

Merger Policy: What can we learn from experiments?

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ABSTRACT: This paper surveys experimental literature relating to mergers. We put particular emphasis on discussing whether this literature addresses the issues that are relevant for competition policy. We also include some suggestions as to how the fit between the experiments and the requirements of competition policy research might be improved.

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1 Introduction

So far, the explicit laboratory analysis of merger policy has been limited to very few examples, even though during the last few decades experimental economists provided many contributions directed at understanding imperfectly competitive markets. One might expect such industrial organization experiments to provide some insight into merger policy, even when they were not designed immediately for this purpose. Therefore, this survey attempts to clarify the role that experiments can play in answering the following questions.

1. Which effects do mergers have on the profits of the inside firms, on their competitors, and on consumer welfare? On a related note, under which circumstances should a merger be allowed?
2. Under which circumstances are mergers likely to occur? How close is the relation between conditions that are likely to generate mergers and conditions under which mergers are desirable? In other words, under which conditions do the decisions of firms lead to the “right kind of mergers”?
3. When policy decisions about mergers have to be taken without precise information about whether the theoretical conditions for allowing them are fulfilled, what kind of simple proxies should be used to determine that the circumstances are right?
4. What kind of remedies might be useful to alleviate the negative competition effects of certain mergers while preserving whatever synergies there may be?

To analyze these questions, two aspects of mergers must be taken into account. First, a merger creates a new entity that differs in some important way from each of its components. The new firm typically controls more assets than each of its predecessors: It may have more capacity or a greater product

spectrum. Also, it may have access to more technological and organizational knowledge, which should increase its efficiency. Negative effects are also conceivable: The larger firm may be harder to manage, the organizational cultures might not fit, etc. Second, just like the exit of a firm, a merger between two firms means that the total number of firms is reduced, at least if the merger does not spark off new entry.

A useful starting point for the analysis of mergers, whether in theory or in the lab, is to focus on the second effect and abstract from the important fact that a merger creates an entity that differs from its predecessors in some sense. Specifically, one of the most influential theory papers in the area (Salant, Switzer and Reynolds 1983, henceforth SSR) treats a merger between symmetric firms in much the same way as the exit of one of its constituent parts: Only one of the two original firms remains in the market, which is completely indistinguishable from its predecessors. In this case, we use the terminology *pseudo-merger* as opposed to a *real merger* where the new firm differs in some way from at least one of its components. While a full-fledged analysis of mergers must ultimately take into account that the new firm differs from each of its predecessors, decomposing the effects of a merger into the exit of one firm and a change in the assets of the other one helps to understand what is going on.

Similarly, the timing aspects of mergers can be simplified. In the real world, mergers involve the transformation of an old market structure into a new one: Each firm has a pre-merger history, on the basis of which expectations about the post-merger situation are formed. A large chunk of theoretical and experimental work in the field simplifies the analysis by ignoring the time dimension. In this literature, market structures are investigated in a comparative statics fashion rather than in an explicitly dynamic way. The papers consider several versions of static oligopoly games which differ only with respect to the number of firms. In principle, comparison of such games with different numbers of players can help us to understand the effects of mergers, with large numbers of players corresponding to pre-merger

situations and small numbers to post-merger situations. However, there is a severe disadvantage of such a procedure: Players are not clearly in the role of insiders or outsiders to a merger, so that there are limits to what we can learn from these papers.

Fortunately, there is a small group of papers that does not suffer from this deficiency: They consider experiments where an oligopoly game is played for a certain number of periods, after which a merger, or, in our terminology, a pseudo-merger takes place.¹ The oligopoly game is then continued with the reduced number of players. In such a setting, players have clearly defined roles as insiders and outsiders, so that the effects of the merger on the different groups of players can be addressed more directly.

Thus, we can categorize different approaches to merger analysis as in Table 1, which classifies existing experimental research on horizontal mergers.

²

| Asset Dimension → ↓ Time Dimension | Pseudo-Merger | Real Mergers |
|---|------------------------------|---------------------------|
| Static | Huck et al. (2004) | Isaac and Reynolds (1999) |
| | Dufwenberg and Gneezy (2000) | |
| Dynamic | Huck et al. (2003) | Davis and Holt (1994) |
| | | Davis and Wilson (2000) |

Table 1: Experimental Literature on Horizontal Mergers

Except for some comments towards the end of the paper, we shall not discuss whether there are fundamental reasons to distrust laboratory experiments as a means of understanding the strategic role of firms. Rather, we

¹In the lab, the "merger" is typically implemented by randomly selecting two players, designating one of them as a decision maker for the new firm and sending the other player away or letting him act as an "advisor" to the decision-maker.

²Vertical and conglomerate mergers typically belong to the right column, as both types of mergers change the set of goods that the firms produce.

shall give the benefit of doubt to the experimentators, asking merely whether the particular experiments chosen are suitable to analyze the policy issues arising in merger policy.

Our paper is organized as follows. Section 2 surveys experiments that are relevant to horizontal mergers. Section 3 discusses to which extent these experiments can help to answer the policy questions discussed above. In Sections 4 and 5, we discuss vertical and conglomerate mergers respectively. The concluding Section 6 will argue that the relatively small impact of the experimental literature on merger policy analysis is justified in view of the fairly limited contributions that this literature has made so far: Some useful individual contributions notwithstanding, there does not seem to be a research program that matches the needs of competition policy. We will also argue, however, that, in spite of some intrinsic limitations, experiments can potentially play a useful role in informing merger policy.

2 Horizontal Mergers

This section summarizes the experimental research on horizontal mergers, embedding it into the context of existing theoretical research on competition policy. We analyze each column of Table 1 in turn.

2.1 Pseudo-Mergers

2.1.1 Static Approaches

We first discuss the theoretical and experimental results that can be obtained for pseudo-mergers in a static setting, by comparing oligopolies with different numbers of firms.

Most of this research deals with the standard linear Cournot oligopoly model with homogeneous firms: The analysis compares the performance of markets with n firms with identical marginal costs with otherwise identical markets with $n - 1$ of these firms. The n -firm market is interpreted as “pre-

merger” and the $(n - 1)$ -firm market as “post-merger”. Thus, neither are there any initial differences in market shares nor does the merger create such differences.

