The Auctioning of a Failing Firm

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Abstract

This paper evaluates the welfare consequences of the failing firm doctrine in the EU and US merger laws. I combine an oligopoly model with an "endogenous valuations" auction model. Thereby, I take into account that, in an oligopoly, a firm's willingness to pay for the assets depends on the identity of the alternative buyer. The main result is that the doctrine leads to cost inefficiencies, due to a "least danger to competition" (LDC) condition, which favors small, and thus inefficient, firms. In particular, the LDC condition implies that small firms can preempt acquisitions that would lead to both higher producer surplus and higher consumer surplus.

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1. Introduction

Mergers creating or strengthening dominant positions are illegal according to the competition laws in most developed countries. Competition authorities typically implement these laws in a way which can roughly be described as "trying not to allow measured concentration to become too high".[1] If the target is failing, a merger leading to high concentration may nevertheless be accepted under the so-called failing firm defense.[2] For instance, the failing firm defense is well established in the US case-law as is indicated by the following quote from Hovenkamp[3] (1994, p. 496): "The failing firm company is well established in anti trust case law, although a qualifying "failing firm" has been found only a few times.[4] Citizen Publishing Co. v. United States assessed the requirement that before the failing company defense can be used, the defendant must show 1) that the acquired firm is almost certain to go bankrupt and cannot be reorganized successfully; and 2) that no less anticompetitive acquisition (i.e., by a smaller competitor or a noncompetitor) is available as an alternative."

Moreover, the failing firm defense is included in the Department of Justice and Federal Trade Commission US 1992 Horizontal Merger Guidelines which state that an otherwise anti-competitive merger may be permitted if four conditions are met: 1) the allegedly

[1] For instance, in the US, the Herfindahl-Hirschman Index (HHI) is used as a measure of concentration. The HHI is calculated by summing the squares of the individual market shares of all firms in the market.

[2] Mergers with failing targets are not quantitatively irrelevant. For instance, in a 634-company sample including a cross section of both small and large acquisition targets, 5.8% had a negative operating income in the year before being acquired, see Scherer, F. M., and Ross, D., "Industrial Market Structure and Economic Performance," Houghton Mifflin Company, 1990.

[3] Hovenkamp, H., "Federal Antitrust Policy: The Law of Competition and its Practice," West Publishing Co., 1994.

[4] "See Union Leader Corp. v. Newspaper of New England, Inc., 284 F.2d 582, 589-590 (1st Cir. 1960), cert. denied, 365 U.S. 833, 81 S.Ct. 747 (1961) (stating failing company defense, but in fact finding no injury to competition; FTC v. Great Lakes Chem. Corp., 528 F.Supp. 84, 96-98 (N.D.III.1981) (approving a merger that would benefit failing firm, its shareholder, and economy); Grander v. Public Bank, 281 F.Supp. 120 (E.D.Mich.1967) (defense accepted where bank failure would injure the public and alternative offers were unacceptable); United States v. M.P.M., 397 F.Supp. 78, 96 (D.Colo.1975) (defense accepted where failure was almost certain and attempts to find alternative transactions failed)."

failing firm would be unable to meet its financial obligations in the near future; 2) it would not be able to reorganize successfully under Chapter 11 of the Bankruptcy Act; 3) it has made unsuccessful good-faith efforts to elicit reasonable alternative offers of acquisition of the assets of the failing firm[5] that would both keep its tangible and intangible assets in the relevant market and pose a less severe danger to competition than does the proposed merger; and 4) absent the acquisition, the assets of the failing firm would exit the relevant market.

In the EU, neither Article 2 of the Merger Regulation nor any other provision of the Community merger legislation contain an explicit reference to the "failing firm defense" as a ground for authorizing a merger that would create or strengthen a dominant position in the EU. Despite the lack of statutory definition, the Commission has developed the concept of a "rescue merger" in its case-law.[6]

The concept of the "rescue merger" has been invoked by the parties as a ground for authorizing the notified transaction before the Commission in several cases. However, Kali and Salz/Mdk/Treuhand[7] is the only case to date where this concept is discussed in length in the Commission's decision. In point 71, the Commission states that: "Accordingly, a merger generally is not the cause of the deterioration of the competitive structure if it is clear that:

- the acquired undertaking would in the near future be forced out of the market if not taken over by another undertaking,

- the acquiring undertaking would take over the market share of the acquired undertaking if it were forced out of the market,

- there is no less anticompetitive alternative purchase."

