Horizontal Mergers With Free-Entry: Why Cost Efficiencies May Be a Weak Defense and Asset Sales a Poor Remedy

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Abstract

I analyze the effects of a merger between two firms in a spatially differentiated oligopoly. I make the crucial assumption that the industry is at a free-entry equilibrium both before *and* after the merger. I show that cost efficiencies (in the form of lower marginal cost) decrease the likelihood of entry, and thus benefit consumers less than if entry conditions were exogenously given. Likewise, by selling assets (stores) to potential rivals, merging firms effectively "buy them off,' that is, dissuade them from opening new stores, an effect that may be detrimental to consumers.

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JEL Code Nos.: L1, L4.

1 Introduction

On September 1996, Staples and Office Depot, the two largest office supplies superstores (OSS) in the U.S., announced their agreement to merge. The Federal Trade Commission voted 4-1 to oppose the merger on the grounds that it would likely lead to substantially higher prices. In fact, an econometric study commissioned by the FTC showed that prices are higher in markets where only one firm operates than in markets with two- or three-way competition. Addressing the FTC's concerns, Staples / Office Depot offered to sell a series of stores to rival OfficeMax, but the FTC maintained its opposition to the merger.

Although the merging parties contested the FTC's challenge, the courts eventually ruled in favor of the FTC. Judge Thomas Hogan, the federal district court judge who decided the case, dismissed the defendants' argument that cost efficiencies would be significant and passed on to consumers. Moreover, entry was considered irrelevant as the cost of setting up a new OSS chain "would be extremely high."[1] Surprisingly, little importance was given to the issue of the impact of the merger on OfficeMax's expansion rate, even though the parties seemed to agree that the cost of opening a new store is reasonably low and certain. The defendants did argue that OfficeMax's growth in 1997 demonstrates the ease of expansion by existing leaders. However, Staples and Office Depot failed to show how the rate of expansion relates to the event of the merger.[2]

[1] FTC v. Staples and Office Depot, Judge T. Hogan's Redacted Memorandum Opinion, June 30, 1997.

[2] For an analysis of the Staples/Office Depot merger proposal, see Baker (1998).

The 1992 U.S. Merger Guidelines accept that, "in markets where entry is ... easy, ... the merger raises no antitrust concern and ordinarily requires no further analysis" (point 3.0). However, the quantitative analysis of entry conditions is frequently absent from actual merger policy: It is difficult to identify potential entrants and the height of entry barriers, whereas other indicators — such as market shares and concentration indices — are more readily obtained.[3] By contrast, cost efficiencies are relatively easier to quantify—and are a frequent argument in favor of mergers; moreover, asset sales such as the one proposed by Staples/Office Depot are frequently offered or requested as a partial remedy for the adverse effects of the merger.

Notwithstanding the general difficulties in taking entry into account in merger analysis, there are cases where both the set of potential entrants and the costs of entry seem easy to determine. Consider again the OSS industry. Although the costs of creating a new firm would be very high, it would certainly be possible for the non-merging party (OfficeMax) to expand into markets dominated by the would-be Staples/Depot alliance.

In this paper, I analyze the impact of a merger between two multi-location (or multi-product) firms, taking into account the possibility of entry by rival firms, that is, the possibility that rival firms will open new locations (or create new products) as a result of the merger. Specifically, I assume that the industry

[3]White (1987) argues that, in this sense,

> the [DOJ] Guidelines might justly be accused of reversing the order of importance of and quantitative attention paid to [entry conditions, thus being] likened to the drunk who, though he thinks he probably lost his keys in the middle of the road, spends most of his time looking for them on the sidewalk "because the light is better there."

is at a "free-entry" equilibrium both before and after the merger takes place, where "free-entry" refers to the creation of new locations/products.

Not surprisingly, the analysis reveals that the possibility of entry improves the effect of the merger on consumer welfare. For parameter values that roughly calibrate the Staples / Office Depot case, I show that, in markets that start with a two-store duopoly, the price increase resulting from the merger is one- to two-thirds lower than what it would be were entry never to take place.[4]

More importantly, I show that post-merger entry dramatically shifts the perspective on cost efficiencies as a merger defense and asset sales as a remedy. The efficiencies defense is that mergers imply a decrease in marginal cost, part of which is passed on to consumers in the form of lower prices. But a more efficient merged firm also implies that entry is less likely, as potential entrants would be facing tougher price competition. The benefit that consumers receive from cost efficiencies is therefore lower than the benefit they would receive if entry conditions were not exogenous.

