Can It Be Economically Rational to Restrict Big Box Retailers?

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Abstract

The conventional wisdom among "free market" economists is that moves to ban "big box" retailers such as Walmart from certain localities flout consumer sovereignty and must hurt consumer welfare. After all, if consumers did not want to shop at the big box retailer, they would simply not do so, correct? The fact that they switch their shopping to the big box and away from "mom-and-pop" stores shows they prefer the big box.

This paper attempts to show that the above analysis is simplistic. We present a model in which all consumers have the following preference ordering in some retail sector:

1. Have both local shops and a big box store.
2. Have only local shops.
3. Have only a big box store.

We demonstrate that, under not outrageous assumptions, consumers, despite preferring 1, can easily “achieve” 3, due to both collective action and knowledge problems.

Keywords: consumer sovereignty, big box retailer, constitutional restraints

Introduction

The conventional wisdom among free-market economists is that moves to ban "big box" retailers such as Walmart from certain localities flout consumer sovereignty and must hurt consumer welfare. After all, if consumers did not want to shop at the big box retailer, they would simply not do so, this line of reasoning goes. The fact that they switch their shopping to the big box and away from "mom-and-pop" stores shows they prefer the big box.

This paper attempts to show that the above analysis is simplistic. We present a model in which all consumers have the following preference ordering in some retail sector:

1. Have both local shops and a big box store.
2. Have only local shops.
3. Have only a big box store.

(We can further assume they know the costs of achieving 1, 2, or 3: they prefer option 1 or 2 even if they sometimes pay higher prices to achieve them compared to 3, i.e., we could add a monthly shopping bill to each of the above.)

Theoretical Considerations

Even with the preference ordering given above, the model we have created demonstrates that, under not outrageous assumptions, it is possible for consumers, in trying to achieve their first preference, to instead wind up with their third. This is due to consumers facing a collective action problem, as well as a knowledge problem: Consumers might, if they had perfect knowledge of the exit points of the local shops and the ability to finely coordinate their own shopping with that of others, achieve their first preference (a mix of big box and mom-and-pop shopping available). But, in general, consumers have little knowledge of what percentage reduction in sales will cause a small shop to exit the industry, nor do they have very much ability to coordinate their shopping with other consumers. (The latter means that even if consumers forego a certain amount of shopping at the big box stores, which they would otherwise do, simply to keep the small stores solvent, they cannot ensure their neighbors will do the same. Therefore, their rational choice is to "defect" and shop at the big box store as often as they wish, regardless of the impact on the small shops.)

Therefore, since they cannot fine tune their shopping to achieve 1), they shop at the big box store whenever it suits them for any particular purchase, without regards to the "macro" effects of their choices. (See Schelling, 2006, for extensive analysis of the potential gap between micromotives and macrobeahvior.) They shift "too much" of their shopping to the big box, with the result that all of the mom-and-pops are driven out of business, despite no consumer wanting that outcome. Thus, it *might* make sense, faced with such knowledge and game theoretic difficulties, for consumers to bind themselves in advance to 2), by banning one, or some, or all, big box stores, or to trying to achieve 1) by, say, forcing big box retailers to locate well outside the center of town, making trips to them less convenient. (All legislation has unintended consequences, which is why we make only the weak claim that these types of actions *might* make sense: such legislation might also, for instance, serve the interest of an inefficient local monopolist seeking to protect its privileged position in a market.)

Predatory Pricing

We further suggest that our model may actually capture the mechanism underlying the intuition of the existence of "predatory pricing." As has often been noted, the idea that big box stores engage in predatory pricing to drive out small competitors and then jack up the prices to achieve high profits has an obvious problem: once the prices charged by the big box stores have been raised, why don't the small competitors simply reenter the market? (See, for instance, DiLorenzo, 1992.)

Our model avoids this pitfall: the big box stores do not need to set prices artificially low for a time: they can rely on their greater financial resources to ride out the period during which *all* stores will be losing money, and once their smaller competitors have exited, they can keep their prices right where they were, and now be profitable. And new smaller competitors will not enter the market, since that would merely reestablish the situation in which all stores are losing money. Furthermore, our model has the advantage that we need not posit any vicious intent on the part of big-box retailers: they need not be *intending* to drive small retailers out of business. They just know that in a year or so, their new outlet will be making plenty of money.