Several theoretical predictions in this setting are rather plausible.

Proposition 1 *In the homogeneous linear Cournot model, a pseudo-merger between two firms*

(i) increases prices;

(ii) reduces total output;

(iii) increases the output of each individual firm.

More controversial, however, is an implication pointed out by SSR. They compared the profits of two of the n firms in the pre-merger situation with those of one of the $n - 1$ firms in the post-merger situation, interpreting the former quantity as the joint profits of the merger insiders and the latter as the post-merger profits of the new firm. They arrived at the following conclusion.

Proposition 2 *In the homogeneous linear Cournot model, the parties to a pseudo-merger have higher total stand-alone profits than the new entity has as joint profits except when $n = 2$.*

Therefore, from the point of view of their owners, firms should not merge in the first place. Unlike the insiders, the outside firms unambiguously benefit from the merger, because it relaxes competition, leading to higher equilibrium prices and per-firm profits. Thus, there are *positive merger externalities*. Both consumers and merging parties are worse off. Also, total welfare, measured as the sum of consumer surplus and producer surplus, falls. Though total profits are higher, this cannot compensate for the lower consumer surplus.

The solution to the “paradox” that the merging parties lose out is quite simple: SSR use a framework where mergers are not really mergers: In fact, they are equivalent to the disappearance of one of the two firms involved.

The merged entity cannot be distinguished from its competitors, as it is not “bigger” in any meaningful way. It does not have more assets, a larger product spectrum or a better technology. It does not have greater internal coordination problems, and it does not suffer from clashes of organizational cultures either. It is just like everybody else. Thus, while the new firm has higher profits than each of its constituent parts used to have, it is not better off than any outsider. Its profit is just the typical profit a firm in an $(n - 1)$ -firm market. The total stand-alone profits of the two parties before the merger were *twice* the typical profit of a firm in an n -firm market.

With one exception to be discussed below, laboratory analysis has not dealt directly with the “merger paradox”. Much effort, however, has been devoted to the underlying comparative statics with respect to prices and quantities, that is, to Proposition 1.

The design of the prototypical experiment in this category is as follows: Subjects were given instructions on the game to be played. They receive a profit table that relates their choice of output and the output of all others to profits. Subjects are then asked to answer control questions, ensuring that they understood the instructions and ensuring that they know that all other participants understood the instructions, too. The typical experiment is one where individuals play the Cournot game repeatedly (typically, for 20 to 30 times), facing the same competitors in each round. After each round, the subjects receive feedback: They are informed how much they have earned and of the choices of their competitors (which is sufficient to figure out how much their competitors earned).

In most of the experimental designs with Cournot competition, the Nash equilibrium predicts the outcomes rather well. In particular, the expected comparative-statics prediction holds.

Experimental Result 1 *Reducing the number of firms in a static pseudo-merger setting lowers total output, much like the theory predicts.*

With the exception of Huck et al. (2004), few papers formally compare how the number of firms affects outcomes in these experiments. In partic-

ular, is there a systematic tendency towards more collusive outcomes when the number of firms is small? In a meta analysis of roughly comparable experiments that differ in the number of firms, there is a weak relationship between the distance of the outcome to the equilibrium and the number of firms (see Huck et al., 2004).³ In their own experiments, Huck et al. find that outputs in markets with only two firms are on average ten percent below the equilibrium quantity. Outputs in markets with five firms are on average 7 percent above. This might lead one to conclude that the collusion-enhancing effects of mergers are larger than theory would suggest. Whether the effect is large enough to warrant such a conclusion is a matter of taste.⁴

The subjects in a Cournot experiment essentially face a public goods problem: Restricting output would be efficient for the industry as a whole, but is not individually rational.⁵ Hence, it is interesting to compare the outcomes in Cournot experiments to the large literature on experiments that are explicitly framed as public goods. While, in the typical public goods experiment, convergence to equilibrium is slower, the outcome in the final few periods is very close to the Nash equilibrium (see, e.g., Fehr and Schmidt, 1999).⁶ It is not surprising that convergence in public goods experiments is

³In the treatments considered, there is neither communication nor discounting. Also, subjects are matched with the same opponents throughout the experiment and are only informed about aggregate behavior of opponents. Most experiments have symmetric firms.

⁴Dufwenberg and Gneezy (1999) find much clearer effects in this direction in a Bertrand model with a homogenous good. In their treatment with three competitors, behavior slowly converges to the equilibrium prediction. However, in the treatment with only two firms, behavior initially converges to equilibrium, but diverges from equilibrium behavior in the last few periods. The substantial difference between the two and three-firm treatments seems closely related to the counterintuitive notion that the number of firms has no effect on the equilibrium outcome in Bertrand oligopolies. It is not surprising that the experiments lead to different outcomes than the implausible benchmark equilibrium.

⁵Choosing a low output in the Cournot model increases the equilibrium price, which is beneficial for all competitors. Thus, like supplying a public good, restricting output involves positive externalities on the other players.

⁶There are institutions under which public goods experiments do not converge, and they are important. However, they are not relevant to our context here. See Fehr and

slower. In these experiments, the equilibrium involves zero contributions. Hence, any error the subjects make moves them away from the equilibrium. On the other hand, in Cournot games, unsystematic errors do not move the outcomes systematically away from the equilibrium.⁷It is also instructive to compare the results on the effects of the numbers of players to the research on public goods experiments: There, the number of players has a relatively small effect on the extent of deviation from the Nash prediction (see Isaac, Walker and Arlington, 1994).

2.1.2 Dynamic Setting

Next, we move to the lower left corner of Table 1. Theoretical analysis that treats the effects of a merger by distinguishing explicitly between pre-merger and post-merger behavior is very rare. Levin (1990) takes such an approach. He supposes that, before the merger, firms act as Cournot players, whereas after the merger the new firm may adopt a different role. For instance, it may act as a Stackelberg leader to which the competitors adapt their behavior. As a result, outputs and profits of the new firm may be higher than for the competitors, even when firms are symmetric *ex ante* and the merger does not affect technology.