A similar phenomenon occurs with respect to asset sales. Asset sales are frequently sought as a remedy for the increased market power resulting from a merger. I show that asset sales and post-merger entry are "substitutes." By selling stores to potential rivals, merging firms may effectively buy them off, that is, dissuade them from opening new stores.[5] This is good for the

[4]In a recent, related paper, Werden and Froeb (1998) argue that "when sunk costs associated with entry are at levels suggested by prevailing market structure, the opportunity for entry created by an anticompetitive merger plausibly is too small to induce entry, even absent Stiglerian 'barriers to entry.'" My conclusions differ from theirs. One important difference between our models is that Werden and Froeb use a logit model of product differentiation (with little or no neighborhood effects), whereas I use a Salop-type model (with strong neighborhood effects). More on this in Section 4.

[5]There is an interesting contrast between this situation and Rasmusen's (1988) model of entry for buyout. In the latter, the possibility of asset acquisitions by the incumbent

merging firms but bad for consumers: the latter prefer an asymmetric duopoly with more stores (no asset sales but nevertheless entry by the rival firm) to a symmetric duopoly with fewer stores (asset sales).

Previous literature has explicitly considered the equilibrium adjustment following a merger (Farrell and Shapiro, 1990). However, entry is typically not taken into account in this research. An exception is given by Werden and Froeb (1998), who nevertheless do not address the issues of cost efficiencies and asset sales.

The paper is structured is follows. In the next section, I present the model and the main results. In Section 3, I calibrate the model with data from the Staples case. Section 4 concludes the paper.

2 Model and results

Consider an industry where three firms own a series of stores each and compete in a given set of markets.[6] Initially, the industry is at a free-entry equilibrium, in the sense that no firm would wish to open an additional store in any of the markets. Suppose now that Firms 1 and 2 merge, turning the industry into a duopoly. What will the new free-entry equilibrium look like?[7]

I assume that the various markets are separated and will focus attention in one particular market. Echoing the concerns of several recent merger cases, my particular focus is on markets that initially comprise only Firm 1 and Firm

induces entry. In the former, the possibility of asset sales by the incumbent prevents entry.

[6]Throughout the paper, I will describe the model as one of spatial competition. As usual, an alternative interpretation is that of multiproduct firms competing in product differentiation spaces.

[7]Although there is free entry in terms of store openings by the incumbent firms, I assume the barriers to entry by a new firm are very high. That is, all entry is accounted for by stores opened by one of the three incumbent firms.

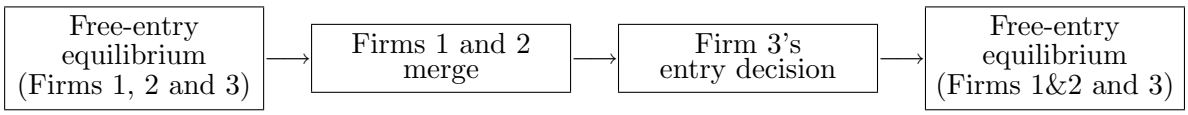

Figure 1: Timing of the model.

2 stores, so that, absent additional adjustments, the merger would lead to a local monopoly. Specifically, I consider a market where the merging firms own one store each in the initial free-entry equilibrium. What is the impact of the merger in such a market?

Absent any additional entry, we would go from a duopoly of one-store firms to a monopoly with two stores. The merger would naturally imply higher prices, to the detriment of consumers. However, less aggressive behavior by the newly-formed Firm 1&2 is likely to induce entry by Firm 3, which implies an increase in consumer welfare, both in terms of lower prices and greater product variety. The purpose of this paper is to evaluate the importance of this effect on expected consumer welfare.

I assume each market is characterized by the Salop model of product differentiation.[8] There exists a population of s consumers uniformly distributed along a circle of unit length. Firms have stores located along the circle. Each consumer is willing to pay up to v for one unit of the firms' product and chooses the firm offering the lowest total cost, where total cost is given by price plus transportation cost. The latter is equal to $t\,d^2$, where d is the distance between the consumer's and the firm's locations.[9] If total cost is greater

[8]Alternative approaches to mergers in differentiated industries include Deneckere and Davidson (1985), Levy and Reitzes (1992), Werden and Froeb (1994).

[9]The original Salop (1979) paper considered linear transportation costs. Following d'Aspremont et al. (1979), I assume quadratic transportation costs, which simplifies the problem of equilibrium existence (equilibrium in pure strategies does not always exist with linear transportation costs).

than valuation, then the consumer makes no purchase. Firms must incur a sunk cost of k per location and a constant marginal cost of production c.

I assume the value of v is such that, when there is competition, the entire market is covered. It can be shown that this amounts to

Assumption 1 $v > c + \frac{5}{16}t$.

