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Profitable Horizontal Mergers without Cost Advantages: The Role of Internal Organization, Information, and Market Structure

Steffen Huck*
Kai A. Konrad**
Wieland Müller***

* Royal Holloway College
** Wissenschaftszentrum Berlin für Sozialforschung
*** New York University and Humboldt-University Berlin

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Wissenschaftszentrum Berlin für Sozialforschung gGmbH,
Reichpietschufer 50, 10785 Berlin, Tel. (030) 2 54 91 – 0
Internet: www.wz-berlin.de

ABSTRACT

Profitable Horizontal Mergers without Cost Advantages:
The Role of Internal Organization, Information, and Market Structure

by Steffen Huck, Kai A. Konrad and Wieland Müller

Merged firms are typically rather complex organizations. Accordingly, merger has a more profound effect on the structure of a market than simply reducing the number of competitors. We show that this may render horizontal mergers profitable and welfare – improving even if costs are linear. The driving force behind these results, which help to reconcile theory with various empirical findings, is the assumption that information about output decisions flows more freely within a merged firm.

Keywords: Merger, internal organizational structure, information, timing, market structure
JEL classification: L11, L13, L22, L41

ZUSAMMENFASSUNG

Profitable Unternehmensfusionen ohne Kostenvorteile:
Die Rolle der internen Unternehmensorganisation, des Informationsflusses und der Marktstruktur

Unternehmensfusionen führen häufig zu komplexen Organisationen. Fusionen haben deshalb andere und tiefgründige Wirkungen auf die Marktstruktur. Sie reduzieren nicht einfach die Zahl der Wettbewerber in einem Markt, sondern durch Fusionen entstehen Wettbewerber, die sich wegen ihrer komplexen Organisationsstruktur anders verhalten als jedes der einzelnen Unternehmen vor der Fusion. Wir zeigen in dieser Arbeit, dass horizontale Fusion von Unternehmen aus diesen Gründen profitabel für die fusionierenden Unternehmen und wohlfahrtserhöhend wirken kann, selbst dann, wenn es durch die Fusion keinerlei Kostensynergien gibt. Der Schlüssel für dieses Ergebnis, das eine Theorie für eine Reihe von empirischen Befunden liefert, ist der verbesserte Informationsfluss zwischen Unternehmensteilen des durch die Fusion entstehenden Konzerns im Vergleich zum Informationsfluss zwischen unabhängigen Unternehmen.

Schlüsselbegriffe: Fusion, Organisationsstruktur, Informationsfluss, Marktstruktur

1 Introduction

Although merger of two …rms is frequently dubbed "fusion", this term is quite misleading. In contrast to the fusion of atoms, the new entity that results from a merger of two …rms is usually a much more intricate structure than either of the two …rms. Through merger …rms do not just become "bigger" they also become more complex organizations. This is empirically well documented. Prechel, Boies, and Woods (1999), for example, report that newly merged …rms mostly move from the classical multidivisional form[1] to the so–called multisubsidiary organizational form, where the old …rms are kept as still fully functional a¢liates.[2]

The economics literature generally ignores such organizational issues and models a merger either as a fusion or as perfect collusion. In this paper we depart from both and draw on the above …ndings by modeling a merged …rm as a …rm with separately managed subsidiaries. We analyze how this a¤ects market structure, pro…tability of …rms and welfare. The main assumptions we make about mergers are very minimalistic. Instead of assuming "synergies" or cost reductions that render mergers pro…table, we simply assume that within a merged …rm information is exchanged more easily than between other …rms.[3] More speci…cally, we follow the observations by Prechel, Boies, and Woods (1999) according to which merging …rms become a¢liates in a holding company, with each a¢liate having the discretion to make independent decisions, and we assume that, due to the many formal and informal links between these a¢liates, one a¢liate's production plans can be observed by the other a¢liate before this information is observable for …rms that do not belong to the same holding company. Moreover, we allow for some time structure in production decisions. As a consequence, an a¢liate among the merged …rms might be able to observe the output decision of its "sibling" before deciding about its own output.