Inspired by Levin’s paper, Huck, Konrad, Müller and Normann (2003), henceforth HKMN, explore the idea that a merger might have psychological effects distinguishing the behavior of the new firms from the competitors. They consider a 50-period experiment. In a typical treatment, an initial number of n firms plays a symmetric homogeneous linear Cournot (“pre-merger”) oligopoly game for the first 25 periods. Then, two of the players are randomly chosen as parties to a merger. One of them is assigned the role of a decision maker, the other one can act as an “advisor” by suggesting output decisions. The post-merger game continues for another 25 periods, without

Gaechter (2000) for a discussion.

⁷In public goods experiments with an interior equilibrium as in Cournot games, equilibrium is reached very quickly. See, e.g., Falkinger et al. (1999).

any changes in the underlying technology. Thus, using the terminology of Section 1, the authors are considering a pseudo-merger.

The experimental results suggest that the new firm's behavior indeed differs from the competitors', even though the only difference between the merged entity and the remaining competitors is that it originates from formerly separated firms.

Experimental Result 2 *In HKMN, the firm that originated from the merger produces more than the symmetric Cournot quantity, the competitors produce less. Profits of merging firms tend to increase in the short-term and are roughly like the joint pre-merger profit in the long term (with details depending on the initial number of firms).*

Thus, the firm that originates from a merger behaves differently, even though it does not differ from the competitors with respect to the assets it owns. Huck et al. propose the following psychological mechanism behind their result: Each of the two merging firms has an aspiration level in mind that is shaped by previous play. Falling below the aspiration level feels like a loss.⁸ In the post-merger period, the newly merged firm aggressively increases output to avoid falling behind the reference profit. The other firms anticipate this and decrease their output somewhat. Thus, even though two firms out of a pool of perfectly symmetric firms merged, the merger alone creates an asymmetry, because after the merger, one of the firms has a much higher reference profit than the others. As the experimental results show, this is enough to substantially change the distribution of output levels between firms. Thus, there is a slight movement towards Stackelberg behavior, even though the post-merger decisions are made simultaneously.

This result is potentially relevant for competition policy: It suggests that even in instances where two out of a pool of symmetric firms merge, the out-

⁸The argument is closely related to research in psychology showing that falling short of a reference outcome by one unit is distinctly more painful than exceeding it by one is pleasurable, and that the prospect of a loss can have a strong influence on behavior (Tversky and Kahneman, 1981).

come need not be symmetric. If the two merged firms each have a reference profit in mind, the merger produces a new entity where the reference outcome is the sum of the two reference profits, and hence creates an asymmetry, and may even change the market structure from Cournot to Stackelberg.

More tentatively, the results also suggest that the type of merger may matter for the subsequent outcome. The effect in HKMN can only arise in cases where both previous decision makers are still involved in the post-merger firm.⁹ Thus, the result does not apply to situations where one firm simply buys all the stock of the other firm, and the previous owners are not involved in the management subsequently.

Finally, unlike some of the experiments discussed earlier, the HKMN analysis generates outcomes that do not just confirm the predictions of standard theory.

2.2 Real Mergers

2.2.1 Introduction

Real-world discussions of mergers hinge in an important way on the change in asset ownership that goes along with a merger. In the theoretical or experimental papers mentioned so far, however, there is no role for assets.

We therefore now move towards treatments of *real mergers* in which the merged entity differs from its component parts in some objective way. The theoretical literature has considered a number of examples.

- (1) *Rationalization Mergers* between sufficiently heterogeneous firms where the new entity works with the technology of the more efficient constituent part (Farrell and Shapiro 1990, Barros 1998).
- (2) *Synergy Mergers* where the new entity works more efficiently than either of the inside firms (Farrell and Shapiro 1990).

⁹In fact, the authors show that the effect is no longer present when one of the parties to the merger is sent away with a compensation that does not depend on the performance of the merged entity.

- (3) *Capacity Mergers* where the merger combines the production capacities of the constituent parts, so that the firm indeed has more assets (Perry and Porter, 1985).
- (4) *Variety Mergers* where the new firm produces a larger product spectrum than before (Deneckere and Davidson 1985, Aydemir and Schmutzler forthcoming).

We do not delve deeply into the welfare analysis of real mergers.¹⁰ Rather, we just sketch why such mergers can potentially be beneficial for the insiders, though the details differ. In cases (1) and (2), the driving force of the profit increase is the cost reduction. In case (3), if the new firm has a high capacity relative to its competitors, then it has some scope for setting high prices without having to worry that the competitors can then supply the entire market by undercutting them. In case (4), the merged entity benefits not only from selling a larger number of products, but also indirectly from controlling the prices of a larger number of products. Either way, unlike in the pseudo-merger case, the profits of the merged entity may well be higher than for the joint profits of the inside firm.

For real mergers, the effects on competitors and customers may also differ from the pseudo-merger case. This is most easily seen for synergy mergers: With sufficiently strong synergy effects, if the marginal costs of the merging firms are considerably lower than the costs of its constituent parts, the new firm will set lower prices in equilibrium. Thus, competitors suffer from “negative merger externalities” in spite of the reduction in the number of firms, whereas customers benefit from the lower prices. When synergies are small, however, the anti-competitive effects familiar from the pseudo-merger case dominate, giving rise to “positive merger externalities” for competitors and detrimental effects on consumer surplus.

The analysis so far suggests:

¹⁰The most useful source is still Farrell and Shapiro (1990).

- (i) Whether a real merger is beneficial for customers depends on the details of the situation, in particular, on the size of synergies.
- (ii) Mergers tend to be beneficial for customers when they are bad for outside firms.

Laboratory experiments are well-suited to investigate real mergers, because costs, capacities and product spectrum can easily be controlled by the experimenter. Relevant experiments have been carried out both in the comparative static setting (corresponding to the upper right corner in Table 1) and in the dynamic setting (corresponding to the lower right corner).

2.2.2 Static Case

We start with the static case. Isaac and Reynolds (1999) is the only example we are aware of. Before outlining their approach, it is important to note that their objective was not primarily to analyze mergers. Rather, they belong to a large group of papers searching for the “magic number of firms” at which a market becomes competitive. Nevertheless, comparing their treatments can be potentially informative of the impact of mergers, as we will see below. They use a two-by-two design where they vary the number of firms and their capacity in such a way that the impact of the number of these parameters on market outcomes can be examined. Firms post prices to computer-simulated buyers who fully revealed trades.¹¹ Importantly, demand was not known to the sellers. The demand functions resulting in this way are step functions so that there exists an entire range of prices that is compatible with the competitive equilibrium.