For a given set of parameter values, there typically exist multiple initial free-entry equilibria. I consider the equilibrium that would result from the following sequential entry game: at stage 1, Firm 1 decides whether to open a store and where to locate it. At stage 2, Firm 2 does the same; then Firm 3; then Firm 1 has the option of opening a second store; and so forth.[10] In the case when only Firms 1 and 2 open one store, the equilibrium configuration is for Firm 1 to open a store at zero and Firm 2 at $\frac{1}{2}$.[11] I assume that the values of k, c, v, d are such that this is the initial equilibrium and address the question of the impact of the merger between Firms 1 and 2.

Following the merger between Firms 1 and 2, there will typically exist multiple free-entry equilibria. I will assume that the new equilibrium results from entry by Firm 3 only. This assumption seems consistent with the observation that merging firms spend more resources restructuring than expanding. It also pins down a unique post-merger equilibrium.[12]

The assumption that we start from a free-entry equilibrium with only Firms

[10] I consider an exogenously given entry order. For the case of endogenously determined entry times, see Anderson and Engers (2001).

[11] This is equilibrium is unique up to a rotation along the circle.

[12] The model could be extended by considering entry deterring strategies by the merging firms. In this respect, see Schmalensee (1978), Salop (1979), Judd (1985), Bonanno (1987). Other than the possibility of asset sales (see below), I will not consider any of these preemption strategies.

1 and 2 implies particular parameter values, specifically particular values of market size given k, c and v. Likewise, which new equilibrium takes place following the merger of Firms 1 and 2 depends on the values of k, c, v and s. Table 1 depicts the critical values of s for each equilibrium configuration. The middle column shows the critical value of equilibrium profits for the "marginal firm" according to each equilibrium configuration. For example, in the first row we have $\pi_1 = \frac{4}{9}\sqrt{\frac{3(v-c)^3}{t}}\, s - k$. This is the profit that a monopolist with one store would earn. Equating to zero and solving with respect to s we get the critical value s_0 shown on the third column. We conclude that, if $s < s_0$, then no firm will enter in equilibrium.

Suppose now that there are two firms in the market, each with one store. Store locations are $l_1 = 0$ and $l_2 = 1/2$, as indicated in the second row of Table 1 (first column). Equilibrium profits per firm are given by $\pi_2 = \frac{1}{8}\, s\, t - k$ (second column). Equating to zero and solving with respect to s, we get $s_1 = 8\,\frac{k}{t}$ (third column). We conclude that, if $s_0 < s < s_1$, the initial equilibrium is one store only, whereas $s > s_1$ implies two or more stores.

Would a third firm want to enter in the initial situation? In order to address this question, we compute Firm 3's equilibrium profits if it were to open a store at $l_3 = 1/4$ (the best location possible). This is given in the third row of Table 1 (second column): $\pi_3 = \frac{121}{4096}\, s\, t - k$. Equating to zero and solving for s we get $s = s_3 = \frac{4096}{121}\,\frac{k}{t}$. It follows that, if $s_1 < s < s_3$, the initial equilibrium consists of a duopoly of one-store firms.

Suppose that this is the case ($s_1 < s < s_3$) and that Firms 1 and 2 merge. What is the new free entry equilibrium? Given that Firm 1&2 will now price

less aggressively, it is possible that Firm 3 want to enter when it didn't before.[13] In order to answer this question, we compute Firm 3's equilibrium profits when it competes against a two-store Firm 1&2. This is done in the fourth row of Table 1. Firm 3's equilibrium profits are given by $\pi_3 = \frac{25}{576}\, s\, t - k$ (second column). Equating to zero, we get $s = s_2 = \frac{576}{25}\, \frac{k}{t}$. If follows that, if $s > s_2$, then the merger between Firms 1 and 2 induces the entry of Firm 3.

From a consumer welfare point of view, it makes a big difference whether s is greater or less than s_2. In cities of relatively smaller size, the effect of the merger is simply to increase prices; the number of stores and their locations remain the same. In cities of relatively larger size, however, the merger brings in new competition. Consumers then benefit from greater price competition as well as a greater number of stores (lower transportation costs). This is confirmed in Table 2, which displays the average equilibrium price, transportation cost, and total cost (the negative of consumer welfare) in the three cases considered above: pre-merger, post-merger with no entry, and post merger with entry. Notice that $\frac{13}{48} \approx .271 > \frac{167}{1152} \approx .145$. Moreover, $\frac{1}{4} > \frac{148}{1152} \approx .129$. Finally, Assumption 1 implies that $v - \frac{2}{48}\, t > c + \frac{13}{48}\, t$. We conclude that

Proposition 1 *If $s_1 < s < s_2$, then a merger between Firm 1 and Firm 2 leads to no additional entry; prices increase and consumer welfare decreases. If $s_2 < s < s_3$, then a merger between Firm 1 and Firm 2 leads to entry by Firm 3; average price and average transportation costs decrease, and so consumer welfare increases.*

[13] I assume that it is not possible for the merged firm to commit to price competitively.

