments. The first specification uses a simple fixed effects model that controls for any time invariant unobserved characteristics across counties that may affect both the number of retail establishments within that county as well as Wal-Mart's decision to locate there. I then consider a partial adjustment model in which I include lags of the dependent variable as covariates in order to co 27 for the fact that small retail establishments may not immediately adjust to Wal-Mart's entry because of inertia and/or costs of adjusting. Finally, the third specification employs an Instrumental Variables model in which the potential endogeneity of the Wal-Mart location decision is addressed by using an instrument that should be free of any correlation with the regression error term. In principle, all three approaches could give consistent estimates. However, as explained briefly below, I believe that the IV approach provides the most meaningful results. I now 28 ss each model in turn.

Fixed Effects Transformation

[10] Downloaded from http://www.econ.umn.edu/~holmes/data/WalMart/index.html by: Thomas J. Holmes University of Minnesota, Federal Reserve Bank of Minneapolis, and NBER

The fixed effects estimator is a simple pooled regression relating the number of retail establishments per 100,000 people in county *j* in year *t* to a measure of personal income per capita in county i and year t plus some additional dummy variables to control for each year and, of course, the presence of Wal-Mart in the county.

$$EST-PC_{jt} = \alpha + \sum \delta_t Year_t + \gamma INC-PC_{jt} + \phi WalMart_{jt} + a_i + u_{it} \qquad (1)$$

where $EST\text{-}PC_{jt}$ is the number of retail establishment per 100,000 people; $Year_t$ is a year dummy; $INC\text{-}PC_{jt}$ is real personal income per 100,000 people; and $WalMart_{jt}$ is a binary variable that equals unity if at least one Wal-Mart is located in county *j* in year *t*. I use a binary variable because I think it is more consistent with the theoretical model presented earlier. In particular, local firms may not know where Wal-Mart will enter first but, once it does, all the evidence is that more Wal-Mart stores will follow. Thus, once one Wal-Mart store emerges in the county, local firms know that others will follow and they begin their exit in anticipation. To put it another way, there is little additional effect when further Wal-Mart stores are built because the impact of those additional stores was already ready factored into the exit decisions of local firms after the first Wal-Mart appeared. Hence, the binary variable I use should capture the ultimate effect of Wal-Mart's entry into a particular county. Note too that the fixed effects approach to capture the unobserved differences across counties implies that all of the variation identifying the effect of Wal-Mart entry comes from within-county differences.

Partial Adjustment Model

By construction of the following linear-dynamic model,

$$EST-PC_{jt} = \alpha + \beta EST-PC_{jt-1} + \sum \delta_t Year_t + \gamma INC-PC_{jt} + \phi WalMart_{jt} + a_i + u_{it} \qquad (2)$$

the unobserved panel-level effects are correlated with the lagged dependent variable, which causes the fixed effects estimator to be inconsistent. In order to arrive at a consistent estimator, I implement the Arellano-Bond estimation procedure in which the estimators are constructed by first-differencing to remove the county fixed effects and further lagged levels of the dependent variable are used as instruments. After testing for the lag length of the dependent variable, I find dynamic consistency in the above model requires that there be six lags of the dependent variable.

Instrumental Variable Regression

Despite the measures taken in the previous models to control for endogeneity issues, it may still be the case that such problems remains because, as noted by Neumark et al. (2007), it is likely that Wal-Mart location decisions are based on contemporaneous and future changes in factors that affect the number of retail establishments and per-capita personal income, as well as other unobserved factors in the time-variant error term. In particular, the same growth expectations that encourage the formation of local firms are also likely to attract Wal-Mart. This will then impart a downward bias on any negative effect Wal-Mart's presence might have on local firms Therefore, for the third specification I use an Instrumental Variable regression in order to correct for the endogeneity of Wal-Mart's location decisions. In implementing this empirical strategy, I follow closely the approach of Neumark et al. (2007) in using distance-time interactions as instruments for exposure to Wal-Mart stores, in which distance is the distance from Wal-Mart's corporate headquarters in Benton County, Arkansas. Specifically, I use latitude and longitude data for each county from the U.S. Census Bureau's Census 2000 Gazetteer Files, and create dummy variables for counties located in rings within a radius of 100 miles from Benton County, Arkansas, 101-200 miles, etc., out to the maximum of 1800 miles.[11] I then interact these dummies with time dummies to capture the geographic and time related pattern of Wal-Mart's expansion over the years of the sample. The sample is restricted to store openings before 1995 because, as Neumark et al (2007) argue, after 1995 Wal-Mart began saturating

[11] Downloaded from http://www.census.gov/tiger/tms/gazetteer/county2k.txt

counties where it had already located. They justify this instrument on the practical ground that it accurately captures the growth of Wal-Mart, which on a map looks something like a wave spreading out from a center located at Wal-Mart's origination in Benton County, Arkansas, to more distant regions as time passes. However, there is also substantial anecdotal evidence in Sam Walton's writings that suggest this evolution is very much the plan that Wal-Mart's management envisioned. While Basker (2007) argues that this approach is flawed, I believe that it does a good job of dealing with the potential endogeneity issues here.