Their treatments and basic results are summarized in Table 2.

Capacity of Firms

¹¹The description of the demand side in this (preliminary) paper is not entirely clear at the present stage. Specifically, some formulations suggest that the buyers are experimental subjects themselves.

| | | Low | High |
|--------------------------------|---|--|---|
| Number of Firms | 2 | Prices are near the Cournot equilibrium | Prices are near the upper range of the competitive equilibrium |
| | 4 | Prices are near the upper range of the competitive equilibrium | Prices are near to the lower bound of the competitive equilibrium |

Table 2: The design and the main results from Isaac and Reynolds (1999)

Three results are noteworthy. First, market prices never exceed the Cournot prices. Second, the results suggest a consistent impact of excess capacity on market outcomes: Greater capacity leads to more efficient outcomes. Third, in this setting, there appears to be a number effect: The lower the number of firms, the less competitive the outcomes.

The first result differs from the results one obtains in Cournot settings without explicit capacity constraints: The most likely explanation appears to be that demand uncertainty might make sellers cautious in their demands.

Additional interpretations might be possible if the treatment of the buyers in the experiment was clearer. Suppose, as some formulations suggest, sellers thought that the buyers were real players. Intuitively, having to present price offers to real buyers rather than “producing” to satisfy a computer-simulated demand puts competitive pressure on firms (see, e.g., chapter 5 in Kagel and Roth, 1995). Other research in experimental economics (Kahneman, Knetsch and Thaler, 1988) suggests that fairness considerations on the behalf of the buyers might contribute to this outcome. There is evidence that buyers reject trades with a positive profit for them if the price is so high that it creates a very unequal split of the surplus between the firm and the buyer.¹² Thus, the differences between Isaac and Reynolds (1999) and the Cournot examples without capacity constraint appear to be related to the presence of “real”

¹²The results in Fehr, Kirchsteiger, and Riedl (1993) rely on exactly this mechanism, though in a different context.

buyers as opposed to a computer-simulated demand curve used in most other experiments we discuss here.¹³ A better understanding of how the presence of “real” buyers change the way mergers affect market outcomes appears to us as one of the areas where experiments could contribute to competition policy.

2.2.3 Dynamic Case

Finally, we deal with real mergers in a dynamic setting. All the experiments we consider have a common set-up. For a certain number of periods (typically 30), the firms play one oligopoly game. Then there is a change in the rules of the game which usually involves a reallocation of assets between different firms. This may involve a full-fledged merger, but it may also just be a capacity reallocation leading to growth of some firms at the expense of others. After this exogenous shock, the modified game is played until the end of the session.

Davis and Holt (1994) is an early example of such a paper. Their experiments were designed to disentangle the effects of capacity reallocation and of changes in the number of firms on market power. In each period, the players were confronted with one of three designs: “No-Power – Five Sellers”, “Power – Five Sellers” and “Power – Three Sellers”.

In the “No-Power” Design, there are three large sellers, each with three capacity units, and two small sellers, with one unit each.¹⁴ In the “Power –

¹³As an aside, fairness concerns can be relevant for competition policy because they affect the price elasticity. When a firm raises prices because of increased market power, this would alter the distribution of surplus. If customers refuse to buy at the new “unfair” price, the price elasticity might be quite large and the firm might, in fact, have very little pricing power. On the contrary, if firms raise prices because costs have increased, this price increase does not necessarily redistribute surplus towards the firm, and no fairness effect is expected. Thus, if one uses variation in costs to estimate the price elasticity, this estimate may significantly overstate market power.

¹⁴For a precise argument, it is important that these units have different marginal costs but for the purpose of brevity, we ignore this.

Five Sellers" Design, a capacity reallocation takes place. As a result, there are two remaining large firms, each with four capacity units, and three small firms with one unit each. Thus, the change in market structure corresponds to a situation where two of the three large firms each buy one third of the assets of the third one, rather than to a full-fledged merger. In the "Three-Seller"-Design, the three small firms from the "Power – Five Seller"-Design merge. The crucial result of the paper is the following.

Experimental Result 3 *In the Davis and Holt experiment, the shift from the "No-Power – Five Seller"-Design to the "Power – Five Seller"-Design has much greater impact on prices than the actual merger, that is, the shift from "Power – Five Sellers" to "Power – Three Sellers".*

To understand this result, it is important to consider the nature of the demand function with which the subjects are confronted. For each of the first eight units, the willingness-to-pay of the (simulated) buyers is r , which is substantially above the high marginal production costs. For the last three units the willingness-to-pay is only slightly above marginal costs.

As a result, it makes an enormous difference for the pricing incentives of sellers whether they have three or four units of capacity. In the former case, competitors supply eight units to the market, which corresponds exactly to the number of units which can be sold at a high price. In the latter case, the competitors only have seven units, so that the seller can be sure to sell at least one unit as long as he prices below r . Thus, the large sellers in the Power-Treatment have considerably stronger incentives to set high prices than the larger sellers in the No-Power treatments. The reallocation of capacity which falls short of being a merger should thus be expected to lead to higher prices on theoretical grounds. This idea is formalized by Davis and Holt, and it is also confirmed in the lab. It turns out that the capacity reallocation has price effects that come close to what one would expect from a concentration-increasing merger. The additional movement to the three-firm treatment has a comparatively small effect. Thus, a "merger-like" capacity reallocation by

which two of the three largest firms become larger at the expense of the third one has stronger effects on market prices than the following merger between the three smallest firms. Very roughly, this corresponds to the familiar idea that mergers involving industry leaders should be viewed with greater caution than mergers involving laggards. Before jumping to general conclusions, however, one should take the very special nature of the demand function into account.¹⁵

Davis and Wilson (2000) is an interesting paper pertaining to merger policy. Like Davis and Holt (1994), the authors do not explicitly model a merger, but consider the effect of capacity reallocations that fall short of describing an actual merger. Nevertheless, the paper provides some insights for the discussion of merger-related synergies. The standard problem facing authorities is to weigh the expected increases in market power against potential efficiency effects. We argued above that sufficiently high efficiency gains justify the merger not only from the insiders' perspective, but also from a social welfare point of view. The argument was implicitly based on an assumption of constant marginal costs. In a setting with increasing marginal costs which appears more appropriate for certain industries (e.g. electricity), the potential positive effects of cost savings on consumer surplus are less obvious. Indeed, the following observation arises naturally.