The general motivation for allowing mergers in these circumstances is that the rejection of a proposed merger when the target is failing might lead to the liquidation of

[5] "Any offer to purchase the assets of the failing firm for a price above the liquidation value of those assets - the highest valued use outside the relevant market or equivalent offer to purchase the stock of the failing firm - will be regarded as a reasonable alternative offer."

[6] See the Contribution by the European Commission Delegation in OECD Roundtables, Failing Firm Defense, OECD/GD(96)23.

[7] Case No IV/M.308. See Official Journal of the European Communities, No L 186/38.

productive assets. On these grounds, it has been argued that the failing firm defense has positive effects on welfare.[8] But little attention has been paid to failing firm rules in economic theory, despite their policy relevance.[9]

Existing studies of the failing firm defense employ models that are unsatisfactory in several respects. First, they do not model the market in which the failing firm has failed as an oligopoly.[10] Rather, all studies rely on perfect competition models, monopoly models, dominant-firm models or *ad hoc* assumptions concerning the value of the failing firm's assets under different ownerships. But typically, the failing firm defense is applied to situations with a concentrated market and other potential buyers for the failing firm. Thus, studying the performance of the failing firm defense in an oligopoly seem essential. The main advantage of using an oligopoly model is that it can then be captured how the allocation of the failing firm's assets affects the distribution of production in the industry, and thus the consumer and producer surplus. The second unsatisfactory feature of these studies is that they abstract from the issue of how the assets are sold. But, the identity of the buyer depends on how the assets are sold. Thus, a formal model of the selling of the assets is needed for evaluating the different acquisition rules.

The aim of this study is to evaluate the welfare implications of the US failing firm

[8] Note that in this paper, *failing firm defense* refers to all laws concerning this situation, whereas *the US failing firm defense* refers to the US version.

[9] As far as I know, only a few studies deal with this issue. Campbell, T. J., "The Efficiency of the Failing Company Defense," *Tex. L. Rev*, 1984, Vol. 63, 251-283, Friedman, R. D., "Untangling the Failing Company Doctrine," *Tex. L. Rev*, 1986, Vol. 64, 1375-1426, Kwoka, JR. J. E. and Warren-Boulton, F. R., "Efficiencies, Failing Firms, and Alternatives to Merger: A Policy Synthesis," *The Antitrust Bulletin*, Summer 1986, 431-450, McChesney, F. S., "Defending the Failing-Firm Defense," *Neb. L. Rev*, 1985, Vol. 65, 1-20, and Shughart II, W. F. and Tollison, R. D., "The Welfare Basis of the "Failing Company" Doctrine," *The Antitrust Bulletin*, Summer 1985, 357-364. All these studies concern the efficiency of the failing firm defense in the US 1984 Merger Guidelines, which differs slightly from the failing firm defense in the US 1992 Merger Guidelines. For a discussion of the differences between the 1984 and 1992 rules see Persson, L., "The Auctioning of a Failing Firm?," 1998a. In L. Persson, Ph. D. Thesis, Stockholm University. Monograph Series, No. 35.

[10] The paper by Friedman (1986) is the exception (Cited in note 7). The author studies the welfare effects of letting the assets stay in the industry with letting them exit. However, the author does not compare the welfare effects of letting different firms in the industry obtain the failing firm's assets, an issue which is central to my study.

defense rule and the EU rescue merger rule. When will either of these imply that the socially preferred buyer obtains the assets, or at least performs better than the standard merger law rule? Will one of these rules perform better than the other?