The specified IV model that I estimate then include dummies for distance, time, and the distance-time interaction to generate a predicted first-stage value for $WalMart_{jt}$, and then employs that instrumented value as the Wal-Mart variable in the second-stage regression which is the same as Model (1) above. I will refer to this as model (3) when I present my results.

Results & Discussion

The results for the aforementioned models are presented here in Table 2. As noted by Basker (2005b), since models (1) and (2) do not correct for the endogeneity in Wal-Mart's entry decisions, the results from these models are difficult to interpret.

Table 2: Regression Results
Dependent Variable: Retail Establishments Per 100,000 People

Coefficient	Fixed Effects (1)	Partial Adjustment (2)	Instrumental Variables (3)
Wal-Mart	-48.724***	-46.218***	-106.040***
	(7.125)	(10.412)	(10.698)
L.Establishments		0.903***	
		(0.002)	
L2.Establishments		0.017**	
		(0.007)	
L3.Establishments		-0.098***	
		(0.007)	
L4.Establishments		0.053***	
		(0.007)	
L5.Establishments		0.005	
		(0.007)	
L6.Establishments		-0.582***	
		(0.022)	

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The interpretation of the coefficient estimate for model (1), ignoring the endogeneity of Wal-Mart's location decisions, is that Wal-Mart's entry leads to a 7.55% decline in the number of retail establishments, on average with all else constant. For model (2), the interpretation of the results is that Wal-Mart's entry leads to a 7.16% decline in the number of retail establishments in the short-run, and a 10.20% decline in the number of retail establishments in the long-run, *ceteris paribus*. As expected, the IV results correct for the downward bias on any negative effects of Wal-Mart's entry, and therefore suggest the greatest decline of 16.43% in the number of retail establishments, *ceteris paribus*. It is worthy to note that since I use a binary variable for Wal-Mart in order to account for its initial entry decision, rather than the number of Wal-Mart's in a county, it is feasible that the distance-time interaction may not actually break down as the markets become saturated. When I use data from 1977-206, the IV results suggest that Wal-Mart's entry leads to an approximately 25 percent decline in the number of retail establishments.

The most important finding of my empirical analysis is that all three of the methods produce similar results. Also, the IV results in particular provide evidence that Wal-Mart's entry has a moderate to strong significant economic impact on the number of retail establishments. This verifies the initial result of my spatial equilibrium model that a cost-advantaged, big box firm's entry into regional economy leads to a significant decline in the number of small entrepreneurial entrants. Further, since complete contestability is necessary for the most optimistic case in which local welfare is unaffected by big box entry, and since this seems unlikely in the real world, these results further suggest that big box entry will typically lead to a fall in local welfare with both local consumer and, especially, local producers worse off.

8. Conclusion

In this paper, I have examined the impact of entry into a local, product-differentiated market by an external big box or national franchise firm. The idea is to provide some theoretical guidance regarding the impact of entry of firms such as Wal-Mart or Home Depot on regional economies as a supplement to evidence from empirical studies such as Jia (2008) and Davis *et al* (2009). My work builds on the brand-stretching model of Norman, Pepall, and Richards (2008) and Richards and Sheng (2009).

I find that a comparison of local welfare prior to the big box firm's entry and after invariably shows that local welfare either declines or, at best, stays unchanged depending on the degree of market contestability. However, the distribution of local welfare is altered in favor of consumers. When the market is perfectly contestable, overall local welfare is unchanged by big box entry but consumers gain while local producers lose offsetting amounts. When the market is incontestable, both local consumers and local producers lose. Independent of local welfare, global welfare is always increased by big box entry.

When I relax the myopic assumption and assume that local firms anticipate big box entry, it is evident that, although the initial number of entrants is reduced to a more efficient level, the total local welfare decreases in comparison to the myopic case. Furthermore, the idea of redistributing the big box firm's profit seems infeasible given the large amount of its profits that would have to be taxed away since this would most likely deter the big box firm from entering the market to begin with. Therefore, if there is reason to believe that local retail markets are incontestable, it is reasonable to believe that the second-best policy may be to ban big box entry. In future research, I will consider this policy issue under the contestable market case.

In an empirical analysis that verifies my underlying spatial equilibrium model, I was able to loosely replicate the overall findings of Stone (1995), Jia (2008), and Davis *et al* (2009) in proving that Wal-Mart's entry has a definite negative economic impact on the number of local retail establishments. This adds to the case for county business regulators to ban big box firms from entering into local markets. In order to provide further evidence for this policy decision, I plan to continue empirical research on this topic to analyze the effects of Wal-Mart's entry on other economic indicators, such as employment, poverty, and crime at the county level.

9. Appendix

Big Box Location Choice in a Contestable Market

1) Suppose $\alpha = 1$:

The big box firm would choose to locate in-between so long as $\pi_{in\text{-}between} \geq F = rM/2(n^e)^2$.

For $\alpha = 1$, $\pi_{\text{in-between}} = r/16(n^e)^2$, which is less than F, thus the big box would not enter the market.