As innocent as this assumption may seem, it has dramatic consequences—for the two merging …rms as well as for the market as a whole. In particular, we …nd that merger is pro…table for the involved …rms, reduces pro…ts of outsiders and enhances welfare. All three results are in sharp contrast with the literature on mergers in markets with quantity com-

[1] Chandler (1962) is usually credited for having been the …rst to conceptualize the "M-form". A further classical reference is Cyert and March (1963).

[2] Zey and Swenson (1999) report similar …ndings.

[3] In a recent article, Nault and Tyagi (2000) argue that improved communication technologies make horizontal alliances and other horizontal organization structures more attractive and more prevalent than traditional centralised structures. Nault and Tyagi take this is a starting point for modelling coordination mechanisms in alliances of geographically dispersed …rms.

petition that originated with Salant, Switzer, and Reynolds (1983) and help at the same time to reconcile theory with three stylized facts:

- There is no clear evidence for welfare reductions as a consequence of mergers, welfare changes go in both directions (see, for example, Pesendorfer 2000 who reports huge welfare gains for mergers in the paper industry and, for a general appraisal, Federal Trade Commission 1999).
- Competitors often su¤er when other …rms merge (see, for example, Banerjee and Eckard 1998).
- (Bilateral) mergers are observed in all industries, even in those where costs are unlikely to be convex (see O¢ce of Fair Trading 1999).

There is a vast body of theoretical literature on mergers and some strands of it can accommodate some of these …ndings. For example, Deneckere and Davidson (1985) show that bilateral merger in Bertrand markets is pro…table. This can explain why we observe bilateral mergers. However, they also show that merger in these markets reduces consumer welfare and that competitors bene…t if other …rms merge.[4]

The literature on mergers in markets with quantity competition (Cournot markets)[5] is, however, at odds with all three observations. In Cournot markets mergers have only two consequences: First, they reduce the number of …rms (or strategic players) acting in the market as mergers are indeed modelled as a fusion after which one …rm has disappeared. Second, if costs are non-linear, they may change the cost function of the newly merged …rm. This has a number of important implications:

- Mergers are only welfare–improving if …rms are asymmetric and output is shifted from less to more e¢cient …rms (Farrell and Shapiro 1990).
- Competitors bene…t if other …rms merge (Salant, Switzer, and Reynolds 1983).
- Bilateral mergers are only pro…table if costs are su¢ciently convex (Perry and Porter 1985).

[4] Cabral (1999) shows that merger in markets with di¤erentiated products may increase consumer welfare if there is the possibility of free entry.

[5] At …rst sight quantity competition might be seen as of lesser importance than price competition. However, as Kreps and Scheinkman (1983) show standard Cournot analysis might be interpreted as a shortcut to analysing markets where …rms have to build up capacities and then engage in price competition.

A corollary to this is that bilateral mergers in linear markets are never pro…table and always welfare–reducing.[6] Consequently, one should observe mergers only if the cost savings are su¢ ciently large which seems to be in con‡ict with the third observation above—that there is merger activity in all industries regardless of speci…c production technologies. Cost e¤ects are very hard to observe and measure. Accordingly, it is di¢ cult or impossible to test this theory. In order to eliminate possible production cost e¤ects from our consideration we will consider the case with linear cost.[7] We propose a di¤erent reasoning that resolves the puzzle but is based on assumptions can be tested more easily. As we shall show, the puzzle can be resolved by taking into consideration that merger is not a process that transforms two …rms into one …rm of the same type, basically eliminating one of the …rms, but rather leads to a di¤erent organization: merged …rms are kept as intact decision units within a more complex entity.

Our analysis comes in two parts. In the …rst part we assume that the merged …rm has a joint headquarter that can govern its a¢ liates. In particular, we assume that the HQ can enforce the sequence in which its two a¢ liates decide about their output. For example, the HQ can force one a¢ liate to decide before the other (which then, because information ‡ows freely between the two a¢ liates, will be informed about the quantity of its sibling when making its own decision). This has an important consequence for the market as a whole because the market will no longer be a simple Cournot market. Rather, the market will have the ‡avor of a Stackelberg market as the a¢ liate that decides …rst becomes some sort of Stackelberg leader. Of course, this leadership is partial as the outsiders will not be able to observe what the second-moving a¢ liate can observe. Accounting for this pattern we will introduce the following terminology. We shall call the …rst-moving a¢ liate of the merged …rm a "partial Stackelberg leader" and the second moving a¢ liate a "partial Stackelberg follower" (or the "informed …rm"). To all the other …rms we shall refer as "Cournot …rms" (or the "uninformed …rms"). Analyzing this market we arrive at the above mentioned main conclusions: mergers can be pro…table and welfare–improving even if all …rms have the same linear cost functions. At the same time competitors' pro…ts are reduced.