We note here that what we are describing, in suggesting the possibility that some restriction on big-box retailing might be rational, is an example of the general class of "constitutional constraints" described by Jon Elster in *Ulysses Unbound* (2000): we want to listen to the Sirens, but we know that if we do not tie ourselves to the mast in advance, we will not merely listen, but fall prey to their sweet song. Or, to consider more mundane circumstances, by the sober light of day, we realize that we do not want to find ourselves in a bar at 4:00 AM, but we also recognize that in the bar at 1:00 AM, we will not be thinking so clearly. So we mandate a bar closing time earlier than 4:00 AM. Similarly, we don't want our own speech suppressed, but recognize that in power we might give in to the temptation to suppress speech we don't like, and that others in power might do so to us. So we pass the first amendment to the U.S. Constitution.

Consumer Utility

In our model consumers generally gain the most utility from shopping at mom-and-pop stores, although this is only probabilistically true. (This variation is intended to account for occasions when a big box store is favored due to opening hours, low prices, special deals, and so on.) To account for both this preference and its variability, for the k^{th} consumer, the utility gained from shopping at a mom-and-pop is a positive constant plus some random factor:

$U_k = (p_M + r_{kM}[0,1])$[1]

Consumers gain utility from shopping at the big-box store as well. Thus, the consumer's overall utility gain is:

$U_k = \max\{(p_{kM} + r_{kM}[0,1]), r_{kB}[0,1]\}$

The overall utility in the market is expressed as the sum of these utilities over the population:

$\Sigma_k U_k$

To rephrase our assumptions: consumers gain the most utility when both mom-and-pops and big-boxes are around, they do second best when they have available only mom-and-pops, and worst when they have only big-boxes. But it turns out that even in cases of high preference for mom-and-pop store, the consumers' least preferred outcome can arise.

We give the expected utility in the three periods of our model.

(1) When there are big-boxes as well as mom-and-pops, $E((\Sigma_i U_i)) = E (\Sigma_i (\max \{ p_M + r_{iM}[0,1], r_{iB}[0,1] \})) = \Sigma_i E \max \{ p_M + r_{iM}[0,1], r_{iB}[0,1] \} = N((2/3) + (1/2)p_M+(1/2)p_M\text{^}2-(1/6)p_M\text{^}3)$.

[1] The variables pM and rM[0,1] are between 0 and 1 inclusive. pM is consumer preference for mom-and-pops, and rX is a random number. We abbreviate "mom-and-pop" by M and "big-box" by B. The sub-script indicates the variable belongs to the type of retailer.

(2) When there are only mom-and-pops, $E(\Sigma_i U_i) = E (\Sigma_i (p_M + r_{iM}[0,1])) = (\Sigma_i (E\, p_M + E\, r_{iM}[0,1])) = (\Sigma_i (p_M + 0.5)) = N(p_M + 0.5)$ by linearity.

(3) When there are only big-boxes, $E (\Sigma_i U_i) = E (\Sigma_i r_{iB}[0,1]) = (\Sigma_i E\, r_{iB}[0,1]) = N(0.5)$

We note that for preferences in [0,1], the expected value in (1) is greater than that of (2) which in turn is greater than that of (3).

Results

The following table shows the results for models where consumer "added" utility for mom-and-pops is 0.2, 0.4, 0.6, and 0.8 respectively. All other variables beside preference are held constant.[2] For each preference level, we ran seventy-five runs of seventy-five periods each. Note that in all experiments the big-box store appears in period 20.

In each experiment we give the expected utilities for (1) having only mom-and-pops, (2) having both kinds of store, and (3) having only big-box stores.

In the experiments where added utility from mom-and-pops is 0.2, 0.4, and 0.6, mom-and-pops tend to vanish leaving the result where consumers end up with the situation of least utility.

Average Consumer Utility Gained per Period				
	0.2	**0.4**	**0.6**	**0.8**
Mom-and-Pop only	3.64	4.68	5.72	6.76
MP & BB both	4.08	4.87	5.78	6.77
Big-Box only	2.60	2.60	2.6	2.6

[2] There were 26 consumers, 5 mom-and-pop stores, each of which had an initial endowment of $30, gained $2 per purchase, and lost $10 per step. The big-box appeared on period 20. It had an initial endowment 1000 times that of the big-box-store, and it paid five times the rent.