Experimental Result 4 *In the Davis and Wilson experiment, capacity-reallocations that are accompanied by cost-reductions do not necessarily lead to lower prices than capacity reallocations that are not.*

The authors argue theoretically how this effect comes about; they then show that the theory is borne out in the lab. Intuitively, the idea depends on the difference between efficiency increases concerning marginal units and ef-

¹⁵A second reason why the result should not be overstated is that the experiment again, like much of the literature, uses simulated buyers. As pointed out before, this may matter critically: In light of the previous evidence, it is not clear whether this result survives in an experiment with real buyers.

efficiency increases concerning inframarginal units. While the former typically tend to reduce market power, this is not true for the latter.

More precisely, the authors consider four treatments, N , P , NS , PS . The N -treatment is similar to the “No-Power” Treatment in Davis and Holt (1994) except that there are only three firms, two of which are large. Each of the large firms has one low-cost (c_L) unit of capacity and one high-cost (c_H) units. The small firm has one low-cost unit. Also as in Davis and Holt, moving to P corresponds to a market-power increasing reallocation of capacity: One of the large firms (firm 1) now has both high-cost units, whereas the other large firm only keeps its low-cost unit. Finally, the demand structure is similar to Davis and Holt, with willingness to pay for the first three units being r which is much higher than c_H , and only slightly above c_L for the remaining two units. As before, therefore firm 1 has market power because it can be sure to sell at least one unit at a high price; and the experiment shows that prices are considerably higher in the P -treatment.

The additional treatments allow for “synergies”. NS is like P , except that the cost of producing the high-cost units c_H drops to c_L . PS is like P , except that the costs for producing those units remains at c_H . However, the costs of producing one of the low-cost units drop even further (to c_{LL}).

The results from the experiment are as follows: First, prices in the no-power treatment converge to the competitive equilibrium, irrespective of the cost of the infra-marginal unit. Second, market power increases prices. Third, moving from N to NS or from P to PS does not affect mean prices. The first statement says that a change of costs for marginal units neutralizes an increase in market power - increasing capacity reallocations. The second statement says that cost changes on inframarginal units do not affect mean prices.¹⁶

¹⁶At the risk of repeating ourselves, it should be pointed out that the buyers were simulated in this experiment. In particular, having real buyers that are informed about the changes in the market could have an interesting effect: Based on the previous evidence, we would expect buyers to lose power when cost savings on infra-marginal units are introduced.

3 Horizontal Mergers: What have we learnt?

In the introduction, we raised four sets of questions that come up in merger policy. We now discuss how the existing experimental literature has contributed to answering these questions, and which contributions are conceivable in the future. Much of the discussion will focus on the first question concerning the effects of mergers on profits and welfare.

3.1 The Welfare Effects of Mergers

Existing merger policy literature (e.g. Neven et al. 1993, Motta 2004) has identified a long list of factors that might influence whether the welfare effects of mergers are likely to be positive or negative. These factors include:

1. Market concentration;
2. Synergies;
3. The Likelihood of Entry;
4. Productive Capacities;
5. Demand Variables;
6. The Intensity of Competition;
7. Buyer Power.

1. *Concentration*

The most important parameters in the practical evaluation of mergers are related to concentration. There is a broad consensus that, other things being equal, the problematic effects of mergers dominate when (i) the initial concentration is large and (ii) the expected increase in concentration resulting from the merger is strong. Most of the experimental literature that is related to this issue concerns the case of symmetric firms. Moreover, it typically relates to pseudo-mergers where the firms remain symmetric even after the merger. For these cases, the literature surveyed by Huck et al. (2004) suggests that reductions from three to two firms have substantial price effects and similarly for reductions from four to three firms, whereas mergers with larger initial firm numbers are not problematic. In other words, as long as the post-merger Herfindahl-Index (HHI) is 2500 or less, there is no reason to worry.¹⁷ Taking this result literally would suggest that existing merger

¹⁷The HHI is defined as the sum of the squares of the market shares of all firms (in

policy might be slightly too restrictive.¹⁸

Unfortunately, the much more common scenario that firms are initially asymmetric has not received much attention in the experimental literature. Thus, existing experiments have relatively little to say about who should be allowed to merge with whom for some given initial concentration level. Roughly speaking, common practice is to take a more hostile view towards mergers involving leaders than towards mergers involving laggards.¹⁹ Experiments are very well-suited to check whether such rules of thumb make sense in principle.

Some very preliminary evidence in support of this practice can be obtained from the study by Davis and Holt (1994). As discussed earlier, the transition from the treatment “Five Sellers-No Power” to “Five-Sellers-Power” has much in common with mergers by which two of the leaders get larger. The transition from “Five Sellers-Power” to “Three Sellers-Power”, however, is literally a merger between laggards. To recall, the increase in power was much stronger in the former case than in the latter. This might be interpreted casually as suggesting that mergers between laggards are less problematic than mergers between leaders. However, one should be careful not to overemphasize the point. At the very least, the peculiar demand structure of the Davis and Holt experiments should be kept in mind: It would appear quite possible to generate the converse conclusion with slightly different demand functions. This points to a very serious problem of experiments that is much less of an issue for theory: For obvious budgetary reasons, the comparative-statics insights are usually based on an extremely small class of comparisons between parameter constellations. Drawing far-

percents), so it is $2500=4 \times 25^2$ for 4 identical firms.

¹⁸The U.S. merger guidelines recommend waving through a merger unconditionally if the expected post-merger HHI is below 1,000. If the expected post-merger concentration is higher, the merger is challenged unless the expected increase in the HHI is small, that is, below 100 if the expected HHI is below 1,800 or below 50 otherwise (Motta 2004).