In the second part of our analysis we will relax the assumption about

[6] This was …rst pointed out by Salant, Switzer, and Reynolds (1983).

[7] This assumption is mainly for purity. We will show that merger will be pro…table and welfare enhancing, even with a linear technology. This result implies that, if there are additional "synergies" (e.g., cost savings due to the convexity of cost funtions) the merger will be even more pro…table. In other words, by focussing on linear technologies we do not restrict the generality of our analysis but rather focus on the hardest case, and a generalization to cases with "synergies" is straightforward.

the all-powerful joint headquarter. In fact, we shall completely abandon it (which might even more closely resemble a multisubsidiary form) and we will show that even in the absence of a headquarter, the same timing of decisions that the headquarter would enforce, will endogenously evolve. Consequently, the same Stackelberg commitment power will result endogenously and, hence, the same market outcome. Thus, even if the merged …rm does not bene…t from "commitment by governance" it will increase its joint pro…t.

The model we employ in the second part of our analysis is closely related to the literature on endogenous timing in Stackelberg markets. It closely follows Hamilton and Slutsky (1990) who show that two perfectly symmetric …rms may endogenously play according to the Stackelberg solution. This happens in a two-period model in which both …rms can commit themselves to a quantity in the …rst period. Alternatively, they can decide to wait and produce in the second period (then knowing the other …rm's decision). The only subgameperfect equilibria in this market game that are in undominated strategies are characterized by Stackelberg behavior.[8]

The remainder of the paper is organized as follows: In Section 2 we present the basic model and the benchmark case without merger. In Section 3 we describe the equilibrium outcome if …rms merge and are governed by a headquarter that can impose rules for them. In Section 4 we abandon this assumption and study the model in which the timing of moves is endogenous. Finally, Section 5 summarizes and discusses our results.

2 The benchmark case without merger

We consider a market for a homogenous product with linear demand and cost. Let there be n symmetric …rms. We can normalize price and unit such that inverse demand can be written as $p(X) = \max\{1 - X; 0\}$ with $X = \sum_{i=1}^{n} x_i$ denoting total supply and x_i …rm i's individual quantity.

Each …rm chooses its supply quantity according to the following game structure. There are two production periods. A …rm can choose to produce either in period 1 or in period 2. Production costs do not depend on whether a …rm decides to produce early (in 'period 1') or late (in 'period 2'). Only after period 2, that is, when all …rms have chosen their outputs, can each …rm observe each other …rm's output decision and the market opens. This re‡ects that production and sale do not take place instantaneously (what is assumed in most of the economics

[8] The main reason for this result is that playing Cournot quantities in the …rst period is a dominated action. (By waiting a …rm can always react optimally to what its competitor has done previously.)

literature). Rather production takes some time and precedes selling.

However, although actual output decisions may not necessarily occur simultaneously, due to simultaneous information revelation, the output choice in the benchmark case is a standard Cournot–Nash game. Accordingly, the unique Cournot equilibrium is given by $x_i^{¤} = \frac{1}{n+1}$. Total supply is given by $X = \frac{n}{n+1}$ and the equilibrium price by $p = \frac{1}{n+1}$. Firms' pro…ts are $\frac{1}{(n+1)^2}$.

Note that the choice of timing of production is inconsequential in this benchmark case: Given the information assumptions, the benchmark case is structurally equivalent with the standard Cournot model with n symmetric …rms. However, the additional choice of timing allows for more structure within more complex organizational forms. This is what we consider next.