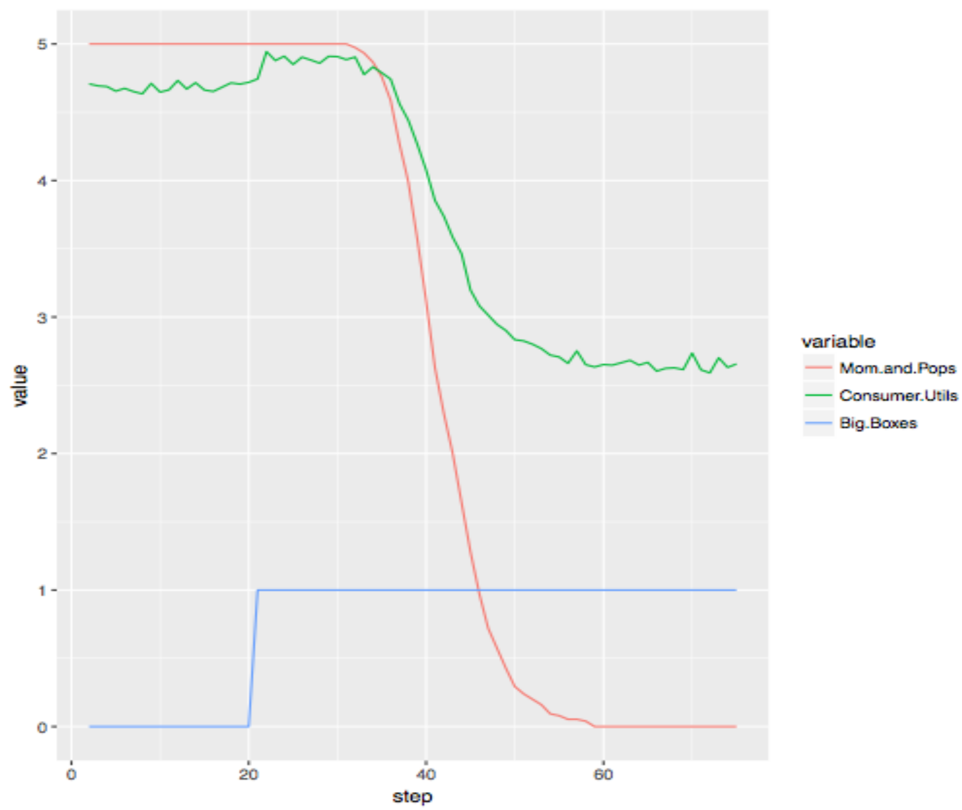

Figure 1: Results for preference .4

As you can see in Figure 1, consumer utility is at its highest when shopping can be split between both small and large retailers. Nevertheless, soon after the entry of the big-box retailer, the mom-and-pop shops are driven from the market, and consumer utility drops significantly.

Model Design

We created a model populated by two basic types of agents: consumers (C), and retailers (R). Retailers are further classed as mom-and-pops (M) or big-boxes (B). The mom-and-pops each supply a specific type of good, such as hardware or groceries. The big-boxes provide every sort of good. At first the environment is occupied by only Ms and Cs. Each supplies something the other needs: the consumers supply money to the mom-and-pop stores, and they supply goods to the consumers. Rs receive a periodic endowment of goods "from heaven" (which is a parameter), while Cs receive their money in a similar fashion. Cs shop in turn at each stores selling each type of good they need. If Rs run out of money, they disappear. Without big box competitors, we discover an equilibrium can exist so that a certain number of Ms can remain in business.

At a certain point in the running of our model (which is also a parameter), the Bs appear. They have a much larger initial endowment of money then do the Ms. The Cs want to shop at both types of retailer (how much they like each is again a parameter), and split their acquisition of goods (according to that parameter) between the two types of retailers. (In order to illustrate the thesis of our paper, that consumer behavior may thwart consumer preferences, we have run our model with consumers preferring the mom-and-pops by as much as four-to-one, and have still gotten a result where the small shops disappear.) This split may cause the funds of both types of agents to dwindle. But as the Bs have a much greater initial endowment, they are able to survive this period of coexistence, while the Ms gradually disappear. We are left with an environment of only Bs and Cs, which the Cs did *not* want. Thus, given simple but not outrageous assumptions, our model shows our story above is plausible: it has what Weber would call "explanatory adequacy." Empirical work would be necessary to decide whether it has Weberian "causal adequacy." (See Callahan and Horwitz, 2010, for a brief description of the difference between the two concepts in Weber.)