¹⁹This is implicit in the recommendations sketched in footnote 18.

reaching conclusion on such a basis appears daring, to put it mildly. This is unfortunate, because the potential to carry out comparative statics analysis with full control over a single parameter is a great virtue of laboratory analysis compared to most econometric field research. Arguably, this advantage may not be all that large when the comparative statics do not depend on the parameter in question, but also on many other parameters. Of course, this issue is not a matter of principle, but rather one of resources. Hundreds or possibly thousands of experiments for varying values of the fixed parameters might lead to a clearer picture.

2. *Synergies*

There seems to be very little debate that, the more a merger contributes to reducing costs, the more likely it is to be welfare-increasing. For fairly general situations, such a statement is hardly arguable on theoretical grounds. Indeed, it seems so self-evident that an experiment confirming it would hardly receive much attention. It is thus not surprising that the only experimental paper we mentioned on the issues of synergies is one that cautions against the notion that synergies must necessarily make mergers more desirable. Davis and Wilson (2000) deserve credit for pointing this out. However, as interesting as their example may be, without further evidence it provides no cause for rethinking the simple rule of thumb that substantial synergies not only make the merger desirable for the insiders, but also for consumers. After all, the example relies not only on a relatively special type of synergy, but also on a very special case of demand function. It is also worth pointing out that the experimental evidence of Davis and Holt is quite consistent with theory. In fact, the authors derived it from standard game-theoretical reasoning.

3. *Entry*

The undesired effect of a merger on market power may well be mitigated

by potential entry. Thus, mergers in markets where sunk costs play a limited role are generally seen as less problematic than in industries with high sunk costs. While we are not aware of any experiments that deal directly with the influence of sunk costs on merger policy, there is a related literature comparing the behavior of monopolists in settings with and without entry barriers. While the evidence for a very strong disciplining role of potential competition is mixed, there is some support for the idea that such a role is more likely when sunk costs are low.²⁰

4. *Productive Capacities*

Whether a merger causes competitive harm may well depend on the outside firm's productive capacities. If the competitors have excess capacities initially, the merger does not necessarily increase the market power of the merging parties very much as they must take into account that competitors can easily supply the market as a response to a price increase. To our knowledge, this idea has not yet been tested directly in the laboratory. However, the experiment of Isaac and Reynolds suggests this conjecture may be true. At least for given firm numbers, excess capacity of some firms increased competitiveness.

5. *Demand Variables*

It is well known that high demand elasticity can discipline the price-setting behavior of firms. The elasticities of market demand are therefore also important to estimate the potential negative effects of mergers on market power. Again, there seems to have been no direct attempt to assess the role of demand for mergers in the lab by comparing treatments where everything else is fixed. Davis and Holt (1994) and Davis and Wilson (2000), however, have exploited the effect of demand elasticity in their experiments. There, if the merger reduces the elasticity of

²⁰See Coursey et al. (1984), Harrison and Mc Kee (1985), Harrison et al. (1989), Millner et al. (1990). This literature is framed as a test of the contestable markets hypotheses of Baumol et al. (1982), which has been criticized by Tirole (1988) and others.

(firm) demand substantially, the observed market power tends to rise, which is consistent with the theoretical prediction.

6. *Intensity of Competition*

Often, there are some firms in the pre-merger market who compete more vigorously with each other than with the remaining firms. Specifically, this will be true when they are producing closer substitutes. A merger between such firms who are initially intense competitors should have stronger price effects than a merger between firms who are not competing vigorously even before the merger. Again, we are not aware of any experiments comparing the effects of mergers under different assumptions about pre-merger competition (except when intensity of competition is identified with the number of firms).

7. *Buyer Power*

In many important merger cases, the firms face buyers who operate in imperfectly competitive markets themselves. In such cases, buyer power may constrain the market power of the merged firm.²¹ Even though we are not aware of any existing experiment investigating the effects of buyer power on merger performance, such an analysis is clearly possible. The literature above typically dealt with simulated demand, which corresponds to low buyer power. If, instead the buyer side was model with a small number of real buyers, it would presumably be possible to understand the role of buyer power better.

3.2 The Circumstances Fostering Merger Activity

Actual competition policy is mainly concerned with the effects of mergers. Understanding their causes may appear to be merely of an academic interest at first glance. However, understanding which circumstances lead to mergers is essential in judging how they should be viewed from a competition policy

²¹Neven et al. (1993) argue that buyer power was important in at least three European merger cases (*Alcatel/Telettra*, *Viag/Continental Can* and *Alcatel/AEG Kabel*).

perspective. If we knew that firms want to merge precisely when this has positive welfare effects, there would be no rationale for merger policy.

In some ways, such an alignment of interests does not seem so far-fetched: For instance, when there are strong synergies, firm owners and consumers should both benefit from mergers. In other ways, however, the private and the public interest are likely to diverge. For instance, mergers between firms that already have high market shares may be particularly attractive to the firms, but particularly undesirable for consumers. In the extreme case of the homogeneous, linear Cournot model without synergies, mergers between duopolists are the only profitable ones, and they clearly have a very negative welfare effect. Similarly, mergers between firms that are initially more competitive than others appear particularly profitable and particularly likely at the same time. More generally, Farrell and Shapiro (1990) have provided a theoretical analysis of the relation between merger profitability and welfare effects.

Experiments do not seem to have addressed these issues. It would seem quite possible to confront subjects with the decision whether they want to merge in different experimental settings where some mergers are desirable from a social point of view and others are not, and then investigate how the decision to merge is correlated with its social desirability.

3.3 Rules of Thumb

In theoretical models, the welfare effects of mergers are judged on the basis of information that is typically not readily available for competition policy authorities, at least not within the time frame that is necessary to judge whether a merger should be allowed or not. Most obviously, this information includes demand and cost functions. More fundamentally, the standard welfare analysis of mergers proceeds as though there was a clearly defined product market. It is well known, however, that in most actual merger cases, it is not entirely obvious what the relevant market is. Practical merger policy uses rules of thumb to deal with these problems.