■ **Cost savings.** To a greater or lesser extent, cost efficiencies are commonly invoked as a merger defense. For example, in preparation for the Exxon-Mobil merger, it is reported that "the companies are working to show cost savings that will result from the merger" (*The Wall Street Journal Europe*, January 20, 1999). Cost savings also played an important role in Staples' defense of its proposed merger with Office Depot. The general argument is that, because of increased efficiency, consumers will benefit from a merger insofar as cost savings are passed on to buyers in the form of lower prices. This is particularly the case when savings are in terms of marginal cost. When entry is endogenous, however, we must also take into account the indirect effect of the merger. And this may reduce (or even reverse) the effect of cost efficiencies on consumer welfare.

What is the effect of cost efficiencies on consumer welfare? From Table 2, we see that, when the merger results in a monopoly, price is a function of v but not of c; that is, no cost savings are passed on to consumers. In the case of duopoly, however, prices are a function of c, and cost savings translate into lower prices and greater consumer welfare. Finally, cost savings by the merged Firm 1&2 have another important effect: Firm 3's equilibrium profit in case it enters the market is lower. This implies that the threshold market size s_2 is greater when the cost efficiencies are greater. We thus have two opposing effects of cost efficiencies on consumer welfare. On the one hand, equilibrium prices are lower (in case of duopoly); on the other hand, the probability of entry is lower: for some values of s, entry will not take place if there are cost efficiencies whereas it would otherwise. That is, the greater cost efficiencies

may have a negative effect on expected consumer welfare, where "expected" means "over a distribution of values of s."

If the value of v is very high, then the difference in consumer welfare between post-merger monopoly and duopoly is also very high. The negative effect of cost efficiencies then dominates the positive effect, to the point that expected post-merger consumer welfare is decreasing in the extent of the merger's cost efficiencies:

Proposition 2 *The greater the merger's cost savings, the lower the probability of post-merger entry. If v is high enough, then the greater the merger's cost savings the lower the expected post-merger consumer welfare.*

This result should *not* be taken to imply that the merging firms should use low cost savings as a merger defense. In fact, the only case when the drastic prediction of Proposition 2 applies is the case when v is very high. But in this case, the impact of the merger is likely to be quite negative in terms of consumer surplus. The general point to retain is that the positive impact of marginal cost efficiencies is lower when endogenous entry is taken into account.

■ **Asset sales.** Merger authorities often demand that would-be merging firms divest from some of their assets as a condition for approving the merger. For example, Exxon and Mobil had a high combined market share in several northeastern U.S. metropolitan areas (e.g., 24% of the stations in northern New Jersey). It was reported that the companies "may be forced to sell or sever contracts for more than 1,000 gas stations ... as a condition for U.S. approval of their $75 billion merger" (*The Wall Street Journal Europe*, January

20, 1999). Another example from the same industry was given by the merger between BP and Amoco, who were "expected to divest themselves of more than a hundred gasoline stations and sever ties with several hundred more in at least half a dozen U.S. states to gain U.S. Federal Trade Commission approval for their merger" (*The Wall Street Journal Europe*, December 30, 1998). Similar examples may be found in the European Union. In 1992, the European Commission allowed the takeover of Perrier by Nestlé once the latter committed to selling various of its well known brands, including Vichy, Thonon, Pierval and Saint Yorre (cf Compte et al., 2002). More recently, the Commission signaled "a negative recommendation ... on the proposed deal [of MCI's takeover by WorldCom Inc.], ... stepping up the pressure for the companies to agree ... to divest more of their Internet holdings" (*The Wall Street Journal Europe*, July 1998).

Sometimes, the merging firms themselves take the initiative of including asset sales as part of their merger proposal. For example, when Union Pacific and Southern Pacific Railroad proposed to merge (1996), they also proposed to divest some routes to rival BNSF (in addition to allowing BNSF trains to run on UP/SP tracks).[14] Another example is given by the merger between Fleet and BankBoston.

In order to address the issue of asset sales, I now augment the previous model by assuming that, together with the merger, the merging firms offer to sell one of their stores to the non-merging firm. I assume that Firm 1&2 make a take-it-or-leave-it offer to Firm 3. After the merger takes place and asset

[14]See Kwoka and White (1999).