In order to incorporate the above mentioned desirable features, I will employ a model in which a firm in a Cournot industry is failing. The remaining firms, as well as an outside firm, are potential buyers of the failing firm's assets, which are sold at an auction. In this case, the identity of the buyer affects the profits of all firms. This interdependence constitutes a fundamental difficulty when determining the buyer, since the price a potential buyer is willing to pay for the assets depends on who might otherwise obtain them.[11] This problem was only solved recently. In particular, my study will use the approach taken by Funk (1996) and Jehiel and Moldovanu (1996),[12] who analyze auctions where the bidders' valuations of an auctioned item depend on the other bidders' identities.[13]

Using the above approach, I show that the US failing firm defense does not guarantee that the socially preferred buyer obtains the failing firm's assets, for two reasons. First, under the US failing firm defense, the allocation of the failing firm's assets are dependent

[11] Few papers deal with the selling of objects which exert externalities on other potential buyers. Exceptions, among others, are Gale, I., "A Multi-Object Auction with Superadditive Values," *Economic Letters*, 1990, Vol. 34, 323-328, Ghemawat, P., "The Snowball Effect," *International Journal of Industrial Organization*, 1990, 8, 335-351, and Krishna, K., "Auctions With Endogenous Valuations: The Persistence of Monopoly Revisited," *American Economic Review*, March 1993, 83, 147-160. The literature on patent licensing also explicitly considers the external effects. See for instance Gilbert, R. J. and Newbery, D. M. G., "Preemptive Patenting and the Persistence of Monopoly," *American Economic Review*, 1982, Vol. 72, 514-526, and Katz, M. L. and Shapiro, C., "How to License Intangible Property," *Quarterly Journal of Economics*, 1986, Vol. 101, 567-589.

[12] Funk, P., "Auctions With Independent Valuations," *International Journal of Game Theory*, 1996, 25, 51-64; and Jehiel, P. and Moldovanu, B., "Strategic Nonparticipation," *RAND Journal of Economics*, Spring 1996, Vol. 27, 84-98.

[13] Note that in line with the existing literature on merger policy, the aim of the paper is to study existing merger law rules, rather than to try to derive the optimal selling mechanisms for the competition authority.

It should be pointed out that almost no literature derives optimal mechanisms for the selling of objects which cause externalities on other potential buyers. As far as I, know Jehiel, P., Moldovanu, B., and Stacchetti, E., "How (Not) to Sell Nuclear Weapons," *American Economic Review*, September 1996a, Vol. 86, 814-829 and Jehiel, P., Moldovanu, B., and Stacchetti, E., "Multidimensional Mechanism Design for Auctions with Externalities," mimeo, 1996b, are the only paper on this subject.

on the firms' bids, and it is well-know that private and social values of assets might differ in an oligopoly. Second, the US failing firm defense includes a "least danger to competition" (LDC) condition, which favors small buyers in the bidding process. At first sight, one might believe that this condition should mitigate the inefficiency caused by making the allocation dependent on the firms' bids. This is not the case, however. In particular, the LDC condition might prevent the most welfare enhancing acquisitions. Too see this, consider a situation where the smaller firm's cost savings from obtaining the failing firm's assets are small. Thus, the smaller firm would not be willing to pay much for the assets if these would otherwise exit. Assume that the cost savings from obtaining the failing firm's assets for a large firm are so large that the firm will expand the output to the extent that the market price will be lower than if the smaller firm obtains the assets. But, the smaller firm's profit will then decrease and consequently, it will be willing to pay for preventing the larger firm from obtaining the assets. The LDC condition implies that this could be done by the smaller firm without overbidding the larger firm, but just overbidding the *liquidation value*. Consequently, the LDC condition implies that a small firm could preempt an acquisition that would lead to both higher producer surplus and higher consumer surplus. This result suggests the importance of taking cost efficiencies into account, when evaluating a merger involving a failing firm.

The LDC condition might be good for consumers, however, if the cost savings are symmetric enough, since then smaller firms have less to lose from a price fall and consequently, have stronger incentives to expand output, which benefits the consumer through lower prices. Furthermore, I show that if society considers the revenues from selling the assets to be important, the failing firm defense is not suitable, since the LDC condition severely restricts the bidding competition between the firms within the industry.

The additional major drawback with the EU failing firm defense is that productive assets exit the industry, due to a "market share" condition, which implies that the defense is only applicable when the purchaser is a monopolist.