3 Model A: A headquarter governs merged …rms

Suppose two of the n …rms merge. A "holding" is formed with a joint headquarter and decision making units in each of the two a¢liates, labelled L and I. As discussed brie‡y in the introduction, the governance structure in the merged …rms is characterized by two properties. First, information ‡ows more easily and quickly between the merged a¢liates than between other …rms. More precisely, we assume that the two merged …rms can observe each other's output decision immediately when it occurs. Second, the headquarter controls the sequencing of output decisions of the two a¢liates and can force a¢liate L to choose x_L prior to a¢liate I's decision. Hence, when I chooses x_I, it knows the choice x_L made by a¢liate L. Of course, all other …rms observe x_L and x_I only at the end of period 2, at the same time when L and I also observe these other …rms' output choices. This structure is common knowledge. We refer to a merger that results in a holding with two a¢liates and this information and decision structure as a merger with enforced information sharing.

The game which results after the merger has taken place is a sequential game without proper subgames. It can be interpreted as a market with "partial Stackelberg leadership" and we refer to the …rm in the merger which moves …rst (L) as the "leader". To the second …rm in the merger (I) we refer to as the "informed …rm". To all other …rms we refer to as the "uninformed …rms", indexed u 2 U.

While a strategy of the leader is simply a number, its quantity x_L, the informed …rm's strategy is a function prescribing for each possible quantity of the leader a quantity of its own. We denote this function by $f(x_L)$. A strategy of one of the uninformed …rms prescribes, strictly speaking, the period in which to produce and the quantity that is produced in this period. However, as an uninformed firm's quantity decision is not revealed until the end of period 2, its choice of period is irrelevant. Hence, we can simplify an uninformed firm's strategy to a number, its quantity x_u.

This game has an infinite number of Nash equilibria, similar to a standard Stackelberg game. In contrast to a standard Stackelberg game the number of equilibria cannot be reduced by simple backward induction, i.e., by requiring subgame perfection. However, by requiring that the informed firm reacts optimally to its information, i.e., by requiring sequential rationality we can achieve a unique solution.

As the derivation of the sequentially rational equilibrium is slightly tedious we refer the full analysis of the game into the Appendix. The results are this: The leader supplies $x_L^* = \frac{2}{n+2}$. Uninformed firms choose $x_u^* = \frac{1}{n+2}$. And the informed firm chooses the function $f^*(x_L) = \frac{2}{n+2} - \frac{1}{2}x_L$ which yields in equilibrium $x_i^* = \frac{1}{n+2}$.

At first sight it may seem surprising that uninformed firms choose the same quantity as the informed firm. After all, one might have suspected that the informed firm "suffers" more from its knowledge about the leader's quantity than the uninformed firms do. However, in equilibrium this cannot happen. The key to understanding this property is the following observation: In equilibrium all firms know the quantities of all other firms. (Of course, about the informed firm they only know the equilibrium function $f^*(x_L)$, but since they know x_L^* they also know x_i^*.) Thus, each uninformed firm has to maximize $x_u(1 - X_{-u}^*)$ with X_{-u}^* being the total quantity of all firms except u. At the same time the informed firm has to choose $f(x_L)$ such that $x_i(1 - X_{-i}^*)$ is maximized. But this implies that the first order conditions for uninformed firms and the informed firms are symmetric and $x_i = x_u$ must hold in equilibrium.

Having solved the market game after the merger we can now proceed by analyzing a) whether this merger is profitable, b) whether it decreases or increases welfare, and c) how it affects the profits of the merged firms' competitors. All questions are not hard to answer.

In order to analyze the profitability of the merger we have to compare the joint profit of the two firms before and after they merge. Before, the joint profit is $\frac{2}{(n+1)^2}$. After, it is $\frac{3}{(n+2)^2}$. (Simply note that the price after the merger is $\frac{1}{n+2}$.) Thus, the change in profits is $\frac{3}{(n+2)^2} - \frac{2}{(n+1)^2} = \frac{n^2-2n-5}{(n+2)^2(n+1)^2}$ which is positive if $n^2 - 2n - 5 > 0$, i.e., if $n \geq 4$.

In order to analyze social welfare it is (due to linearity) sufficient to compare the induced change in total quantities which is $\frac{n+1}{n+2} - \frac{n}{n+1} = \frac{1}{(n+2)(n+1)}$ and unambiguously positive. Thus, the merger is welfare improving. Finally, we find that a competitor's profit is unambiguously reduced (from $\frac{1}{(n+1)^2}$ to $\frac{1}{(n+2)^2}$).