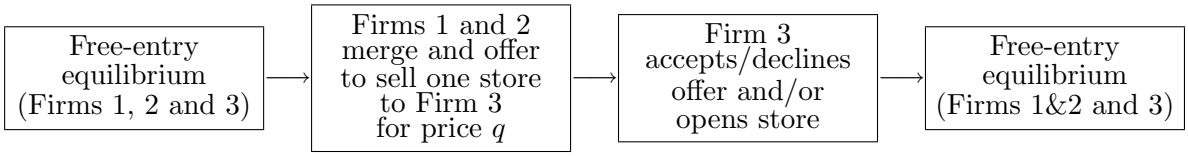

Figure 2: Timing of the model with asset sales.

sales are completed, Firm 3 decides, as before, whether it wants to open new stores, and competition takes place.

The purpose of asset sales, it would seem, is to create a more even distribution of assets between the merged firm and its rival, thus assuring a greater degree of competition and consumer welfare. Specifically, suppose that in the initial equilibrium Firm 1 and Firm 2 own one store each. If the firms merge and there is no entry, then we have a monopoly with two stores; whereas, if Firm 1&2 sells one of its stores to Firm 3, then duopoly competition is maintained. Asset sales thus increase welfare. My main result is that the comparison is reversed once entry is taken into consideration

Suppose that $s_1 < s < s_2$. Absent asset sales, no entry will take place following the merger between Firms 1 and 2. Selling one store to Firm 3 implies a duopoly with Firms 1&2 and 3, whereas no sale implies a monopolist Firm 1&2 with two stores. Clearly, total profits are greater in the latter case, so there are no gains from trade and accordingly no voluntary asset sale will take place. Suppose, however, that $s_2 < s < s_3$. Absent asset sales, Firm 3 will enter with a store at $l_3 = 1/4$. Selling one store to Firm 3 implies a duopoly with Firms 1&2 and 3 and locations $l_{1\&2}$ and l_3. In particular, Firm 3 would not want to open an additional store: if, in the initial equilibrium, one of the incumbents did not want to open a second store, neither does Firm 3 now.

Clearly, total profits are greater in the case of a duopoly with two stores only, so there are gains from trade and accordingly Firm 1&2 will sell one store to Firm 3. Finally, notice that consumer welfare is greater with three stores than with two. It thus follows that

Proposition 3 *Consumer welfare is lower when asset sales, as chosen by the merging parties, take place.*

It is important to note that this result refers to *voluntary* asset sales. If the regulatory agency were to *force* Firm 1&2 to sell one store when $s_1 < s < s_2$, then asset sales would increase consumer welfare.

As mentioned in the Introduction, asset sales were proposed by Staples and Office Depot in an attempt to get their proposed merger through. "Because all three office product chains would benefit from the merger and with pressure from shareholders mounting, analysts said Staples agreed to accept about $140 million less than it originally wanted from OfficeMax" (*The Washington Post*, March 13, 1997). This seems consistent with the idea of the merging firms "buying off rivals" as suggested by Proposition 3.[15]

3 Calibration

Following Proposition 1, the natural questions to ask are: how large is the price increase from a merger when no entry takes place? How large is the price decrease from a merger that induces entry? How likely is it that entry takes place following a merger? To answer these questions, I now proceed to calibrate the model based on data related to the proposed Staples / Office

[15] I am grateful to a referee for suggesting this quotation.

Depot merger. The Salop model is a fairly stylized model. For this reason, the calibration results can only provide a first-order approximation to the likely effects of the merger. But even an idea of the order of magnitude of the effects is useful. As we will see, the results suggest that the effects suggested by Proposition 1 are not purely "theoretical."

The Salop model presented in the previous section includes four parameters: v, t, c and k. Moreover, in order to address the issue of the likelihood of post-merger entry, we need to know the distribution of market size, $f(s)$, and from this derive the relative probability that $s_1 < s < s_2$ versus $s_2 < s < s_3$.

The first thing to notice when calibrating the model is that we can normalize units with no loss of generality. In fact, all of the values considered are proportional with respect to the money unit of account. Accordingly, I normalize units so that $t = 1$.

In its case against the merger, the FTC commissioned a study on the relation between concentration and prices. This study estimates that prices are about 10% higher in monopoly markets than in duopoly markets;[16] and about 4% higher in duopoly markets than in triopoly markets.[17] We thus have two constraints on parameter values. Together with the normalization $t = 1$, this leaves us with one parameter, k, and the distribution of market size.

One of the reasons why the current calibration is bound to be a rough

[16]The precise estimates are 11.6% when Staples is monopolist, 8.6% when Office Depot is monopolist. These are differences with respect to Staples / Depot duopoly markets. See Dalkir and Warren-Boulton (1999).