2) Suppose α is such that if the big box firm locates in-between, it can sell to only the customers up to and including those located at the same-spot as its two nearest competitors: $\alpha = 1 - r/2n^e c$

If the big box firm locates in-between with this cost advantage,

$$\pi_{\text{in-between}} = (1-\alpha)c/2n^e + r/4(n^e)^2$$

If the big box firm locates same-spot with this cost advantage,

$$\pi_{\text{same-spot}} = (1-\alpha)c/n^e + (1-\alpha)c^2/2r$$

3) Suppose α is such that if the big box firm locates in-between, it can undercut its two nearest competitors to drive them out of the market, and can reach a fraction of the next two nearest competitors' customers: $1 - 3r/2n^ec \leq \alpha \leq 1 - r/2n^ec$

$$\pi_{\text{in-between}} = (1\text{-}\alpha)c[3/2n^e + (1\text{-}\alpha)c/2r] - 3r/8(n^e)^2$$

4) Suppose α is such that if the big box firm locates same-spot, it can undercut its two nearest competitors to drive them out of the market, and can reach a fraction of the next two nearest competitors: $1 - 2r/n^ec \leq \alpha \leq 1 - r/n^ec$

$$\pi_{\text{same-spot}} = 2(1\text{-}\alpha)c/n^e - r/(n^e)^2 + (1\text{-}\alpha)c^2/2r$$

Optimizing the location decision using profit information based on values of α in scenarios 2-4 above results in the following decision process for the big box firm:

It is profitable for the big box firm to enter so long as $\alpha \leq 1 - \mathrm{r}/2n^ec$, and:

Locate in-between if: $1 - 3r/4n^ec < \alpha < 1 - r/2n^ec$

Locate same-spot if: $1 - r/n^ec < \alpha < 1 - 3r/4n^ec$

Locate in-between if: $1 - 5r/4n^ec < \alpha < 1 - r/n^ec$

Location same-spot if: $1 - 3r/2n^ec < \alpha < 1 - 5r/4n^ec$

This trend continues for smaller rangers of α, proving that the big box firm's location decision predictably alternates between same-spot and in-between. This information will assist me in subsequent research where I will assume the entrepreneurial firms have foresight about the big box firm's entry into the local market. For now, this suffices to show that the main welfare result of this paper is the same whatever firm *B*'s entry location.

Local Consumer Surplus Derivation for Consumers Served By Firm B

Suppose firm *B* knocks out *j* firms to its right, so that its nearest competitor is now located at a distance of $(j+1)/n^e$ from its base location. The minimum price that firm *B* will be willing to charge will equal the cost that firm *B* incurs to serve its furthest customer located at a distance of $(2j+1)/2n^e$. This is given by $p_{min} = \bar{\alpha} c + (2j+1)r/2n^e$. If we express this in terms of the maximum price that firm *B's* nearest competitor can charge, it can be written as $p_{min} = c + r/2n^e$. The maximum price that firm *B* will charge a customer will be the minimum of the cost that its nearest competitor must incur to serve a consumer located at firm *B's* base location, and the consumer's reservation price *V,* such that $p_{max} = min\{c + (j+1)r/n^e, V\}$. We can rewrite the first term such that $p_{max} = min\{c + [(1-n^s/n^e)/2 + 1/2n^e]r, V\}$. I came to this simplification by recognizing that the distance $(j+1)/n^e$ equals half of the market share of the big box firm plus half of the nearest competitor's market share. Here an assumption will have to be made about the value of *V* in order to guarantee complete market coverage for the big box firm in the event that there are no survivors in the second stage of the game. I will assume that all consumers have the same reservation price, and that the condition $V > \bar{\alpha} c + r/2$ is satisfied. This means that the reservation price must be greater than the cost for firm *B* to serve half of the market in either direction. Using the previous assumptions for $\bar{\alpha}$, *c,* and *r,* it is trivial to show that V > 1.40 to ensure complete market coverage. In the event that there is one surviving local producer, the maximum cost that this competitor incurs to serve a consumer located at firm *B*'s base location given my previous assumptions for $\bar{\alpha}$, *c,* and *r* will equal 1.50, which is greater than the reservation price. In order to avoid this situation so as to not complicate the analysis of local consumer surplus for customers buying from firm *B*, I will assume that V = 1.50. This will ensure complete market coverage, and it will make it so that $p_{max} = min\{c + [(1-n^s/n^e)/2 + 1/2n^e]r, V\}$ always reduces to $p_{max} = c + [(1-n^s/n^e)/2 + 1/2n^e]r$. I can now express the average price per unit that firm *B* charges in the incontestable case as $\bar{p} = c + r[(n^e - n^s + 2)/4n^e]$. The total consumer surplus for the consumers being served by firm *B* can be written as $CS_{2,BigBox} = M(1-n^s/n^e)[V - [c + [(n^e - n^s + 2)/4n^e]r]]$, where $(1-n^s/n^e)$ is the proportion of the market being served by the big box firm.

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