(i) A common practice to find the relevant market is the SSNIP Test (Motta 2004), which asks whether a “small but significant non-transitory increase in prices” in the market under consideration would be profitable for a hypothetical monopolist. If the answer is affirmative, then the possibility of substituting the goods in the market by using outside goods is limited, and there is no need to move to a wider market. In implementing the SSNIP test, own-and cross price elasticities play an important role, with high elasticities suggesting low price effects of mergers. While experiments are clearly of no help in estimating real-world demand elasticities which are used to define the relevant markets, we have already argued that they could be designed to better understand the relation between elasticities and merger effects, precisely because the demand functions are controlled by the experimenter.²²

(ii) Once the relevant market is defined, the standard approach in the U.S. to screen out unproblematic mergers is to use the pre-merger Herfindahl-index as a measure of concentration and calculate the expected post-merger Herfindahl-index under the assumption that the new firm’s market share is the sum of shares of the inside firms (see footnote 18). In principle, one could design experiments to analyze the relation between post-merger HHI and merger price effects in different environments. Though the evidence from the pseudo-merger experiments suggests otherwise, such an analysis might reveal that the relation between post-merger HHI, its increase and the price effects is not sufficiently close to justify relying on it as a rule of thumb.

(iii) If the analysis of concentration reveals a potential problem, additional information will be looked at to clear the merger, including buyer power, potential entry, synergies, and so on. For instances, an efficiency defense might be applied if the parties involved can convince the authorities of substantial synergies from the merger. Davis and Wilson (2000) motivate their paper by arguing that U.S. procedures to assess whether cost synergies might justify a merger are problematic. To determine whether consumers are likely

²²However, this direct control only relates to market demand, not to the perceived demand of each firm which also depends on competitor reactions (see Neven et al 1993).

to benefit from whatever efficiency gains a merger might generate, historical pass-through rates are sometimes considered, the idea being that if cost reductions were passed through to the consumers in the past, this should also be true in the future. One implication of the Davis and Wilson paper is that this is hardly true in general.

A related issue concerns the usage of simulation models to estimate merger effects. The U.S. Department of Justice uses an "Antitrust Litigation Model" (ALM) to screen mergers. This model requires relative little information, which makes it easy to apply.²³ It also relies on very specific assumptions, however. Davis (2002) uses laboratory experiments to compare the performance of the model in a setting which comes close to the ALM set-up with the ALM predictions. It also checks for the robustness of the behavior to violations of the ALM assumptions.

The evidence suggests that

- (i) The ALM predictions are not correct in general, but
- (ii) screens out nonproblematic mergers quite well.

Summing up, though relatively little has been done in this respect, experiments are potentially useful for evaluating rules of thumb.

4 Vertical Mergers

As indicated above, there has been much discussion about the precise welfare effects of horizontal mergers. However, most debates concern the question which types of mergers are detrimental to welfare. There is not much disagreement that horizontal mergers can have negative effects in principle. Accordingly, regulation of horizontal mergers is firmly established. The policy towards vertical merger is much less uniform. In the U.S., for instance, periods of hostility towards mergers were followed by periods where the antitrust

²³The model uses information on prices, market shares, demand elasticity and substitutability to infer the industry cost structure, which is then used to predict post-merger performance.

authorities took a more lenient view (e.g., Kwoka and White 1999).

In a similar vein, industrial organization theory has not come to a definite conclusion about the effects of vertical mergers. The disputed issues do not concern vertical integration per se. For instance, mergers between upstream and downstream firms in a bilateral monopoly are usually seen as efficiency-enhancing. Similarly, there is relatively little concern that oligopolies where all firms are vertically integrated are less desirable than oligopolies where all firms are separated.²⁴ However, the welfare discussion of asymmetric vertical integration in successive oligopolies is not settled. The debate circles around two main issues.

First, if there is an asymmetric vertical structure, does it matter? Proponents of unconstrained integration emphasize its *efficiency effects*: Because of technical reasons (economies of scope) or because of the elimination of a double mark-up, integration is believed to reduce marginal costs of the integrating firms. Opponents highlight the potential *foreclosure effects*: Integration is seen as a commitment not to serve downstream rivals, which is likely to result in higher production costs for these competitors and thus in reduced outputs. The theoretical literature is ambiguous about which effects dominate. The answer depends on such details as the number of upstream and downstream firms, the demand functions, and the type of contracts between suppliers and downstream firms that are allowed (Salinger 1988, Rey and Tirole forthcoming). Second, even if asymmetric vertical integration is problematic when it happens, is there reason to believe that it is likely to occur? The Chicago School (Bork 1978) has argued that asymmetric vertical integration is likely to create a bandwagon effect, with non-integrated firms following their integrated counterparts. Meanwhile, however, many authors have used game-theoretic reasoning to explain why asymmetric integration may well be an equilibrium outcome in fairly general circumstances (Or-

²⁴Therefore, an experiment of Mason and Phillips (2000) demonstrating that a vertically-integrated industry produces higher output than its separated counterpart does not quite get at the heart of the problem.

dover et al. 1990, Jansen 2003, Bühler and Schmutzler 2005). This is also consistent with empirical evidence. Even so, the debate is far from settled. In principle, therefore, experiments might contribute to answering the open questions.

Martin, Normann and Snyder (2001), henceforce MNS, is presumably the best-developed contribution to the subject.²⁵ These authors design their experiment to come close to the setting of Rey and Tirole. In their design, an upstream sector produces an essential input for the downstream sector. In one group of scenarios (separation), one firm is exclusively active on the upstream market, and there are two downstream firms. In a second scenario (integration), the upstream firm merges with one of the downstream firms. In all treatments, the upstream firms offer a contract to each downstream firm, specifying the amount of input they are prepared to deliver and a payment they expect in return. Downstream firms decide whether to accept or reject. Upstream firms also decide how much to produce themselves. Essentially, the authors ask how the vertical merger affects market performance, that is, output prices and firm profits.

The results provide some support for foreclosure theories.

Experimental Result 5 *In the integration treatment of MNS, total quantities are lower and upstream profits are higher than in the various separated treatments.*

This is consistent with the idea that the integrated firm finds it easier to commit to an output restriction in the integrated case than in the separated case.