[17]The exact estimates are 4.9% for a Staples / OfficeMax duopoly vs. a triopoly; and 2.5% for the case of an Office Depot / OfficeMax duopoly. A different study, by Prudential Securities, estimates that prices in Totowa, N.J., a triopoly market, are on average 5.8% lower than in Paramus, N.J., a market served by Staples and OfficeMax only. See Dalkir and Warren-Boulton (1999).

numerical exercise is that the spatial definition of markets is bound to be somewhat arbitrary. In fact, this was one of the points of dispute between the parts involved in the Staples / Office Depot merger (cf Hausman and Leonard, 1998). I consider two possible strategies. One is to take the "minimum information" approach and assume that, in the relevant range, the density of market size is constant. This is a very rough approximation, since it is well known that the density of demographic variables is typically decreasing. The advantage of this approach is that we do not need to calibrate k, as the relevant results are independent of its value.

The alternative strategy is to assume that the distribution of market size is similar to the distribution of city size in the US; and combine census data (city population) with company data (cities where stores are located).[18] Accordingly, from the U.S. Census Bureau data (http://www.census.gov) I estimated a Pareto distribution of city size which seems to fit well the observed frequencies. The generic Pareto distribution is given by $f(s) = \frac{\theta}{s_0}\left(\frac{s_0}{s}\right)^{(1+\theta)}$. The parameter values I chose are: $s_0 = 10,000$ and $\theta = .84$ (see Figure 3).[19] Second, I calibrated the value of k based on the constraint given by the frequency ratio between markets with one store and markets with two stores. From the company data on store locations, I calculated this ratio to be 548/99.[20]

[18] I am grateful to Serdar Dalkir from providing an Excel file with the store location data, which in turn was obtained from the companies' websites. I consolidated the data to get the number of stores in each city where at least one firm is located.

[19] The value 10,000 is the lower limit of the Pareto. It is also the lower limit of the sample of city sizes.

[20] A third strategy to estimating the density of s would be to use the market definition implicit in the FTC study. However, neither the market definition nor the nationwide distribution of market size are available to the public. In any event, as mentioned above, the definition of market boundaries (geographical and otherwise) is by no means subject to general agreement. Moreover, I should note that the important thing, for the purpose of the simulation, is that the shape of the distribution be about right.

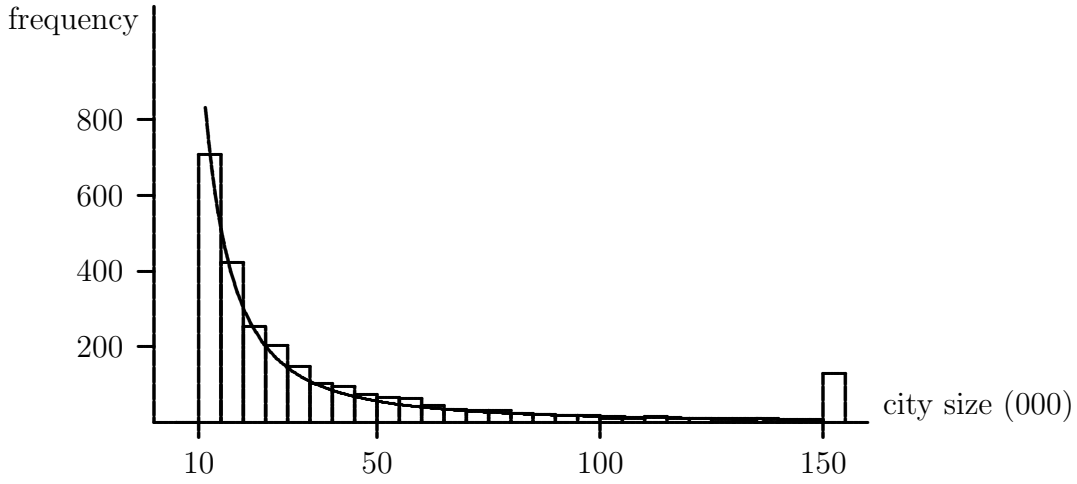

Figure 3: US city population (cities and towns with population 10K+): observed frequency and functional form approximation ($f(s) = \frac{\theta}{s_0}\left(\frac{s_0}{s}\right)^{(1+\theta)}$ times 2578, the total number of cities/towns with population 10K+, times 5000, the frequency class size; $\theta = 1$, $s_0 = 10000$). Rightmost frequency bar corresponds to 150K+. Source: U.S. Census Bureau and author's calculations.

To summarize, I use three data-based constrains and one normalization to obtain the four model parameters. The resulting values are $t = 1$, $c \approx 3.62$, $v \approx 4.57$, $k \approx 8265$. I now turn to the interpretation of these results.