The paper is organized in the following way. Section 2 introduces the model of how the failing firm's assets are sold and later employed. The model consists of a Cournot

industry with n active firms and one non-viable firm. There is also one active firm outside the Cournot industry. In Section 2.1, the model where the failing firm's assets are sold is described in detail. The selling of the failing firm's assets is modeled as a sealed bid auction where the potential buyers simultaneously post bids. In Section 3, the US failing firm defense rules and the EU rescue merger rule are defined and their welfare implications derived. Section 4 concludes.

2. The Model

Consider a Cournot industry with n active firms and one firm which is failing.[14] There is also one firm labeled e, which is active outside the Cournot industry. There are two stages of interaction. In the first stage, the failing firm's assets are sold in one piece at an auction where the n active Cournot firms and the outside firm are the potential buyers. In the second stage, the n firms compete in a standard way in the Cournot industry, where one of them has possibly obtained the failing firm's assets.[15] The outside firm's behavior is not explicitly modeled, but is assumed to generate profits and consumer surplus. The outside market can thus be seen as a perfectly competitive market, a monopoly market or an oligopoly market.

The Cournot model is a modified version of the model analyzed by Farrell and Shapiro (1990b)[16], where inverse demand is given by $p(Q)$, p is price, Q is industry output and $p'(Q) < 0$. The consumer gross surplus function is $B(Q) \equiv \int_0^Q p(z)dz$. Firm i's variable

[14] Several explanations why the firm is failing are compatible with the model. For instance, the firm may not be viable if the market has been hit by an unforeseen shock; possibly a demand fall or cost shifts.

Support for this assumption can be found in richer models with financial asymmetries between the firms. Bolton, P. and Scharfstein, D. S., "A Theory of Predation Based on Agency Problems in Financial Contracting," *American Economic Review*, March 1990, Vol. 80, 93-106 provide a model where the creditor offers an optimal long-term contract. In order to provide managerial incentives, the creditor needs to punish a firm with a low profit in the first period by increasing the risk of termination.

[15] It is assumed that the failing firm's assets cannot be resold in the second period.

[16] Farrell, J and Shapiro, C, "Asset Ownership and Market Structure in Oligopoly," *RAND Journal of Economics*, Summer 1990b, Vol. 21, 275-292.

cost is $c^i \equiv c^i(q_i, k_i)$ and its total cost $C^i \equiv c^i + f^i$. I denote $c^i_q \equiv \frac{\partial c^i(q_i,k_i)}{\partial q_i}$ and $c^i_k \equiv \frac{\partial c^i(q_i,k_i)}{\partial k_i}$, and it is assumed that $c^i_{qk} \equiv \frac{\partial^2 c^i(q_i,k_i)}{\partial q_i \partial k_i} < 0$. Thus, more capital lowers the marginal costs.

Firms in the industry compete in Cournot fashion, where firm i maximizes $\pi_i \equiv p(Q)q_i - C^i(q_i, k_i, f_i)$. The Nash equilibrium[17] is defined by

$$p(Q) + q_i p'(Q) - c^i_q(q_i, k_i) = 0, \quad i = 1, ..., n. \tag{2.1}$$

The firms in the industry are labeled such that $k^0_1 > k^0_2 ... > k^0_n$. Thus, firm 1 is the largest firm in the industry. The social welfare measure is given by $W \equiv B(Q) - \sum_{i=1}^n C^i(q_i, k_i, f_i) + W^e$, where W^e is the welfare in the outside market.

It will be useful for the subsequent analysis to derive the equilibrium effects of a marginal increase in the number of assets owned by some firm i. Following Farrell and Shapiro, and letting $\lambda_i \equiv \frac{-p'(Q)-q_i p''(Q)}{c^i_{qq}-p'(Q)}$, $\delta_i \equiv \frac{-c^i_{qk}}{c^i_{qq}-p'(Q)}$ and $\Lambda \equiv \sum_{i=1}^n \lambda_i$, the following results can be shown to hold:

$$dq_i = -\lambda_i dQ + \delta_i dk_i \tag{2.2}$$

$$dQ = \frac{\delta_1 dk_1}{1+\Lambda} \tag{2.3}$$

$$\frac{d\pi_1}{dk_1} = -p'(Q)\frac{\delta_1(\Lambda - \lambda_1)}{1+\Lambda}q_1 - c^1_k > 0 \tag{2.4}$$

$$\frac{d\pi_i}{dk_1} = p'(Q)\frac{\delta_1(1+\lambda_i)}{1+\Lambda}q_i < 0, i \neq 1 \tag{2.5}$$

and

$$\frac{dW}{dk_1} = -p'(Q)\frac{\delta_1}{1+\Lambda}(q_1(1+\Lambda) - \sum_{i=1}^n \lambda_i q_i) - c^1_k \tag{2.6}$$

In the analysis below, I will also frequently employ a model—denoted "the linear model"—where inverse demand is $p = 1 - Q$, and where each firm's cost function is given by $c^i = \frac{q_i}{k_i}$. Assuming that there are two firms in the industry, the equilibrium

[17] Two standard assumptions are made about the Cournot equilibrium. First, it is assumed that each firm's reaction function slopes downward; i.e. $p'(Q) + q_i p''(Q) < 0, \quad i = 1, ..., n$. Second, it is assumed that the demand curve facing each firm intersects that firm's marginal cost curve from above; i.e., that $c^i_{qq}(q_i, k_i) > p'(Q), \quad i = 1, ..., n$. This assumption is a stability condition for a Cournot equilibrium.

outputs are given by $q_i = \frac{1}{3}\frac{k_j k_i - 2k_j + k_i}{k_j k_i}$ and $Q = \frac{1}{3}\frac{2k_j k_i - k_j - k_i}{k_j k_i}$, where $k_i \geq 2\frac{k_j}{k_j+1}$ ensures positive quantities. The marginal effects in this case are: $\frac{d\pi_i}{dk_i} = \frac{4(k_j k_i - 2k_j + k_i)}{9k_j k_i^3}$, $\frac{d\pi_i}{dk_j} = -\frac{2(k_j k_i - 2k_j + k_i)}{9k_j^3 k_i}$, and $\frac{dW}{dk_i} = \frac{4k_j k_i - 11k_j + 7k_i}{9k_i^3 k_j}$.

2.1. The auction

For a failing firm defense argument to be accepted, competition authorities typically require that there must be no alternative buyer who might cause less harm. They may even require, as a verification, that more preferred buyers have been asked to make an offer for the firm. If such an investigation has not been made, the competition authorities often arrange for a third party to sell the assets.[18] Thus, the failing firm defense rule can be interpreted as an auction where the firms post bids and the competition authority decides who obtains the assets, given the posted bids. The winning buyer typically pays an amount equal to his bid. The collection of bids seems relatively secret.[19] Thus, the buyers do not seem to know each others' bids when bidding.[20] Therefore, the bids are here assumed to be made simultaneously.

Let us now turn to the firms' valuations of an arbitrary distribution of the failing firm's assets. These valuations do not only depend on the identity of firm i, but also on the identity of the firm obtaining the assets, firm j, and on the identity of the firm that will obtain the assets if firm j does not. Some notation is required in order to define a firm's valuation. Let firm i's capital stock be denoted k_i and let $\mathbf{K} \equiv (k_1, ..., k_n, k_e, k_f)$, where k_e denotes the capital stock of the external firm, and k_f the failing firm's capital stock. The corresponding vector in the case where the failing firm's assets are liquidated is used as

[18] In the OECD/GD(96)23 roundtable (cited in note 3), the Secretariat wrote: " This explains why certain jurisdictions withhold a failing firm defence/exception unless the parties demonstrate that serious third party efforts have been made to "shop the firm", and have failed to produce a less anti-competitive reasonable offer". See the E.C. Case No IV/M.308-Kali+Salz/MdK/Treuhand, and FTC v. Harbour Group Investment, L.P., 1990-2 Trade Cas. 69,247 (D.D.C. 1990), for cases where an inadequate search for an alternative buyer resulted in a preliminary injunction.