Model Implementation

The Indra System

Indra is an agent based modeling (ABM) framework built in Python. Our model relies on the Indra framework, and so it would be valuable to review its architecture. Indra includes the following capabilities:

- Looping over agents randomly, in order, in reverse order, or by type.
- Automatic generation of line graphs and scatter plots.
- The ability to enter model parameters interactively, from the command line, or from a file.
- The ability to save parameters sets.
- The ability to dump the state of the system to a JSON file.
- A built-in, extensible interactive menu.
- Automatic creation of network graphs showing the relationship among objects in the system.
- Extensible Markov-matrix capabilities for easily specified, probabilistic behavior on the part of agents.
- A flexible spatial environment model that allows the composition of agent views of the environment of any desired shape, easing the creation of models exploring limited, local agent knowledge.
- In-line debugging capabilities, allowing, e.g., display of an agent's attributes at any point during the run of a model.
- The ability to step through a model to watch it develop in real time.

Implementing the Big Box Model in Indra

Let us look, first, at the behavior of consumers, and then, briefly, at the simpler behavior of retailers.

When a **consumer** acts, he surveys the world around him, evaluates his world on the basis of this survey, and he responds according to his evaluation. Therefore, we call these methods `survey_env`, `eval_env`, and `respond_to_cond`.

```
def act(self):
    env_vars = self.survey_env()
    eval_vars = self.eval_env(env_vars)
    if eval_vars:
        self.respond_to_cond(eval_vars)
```

The way the consumer surveys his environment goes like this: he finds all the stores he can view (a view which happens to be the whole environment this model) and he only selects the stores that sell the good he currently wants.

```
def survey_env(self):
   view = self.env.get_square_view(
              center=self.pos,
              distance=math.sqrt(
                  self.env.width**2 +
                  self.env.height**2))
           sellers = []
           sellers.extend(self.neighbor_iter(view=view,
                                             filt_func=lambda x:
                                             x.sells(self.goal)))
```

```
        return sellers
```

Here is how a Consumer decides where to go shopping:

```
def eval_env(self, sellers):
        """
        The Consumer determines who, of those
        who sell the good he desires,
        he will buy from.
        Args:
            sellers: a list of stores
        Returns:
            a store selling that good
        """
        top_seller = None
        max_util = 0.0
        for seller in sellers:
            this_util = seller.utils_from_good(self.goal)
            if this_util > max_util:
                max_util = this_util
                top_seller = seller
        self.last_utils = max_util
        return top_seller
```

After choosing where to go, he goes there and buys his long sought after good.

```
    def respond_to_cond(self, store):
        if store is not None:
            self.move(store)
            store.purchase(self.allowance)
```

After this action, the consumer now decides his goal is to acquire a new good. This goal is to be acted out during the next cycle of interactions.

```
def postact(self):
    """
        We cycle through the goods the agent might want
        turn-by-turn.
    """
    self.goal = (self.goal + 1) % NUM_GOODS
```

The **retailer**'s action is much simpler. It merely pays its bills. If its funds go below zero, it goes bankrupt, and it disappears from the environment never to reappear.

```
def act(self):
    self.pay_bills(self.rent)
    if(self.funds <= 0):
        self.declare_bankruptcy()
```

Conclusion

Our goal in this paper was simply to show that the typical argument from “free-market” economists, that if consumers prefer smaller shops to big-box retailers, they will get their preference, is simplistic. As big-box retailers, with the resources of large corporations backing a store, can endure losses for far longer than can a sole proprietorship, and so can last through a period where all retailers are suffering losses. We have shown, using a simple model containing no outrageous assumptions, that consumers can easily wind up with their least preferred mix of retailers.

We do not pretend to have demonstrated that this is what happens, either always or even usually: to demonstrate either of those contentions will require extensive empirical work. Nevertheless, we feel that simply showing that the frequent response by economists to efforts to restrict big-box retailers is theoretically unsound is itself a worthwhile achievement.

Appendix: Source Code

- Big Box Model
- Big Box Run

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