Though the argument that vertical integration can be problematic comes across quite convincingly, there are several caveats. First, as the authors themselves note, not all the theoretical predictions of Rey and Tirole are con-

²⁵Other vaguely related contributions are Elliot et al. (2003), and Mason and Phillips (2000).

firmed.²⁶ Second, the set-up of MNS has been chosen in a way that is highly conducive to foreclosure. In particular, because there is only one upstream firm, competitors cannot step in to supply separated downstream firms when they are foreclosed by the upstream firm. While there are very important cases, where an upstream monopoly faces several downstream competitors, in particular network industries, many industries are better described as sequential oligopolies. In these industries, it is much more controversial whether foreclosure can be successful. Third, the analysis has nothing to say about bandwagoning issues. As the vertical industry structure is fixed, the authors cannot clarify whether firms will respond to vertical integration by integrating themselves. Thus, they say nothing about whether asymmetric vertical integration is likely to arise. Obviously, answering this question would not only require endogenous integration decisions, but also more than one upstream competitor.

In spite of these qualifications, the analysis of MNS is clearly promising. To repeat, however, at this stage, it is premature to draw far-reaching conclusions about the effects of integration: Theory suggests that the effects of vertical integration depend in a subtle and not very transparent ways on such details as demand functions, the number of upstream and downstream firms and the type of contracts that are allowed. We should therefore be reluctant to put too much weight on the outcomes of a small series of experiments: It may well be that familiar ambiguities from theory would also show up in experimental research if sufficiently many design variations were considered.

5 Conglomerate Mergers

Unlike horizontal or even vertical mergers, conglomerate mergers receive relatively little attention by competition policy authorities. Though it has often been debated whether excessive diversification is healthy for the firms in-

²⁶Specifically, the effect of the types of contracts allowed on performance differs from the predictions.

volved, there is little worry that, by expanding into unrelated markets, a firm might be able to exercise more market power. Nevertheless, conglomerate mergers could potentially be problematic from a joint dominance perspective. This stance was already taken by Edwards (1955) who conjectures that "... the prospect of advantage from vigorous competition in one market may be weighted against the danger of retaliatory forays by the competitor in other markets ..." (Phillips and Mason 1992, p. 395). A more recent paper by Bernheim and Whinston (1990) uses a game-theoretic setting to investigate whether multi-market contact might foster collusive behavior. Their argument why this might be true formalizes the simple idea that for firms who meet in several markets, the costs of deviating from collusive behavior are high, because a breakdown of collusion will lead to losses in more than one market. However, they also highlight that the argument is not quite as straightforward as it seems, because the potential gains from deviation are also higher under multi-market interaction. Thus, the effects of multi-market interaction are typically ambiguous. Roughly speaking, collusion decreases on the relatively collusive market and increases on the less collusive market.

These ideas pertain to such conglomerate mergers that, before the merger, some other firms are already active in at least two of the markets under consideration: Then the merger creates multi-market contact where there was none before.

A small number of experiments have been carried out to check whether multi-market contact indeed has a positive effect on collusion. For instance, Phillips and Mason (1992) conduct a series of experiments to analyze how multi-market contact affects pricing. The underlying two individual markets are chosen so that, in one of them, collusion is easier to sustain than in the other one in the absence of multi-market contact. The authors compare output decisions in each individual market with output in an experiment where each firm operates in both markets. The results basically confirm theory.

Experimental Result 6 *In the Phillips and Mason experiment, multi-market*

contact increases prices on the less collusive markets and decreases them on the more collusive market.

6 Conclusions

6.1 Overview

In this paper, we surveyed experimental work that relates to merger policy analysis. In the remainder of this paper, we shall argue that, although these experiments have generated some interesting results, the analysis has not yet produced insights into merger policy that would either give more confidence into the conventional wisdom on merger policy or, to the contrary, suggest a fundamental rethinking of familiar ideas. However, we shall also argue that, to some extent these limitations can be overcome.

6.2 Existing Work and its Limitations

A large body of experimental research deals quite directly with the relation between market structure and performance. Some of this work is applicable to merger policy in a very broad sense. For instance, many papers support the notion that reductions in the number of firms tend to induce higher prices, which is the basis for merger policy. A much smaller number of papers discuss experiments that were specifically designed to address mergers. For instance, some authors ask how mergers affect different parties. Others attempt to clarify whether certain practices that are used in merger policy are reasonable. By and large, these papers come to reasonable conclusions, either confirming standard intuition or suggesting in a plausible way why such intuition may be flawed. There are some important (and interrelated) limitations, however.

First, only a tiny fraction of the large number of potentially interesting questions in the area has been addressed. Second, those results that have been obtained so far are relatively unspectacular. On the one hand,

we have not seen a robust-looking corroboration of any truly contested idea: Competition-policy authorities cannot not appeal to existing experiments to judge if and how efficiency defenses, buyer power or potential entry should be weighed in merger cases. On the other hand, there seems to be no example where any undisputed idea has been refuted in a convincing manner: For instance, the experiments do not give us a reason to advise against the use of concentration measures as a useful first step in judging the desirability of mergers. Third, it is hard to discern a clear research agenda. Each paper appears to attack a fairly isolated issue, and there is no clear sense of direction.

6.3 The Potential for Improvements

Some of the problems just sketched can be overcome quite easily, at least in principle. The simplest step is to carry out a more extensive discussion about which kind of topics, relating to merger policy should be addressed with experiments. Some of the comments in this paper point in this direction, but they clearly fall short of a full-fledged research agenda. In addition, a "simple" way to improve the output of experimental research on competition policy would be to invest more resources. In particular, robust insights on such issues as to which factors make mergers less problematic might be obtained by carrying out many similar experiments with small modifications.

There are also a number of other limitations: many potentially interesting questions in the area relate to comparative statics results which might depend in a very subtle way on various parameters of the situation. To obtain supportive evidence for existing theories or competition policy practices that can be trusted, a large number of costly treatment variations would have to be carried out.

Further, many of the decisive issues in merger policy depend on specific knowledge of the particular case. In principle, one might design experiments that fit the particular case to inform policy makers. Unfortunately, given the usual time frames of merger policy, this appears very difficult.

Finally, even for authors who are sympathetic to experimental research it is not obvious that the lab is ideally suited to test theories on problems involving very large time-scales: In the real-world, the impact of mergers only becomes entirely clear after many months or even years of adjustment. At the very least, therefore, the external validity of merger experiments should be discussed with a healthy dose of skepticism.

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