We summarize our results in

Proposition 1 In symmetric linear Cournot markets with at least four firms a merger with enforced information sharing is profitable and welfare–improving. Furthermore, it reduces competitors' profits.

4 Model B: Merger without headquarter

We take the same setup as above. Each of the two merged firms maximizes its own profit. The only aspect we alter is that the two merged firms must now autonomously decide in which period to produce. Thus, we shall speak of a merger with endogenous information sharing.[9] Let the two merged firms be indexed by j. Then a merged firm's strategy is a 3-tuple $(x_i^1; f_i(x_j^1); x_i^2)$ where x_i^1 either specifies an output for period 1 or indicates that the firm waits, i.e. $x_i^1 \in \mathbb{R} \cup \{W\}$ with W indicating the decision to wait. The function $f(x_j^1)$ is a mapping $\mathbb{R} \to \mathbb{R}$ specifying the firm's reaction in case it has decided to wait while the other firm has chosen $x_j^1 \neq W$. Finally, x_i^2 specifies firm i's quantity decision for the case that both firms have decided to wait.[10] An uninformed firm's strategy can, as above, be simply described by a number, i.e., its quantity choice x_u that is taken in either of the two periods.[11]

We focus on equilibria in pure strategies. Some observations about possible subgame perfect equilibria of this game can be made.

1. If one of the merged firms decides to wait, the other will produce in the first period. (The waiting firm will adjust its output to the first mover's quantity or, to put it differently, regardless of the behavior of the uninformed firms there is a Stackelberg-leader advantage.)

2. In any subgameperfect equilibrium in which the two merged firms produce in the first period all firms produce standard Cournot

[9] This term does not preclude that merged firms won't share information. However, as we will show below, they will.

[10] Note that, as Hamilton and Slutsky (1990), we rule out that a firm which has chosen to produce in the first period can produce again in the second period. This assumption can be justified by assuming that firms have to make some arrangements for production actually to take place and that, consequently, producing in two periods instead of one causes fixed costs the firms wish to avoid. However, our results are nevertheless robust in the sense that allowing production in two periods would still yield the same outcomes (see Ellingsen, 1995, for details).

[11] As before, the timing of a firm not involved in the merger is irrelevant, as information about output decisions before the end of period 2 is available only within the merged firm, i.e., an uninformed firm can neither observe the output of others at the end of period 1 nor can its output, if it produces in period 1, be observed by others before the end of period 2.

quantities $\frac{1}{n+1}$. (Otherwise some …rm would obviously not play a best reply.)

3. All …rms producing Cournot quantities in the …rst period is an equilibrium in dominated strategies. (For one of the merged …rms, playing Cournot in the …rst period can never be better than waiting. On the other hand, waiting can clearly be better than playing Cournot.)

4. If one of the merged …rms decides to wait, i.e., decides to produce in the second period, it will produce the same equilibrium quantity as each uninformed …rm. (This follows from the same logic as above.)

Taken together, these observations dramatically narrow down the set of possible solutions. Most importantly, we …nd that (i), (ii), and (iii) imply that one of the merged …rms has to move …rst while the other has to wait. This implies that the same market structure results as in the case with a headquarter. Consequently, the …rms will also produce the same quantities such that we get identical market outcomes as in the case with a headquarter.

Proposition 2 In symmetric linear Cournot markets with at least four …rms a merger with endogenous information sharing is pro…table and welfare–improving. Furthermore, it reduces competitors' pro…ts.

5 Discussion

Empirical evidence on the e¤ects of mergers is mixed even where standard theory makes unambiguous predictions. For example, Banerjee and Eckard (1998) …nd that during the …rst great merger wave from 1897 to 1903 competitors of merging …rms su¤ered signi…cant losses which is inconsistent with the traditional modelling of mergers. The observation is, however, consistent with our approach which predicts such losses.