■ **Results.** The relevant results in terms of probability of entry and consumer welfare are presented in Table 3. Recall that, as in the previous section, I am only estimating the impact on markets that start as a duopoly with one firm owning one store each. Row 1 gives the increase in total consumer cost (price plus transportation cost) in case there is a merger and no entry.[21] Rows 2–3 give the average increase taking entry into account, under the alternative assumptions of uniform and Pareto city size density. In both cases, the actual

[21]In this case, the increase in cost it entirely due to the increase in price. Notice that the value of 16.5% is greater than the differential between one store and two-store markets, which was calibrated at 10%. The reason is that the Salop model predicts a monopolist with two stores to price higher than a monopolist with one store. This is because the latter faces a downward sloping demand, whereas the former faces an inverse L-shaped demand.

increase in consumer cost is substantially lower than in the case of no entry. In other words, entry does play an important role in the evaluation of the welfare impact of the merger.

The importance of entry is confirmed by the values in Rows 4–7, which give the probability of entry as a result of the merger. Rows 4–5 give the probability that entry will take place in a given market. The estimates are about 42% under the uniform distribution assumption and about 16% under the Pareto assumption. These number, however, underestimate the actual impact of the merger since entry takes place in the markets of relatively larger size. A more appropriate measure is the probability that, for a randomly selected consumer, entry will take place in his or her market. These probabilities are presented in Rows 6–7: more than 50% under the uniform assumption and more than 25% under the Pareto assumption.

In order to get a better idea of how reasonable these results are, I consider additional implications of the calibration in terms of other variables of interest. First, the frequency ratio between one-store markets and two-store markets is .256 under the uniform distribution and 5.54 under the Pareto distribution (the latter was directly calibrated from the city location data). Based on the results from the FTC study that were made public, one can estimate the same ratio to be about .5 under the FTC market definition.[22] This value lies between the uniform and Pareto distribution values. This, together with the fact that the results do not differ too much between the uniform and Pareto cases, gives additional confidence to the calibration results. Second, the model

[22]See Table 6.1 in Dalkir and Warren-Boulton (1999). For each 12 stores Staples had as a monopolist it had 21 as a duopolist (7 with Depot, 12 with OfficeMax).

implies that it takes a market 5.8 times bigger to support two firms than it does to support one; and it takes a market 2.9 times bigger to support three firms than to support two. These ratios are much greater than the ones estimated by Bresnahan and Reiss (1991) for selected businesses in small U.S. towns. It is not obvious, however, whether the Bresnahan-Reiss estimates would extend to markets greater than small towns and to businesses with significantly greater entry costs, like office supplies superstores. Finally, the markups implied by the calibration are 17.6%, 6.9%, and 2.8% under monopoly, duopoly and triopoly, respectively. These values are lower than typical margins in the OSS business which would normally hover around 30%.

To conclude, I should mention the effect of the merger on the merging firms' profitability. Until now, I have assumed that, due to fixed-cost efficiencies, or for some other reason, the merging firms want to go through the merger even if this implies, in some cases, entry and lower profits. In fact, while initial duopoly profits are given by $\pi_2 = \frac{1}{8}st$ (or $\pi_1 + \pi_2 = \frac{1}{4}st$ for the two firms), the merged firm facing an entrant only makes $\pi_{1\&2} = \frac{49}{576}st$, while a merger not followed by entry leads to profits of $\pi_{1\&2} = (v - \frac{1}{16}t - c)s$. It can be checked that, for the calibration parameter values, the expected variation in profits is positive: although entry leads to lower profits, the increase in profits when entry does not take place more than compensates for this.

■ **Comparison to related results.** In a related paper, Werden and Froeb (1998) study the impact of mergers allowing for entry. They randomly generate a series of industries with logit consumer demand and simulate the impact of a

merger between two of n incumbent firms, considering the possibility of entry by one additional firm. They consider both the cases of non-nested and nested demand systems. In some respects, their findings are broadly consistent with my calibration. Specifically, (a) a merger typically increases profits if there is no entry but decreases profits if there is entry; (b) a large merger is more likely to increase consumer welfare than a small one; (c) consumer welfare may increase even when price increases (due to increased product variety). In other respects, however, the numerical results are quite different. Specifically, I obtain much greater merger and entry effects on price. This is due to the fact that I consider a Salop model, whereas Werden and Froeb (1998) use a logit model of consumer demand.[23] Moreover, Werden and Froeb (1998) conclude that, unless the merger implies significant efficiencies, it is unlikely to take place, as any large increase in quasi-rents is eliminated by entry. By contrast, my numerical simulation shows that, on average, a merger would be profitable even without cost efficiencies. One important difference is that I consider a merger to monopoly, whereas Werden and Froeb (1998) focus on the case when $n > 2$ (specifically, 4 to 8 incumbents).

4 Concluding remarks

I have argued that the possibility of post-merger entry substantially improves the effect of a merger on consumer welfare. I have also shown that post-merger entry drastically shifts the perspective on cost efficiencies as a merger defense and asset sales as a remedy. Cost efficiencies (in the form of lower marginal

[23]Werden and Froeb (1998) show that the effects are greater with nested logit simulations. In fact, the nested logit model is closer to the Salop model than the non-nested logit model.

cost) decrease the likelihood of entry, and thus benefit consumers less than if entry conditions were exogenously given. Likewise, by selling assets (stores) to potential rivals, merging firms effectively "buy them off," that is, dissuade them from opening new stores, an effect that is detrimental to consumers.

Although my results are primarily of a qualitative nature, I have attempted to show, by means of numerical calibration, that the effects of entry are non-negligible. I should add, however, that the numerical results are subject to a number of caveats. First, because of scale economies, one would expect the entrant to have a higher store opening cost k than the incumbents. This may imply a lower probability of entry than the one computed above. Second, while the price increase effects of a merger are likely to take place almost immediately after the merger, entry may take longer to materialize. For these two reasons, the numerical model only provides an upper bound on the probability of entry.

A second important caveat is the model itself. That is, the calibration results are limited by the validity of the circular-city approach to modelling spatial competition. The problem with this model is that it imposes too strong neighborhood effects. However, the alternative — the logit model — may be criticized for the exact opposite reason, viz. not allowing for neighborhood effects. The distinction matters, for, as Werden and Froeb's (1998) analysis suggests, the likelihood of post-merger entry is significantly lower with a logit demand model.

Reality is somewhere between the two extremes of product differentiation, and I would expect the results also to lie somewhere in between. At a minimum, my results prove the *possibility* that post-merger entry changes merger

analysis in a substantive way: in particular the analysis of efficiency gains as a defense and asset sales as a remedy.

The above caveats also point to a promising route for future research: to set out and estimate (or calibrate) a more complex, realistic model of product differentiation; and, based on this, to measure consumer welfare in the pre- and post-merger equilibria.[24] In this respect, the framework proposed by Anderson and Palma (2000), combining "local" à la Salop differentiation with "global" logit differentiation, may prove useful.[25]

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[24] See the merger simulation in Nevo (2000), who however does not consider the possibility of entry following a merger.

[25] Interesting alternatives include the nested logit model (as in Anderson and Palma, 1992, or Werden and Froeb, 1998) and Hotelling competition with $n > 1$ dimensions (as in Braid, 1999).

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Table 1: Critical values of market size.

Firm locations	Marg firm equil profit	Critical mkt size
$l_1 = 0$	$\pi_1 = \frac{4}{9}\sqrt{\frac{3(v-c)^3}{t}}\, s - k$	$s_0 = \frac{3}{4}\sqrt{\frac{3t}{(v-c)^3}}\, k$
$l_1 = 0$ $l_2 = \frac{1}{2}$	$\pi_2 = \frac{1}{8}\, s\, t - k$	$s_1 = 8\,\frac{k}{t}$
$l_1 = 0$ $l_2 = 1/2$ $l_3 = 1/4$	$\pi_3 = \frac{121}{4096}\, s\, t - k$	$s_3 = \frac{4096}{121}\,\frac{k}{t}$
$l_{1\&2} = 0,\ 1/2$ $l_3 = 1/4$	$\pi_3 = \frac{25}{576}\, s\, t - k$	$s_2 = \frac{576}{25}\,\frac{k}{t}$

Table 2: Pre- and post-merger equilibrium.

	Equilibrium prices	Av. price	Tr'n cost	− Cons. welf.
Pre-merger ($s_1 < s_3$)	$p_1 = p_2 = c + \frac{1}{4}\,t$	$c + \frac{1}{4}\,t$	$\frac{1}{48}\,t$	$c + \frac{13}{48}\,t$
Post-merger, no entry ($s_1 < s_2$)	$p_1 = p_2 = v - \frac{1}{16}\,t$	$v - \frac{1}{16}\,t$	$\frac{1}{48}\,t$	$v - \frac{2}{48}\,t$
Post-merger, entry ($s_2 < s_3$)	$p_1 = p_2 = c + \frac{7}{48}\,t$ $p_3 = c + \frac{5}{48}\,t$	$c + \frac{148}{1152}\,t$	$\frac{19}{1152}\,t$	$c + \frac{167}{1152}\,t$

Table 3: Calibration results. Effect in markets that start as a duopoly with two stores.

Concept		value (%)
1. Total cost increase without entry		16.5
2. Average cost increase	uniform	5.3
3.	Pareto	10.8
4. Entry probability (city)	uniform	41.8
5.	Pareto	16.2
6. Entry probability (consumer)	uniform	56.9
7.	Pareto	29.0