Our approach also predicts the opposite of standard models with respect to the pro…tability of mergers in a market with linear costs and with respect to their welfare implications. As the new wave of mergers still is irresistible we observe mergers in virtually all kinds of markets, including those where the linear–cost assumption seems well–justi…ed. In the traditional approach where one …rm "disappears" after a merger this is puzzling. But empirical evidence clearly shows that …rms acquiring other …rms typically keep target management (Hubbard and Palia 1999) and that the multisubsidiary form (which is implicitly assumed in our model) is the standard organizational form of a merged …rm (see, for example, Prechel, Boies, and Woods 1999 or Zey and Swenson 1999).

As we have shown, such an organizational form may have a signi…cant impact on the structure of the market which provides a new rationale for mergers.

In the …rst part of our analysis we show that if a joint headquarter can govern the (timing) decisions of its a¢liates this may render a merger pro…table even in the absence of cost advantages through the merger. One assumption drives this result— within a merged …rm information ‡ows more quickly and freely, and, due to this, clever governance can induce a commitment advantage for the merged …rm even if no other …rm can observe what its a¢liates are doing. In the second part of our analysis we abandon the assumption of a headquarter and show that, if all …rms are free to choose when to produce, the same market structure results as in the presence of a headquarter governing the merged …rm. As in Hamilton and Slutsky's (1990) model of endogenous timing (which our model generalizes by adding uninformed …rms) we observe endogenous (partial) Stackelberg leadership. Thus, it turns out that two simple assumptions which both seem quite realistic make a merger pro…table— the assumption that production does not take place at one and the same instant for all …rms and that, as pointed out above, a merger may create information channels through which a¢liated …rms can observe what other a¢liates do.

The policy implications of our analysis are twofold: Socially, mergers may be more welcome than traditional views suggest. This, however, may depend on the organizational form merged companies choose. Hence, in judging the (anti)competitive e¤ect of mergers governing bodies may wish to be regardful of how the merged …rm plans to operate.

On a more general level, the model suggests that one can only fully understand the consequences of merger when carefully considering its consequences for market structure. If one does, the standard view that mergers have to induce cost advantages to be pro…table and/or welfare–improving is no longer warranted.

References

[1] Banerjee, A., and E.W. Eckard (1998): Are mega-mergers anticompetitive? Evidence from the …rst great merger wave, Rand Journal of Economics 29, 803-827.

[2] Cabral, L.M.B. (1999): Horizontal mergers with free-entry: Why cost e¢ciencies may be a weak defense and asset sales a poor remedy, mimeo, New York University.

[3] Chandler, A.D. (1962): Strategy and Structure, Cambridge, MA: M.I.T. Press.

[4] Cyert, R.M., and J.G. March (1963): A Behavioral Theory of the

Firm, Englewood Cli¤s, NJ: Prenctice-Hall.

[5] Deneckere, R., and C. Davidson (1985): Incentives to form coalitions with Bertrand competition, Rand Journal of Economics 16, 473-486.

[6] Ellingsen, T. (1995): On ‡exibility in oligopoly, Economics Letters 48, 83-89.

[7] Farrell, J., and C. Shapiro (1990): Horizontal mergers: An equilibrium analysis, American Economic Review 80, 107-126.

[8] Federal Trade Commision (1999): Promoting competition, protecting consumers: A plain english guide to antitrust laws, http://www.ftc.gov/bc/compguide/index.htm.

[9] Gaudet, G., and S.W. Salant (1991): Increasing the pro…ts of a subset of …rms in oligopoly models with strategic substitutes, American Economic Review 81, 658-665.

[10] Hamilton, J.H., and S.M. Slutsky (1990): Endogenous timing in duopoly games: Stackelberg or Cournot equilibria, Games and Economic Behavior 2, 29-46.

[11] Hubbard, R.G., and D. Palia (1999): A reexamination of the conglomerate merger wave in the 1960s: An internal capital markets view, Journal of Finance 54, 1131-1152.

[12] Kreps, D., and J. Scheinkman (1983): Cournot precommitment and Bertrand competition yield Cournot outcomes, Bell Journal of Economics 14, 326-337.

[13] Nault, B.R., and R.K. Tyagi (2000): Implementable mechanisms to coordinate horizontal alliances, Management Science, forthcoming.

[14] O¢ce of Fair Trading (1999): Merger appraisal in oligopolistic markets, Economic Research Paper 19, November 1999.

[15] Perry, M.K., and R.H. Porter (1985): Oligopoly and the incentive for horizontal merger, American Economic Review 75, 219-227.

[16] Pesendorfer, M. (2000): Horizontal mergers in the paper industry, mimeo, Yale University.

[17] Prechel, H., J. Boies, and T. Woods (1999): Debt, mergers and acquisitions, institutional arrangements and change to the multilayered subsidiary form, Social Sciences Quarterly 80, 115-135.

[18] Salant, S.W., S. Switzer, and R.J. Reynolds (1983): Losses from horizontal merger: The e¤ects of an exogenous change in industry structure on Cournot–Nash equilibrium, Quarterly Journal of Economics 98, 185-199.

[19] Zey M., and T. Swenson (1999): The transformation of the dominant corporate form from multidivisional to multisubsidiary: The role of the 1986 Tax Reform Act, Sociological Quarterly 40, 241-267.

Appendix

To solve the game of Section 3 let us proceed step by step.

First, consider an uninformed firm u and let X_U denote total output of all uninformed firms. Its best–reply correspondence assigns to each possible combination of x_L, $f(x_L)$ and $X_{U\setminus u} = \sum_{i \in U \setminus \{u\}} x_i$ a unique quantity x_u which maximizes $x_u(1 - x_L - f(x_L) - X_U)$. Thus firm u's best reply is given by

$$x_u^* = \frac{1}{2}(1 - x_L - f(x_L) - X_{U\setminus u}). \qquad (1)$$

The informed firm's best–reply correspondence assigns to each possible combination of x_L and X_U a function f such that $f(x_L)(1 - x_L - f(x_L) - X_U)$ is maximized. Therefore,

$$f^*(x_L) = \frac{1}{2}(1 - x_L - X_U) \qquad (2)$$

has to hold. It is important to notice that there is for each combination of x_L and X_U an infinite number of functions f^* fulfilling this condition. The best–reply correspondence only demands that f^* assumes a certain value at one particular point and says nothing about the shape of the function elsewhere. Obviously, this is the reason for the multiplicity of equilibria.

However, requiring sequential rationality narrows down the set of functions for firm I. Sequential rationality demands that firm i reacts optimally in all its information sets. As the information sets of firm I are single–valued there are no problems of specifying I's beliefs. Firm I can only react to what it knows about x_L. Taking into account that (2) has to hold, this implies that firm i must choose a function of the form

$$f^*(x_L) = Z - \frac{x_L}{2}. \qquad (3)$$

In essence, this means that, demanding sequential rationality, we now can analyze a "truncated game" where Z is firm I's only choice variable. This means that we can rewrite (1) and (2) as follows. For a firm u

$$x_u^* = \frac{1}{2}(1 - \frac{1}{2}x_L - Z - X_{U\setminus u}) \qquad (4)$$

has to hold and for firm I

$$Z^* = \frac{1}{2}(1 - X_U). \qquad (5)$$

Notice that (5) ensures uniqueness.

Next, we can focus on the leader L. In the truncated game its best–reply correspondence assigns to each combination of Z and X_U a unique quantity x_L maximizing $x_L(1 - \frac{1}{2}x_L - Z - X_U)$. Accordingly,

$$x_L^* = 1 - Z - X_U. \tag{6}$$

Using the symmetry of the uninformed firms, we can now solve the following simultaneous equations

$$\begin{aligned} x_u^* &= \tfrac{1}{2}(1 - \tfrac{1}{2}x_L^* - Z^* - (n-3)x_u^*) \\ Z^* &= \tfrac{1}{2}(1 - (n-2)x_u^*) \\ x_L^* &= 1 - Z^* - (n-2)x_u^* \end{aligned} \tag{7}$$

which gives $x_u^* = \frac{1}{n+2}$; $x_L^* = \frac{2}{n+2}$; and $Z^* = \frac{2}{n+2}$. The implies that the informed firm chooses $f^*(x_L) = \frac{2}{n+2} - \frac{1}{2}x_L$ which yields in equilibrium $x_i^* = \frac{1}{n+2}$.