[19] For instance, the Canadian contribution states that: "While every effort to maintain confidentiality would be made, clearly some important information would have to be disclosed".

[20] I assume that all potential buyers participate in the bidding, and that all potential buyers expect all other potential buyers to participate.

a reference point for interpretational convenience, and is denoted $\mathbf{K^0} \equiv (k_1^0, ..., k_n^0, k_e^0, 0)$. The increase in capital stock for firm i when obtaining the failing firm's assets is denoted $\Delta k_i = \bar{k_f}$. Let $\mathbf{K}^j$ denote the vector of capital stocks after firm j has obtained the failing firm's assets and $\pi_i(\mathbf{K}^j)$ denote the profit made by firm i when firm j has acquired the failing firm's assets. Then, the valuation for firm i, v_i^{jl}, is defined:

Definition 1. $v_i^{jl} \equiv \pi_i(\mathbf{K}^j) - \pi_i(\mathbf{K}^l)$

This valuation is determined by two components. The first is the profit made by firm i when firm j has acquired the failing firm's assets. The second is the profit made by firm i when firm l has acquired the assets. v_i^{il} is the gain for firm i of obtaining the assets given that firm l will otherwise obtain them. From definition (1), we see that $v_i^{il} = (\pi_i(\mathbf{K}^i) - \pi_i(\mathbf{K^0})) + (\pi_i(\mathbf{K^0}) - \pi_i(\mathbf{K}^l))$. Thus, the valuation of obtaining the assets for firm i is the profit increase caused by its asset expansion plus the profit loss avoided by preventing firm l from expanding. Most auction literature does not deal with situations where the latter effect exists. But, as we shall see, it plays a central part in an auction where the potential buyers compete in an oligopoly. Note that the valuation for firm i of obtaining the assets instead of letting them exit is denoted $v_i^{i\mathbf{0}}$.

The valuation for firm i of firm j instead of firm l obtaining a marginal amount of assets is $\frac{dv_i^{jl}}{dk_j} \equiv \frac{d\pi_i(\mathbf{K}^0)}{dk_j} - \frac{d\pi_i(\mathbf{K}^0)}{dk_l}$, where $dk_j = dk_l > 0$ denotes that the assets are obtained by firm j.

A bid (strategy) by one of the potential buyers is a real number $b_i \in R$. As observed above, competition authorities typically require that, for the failing firm defense argument to be accepted, there must be no alternative buyer who might cause less harm to competition,. The interpretation of the expression *less harm to competition* is crucial. This criterion is open to interpretation. But, in practice, it seems as if competition authorities are really looking at market shares.[21] In order to capture this requirement, let

[21] Another possibility is to assume that the competition authorities use the HHI or the Learner Index instead of market shares. The HHI or Learner index would increase less, however, if a smaller firm obtained the assets in a Cournot model. Thus, the set-up is also compatible with this interpretation.

firm i's market share be denoted by $s_i \equiv \frac{q_i}{Q}$. Furthermore, let $\mathbf{s}$ be an arbitrary vector of market shares in the industry and $\mathbf{S}$ the set of all such vectors. The sales mechanism w of the competition authority is then a function from $R^{n+1} \times \mathbf{S}$ to $\{1, ..., n, e\}$ defining a winner $w(\mathbf{b}, \mathbf{s}) \in \{1, ..., n, e\}$. The different acquisition rules studied in the analysis below, will be described by means of different sales mechanisms.

The payoff for a potential buyer i, $\Pi_i(\mathbf{b}, w(\mathbf{b}, \mathbf{s}))$, is $v_i^{j\mathbf{0}}$ if $w(\mathbf{b}, \mathbf{s}) = j \neq i$, and $v_i^{i\mathbf{0}} - b_i$ if $w(\mathbf{b}, \mathbf{s}) = i$. Let $W(\mathbf{K}^i)$ denote the welfare when firm i has obtained the failing firm's assets. The payoff $W_i(\mathbf{b}, w(\mathbf{b}, \mathbf{s}))$ for the authority is $W(\mathbf{K}^i) - W(\mathbf{K}^\mathbf{0})$.

The auctions will be solved for Nash equilibria in undominated pure strategies. It is assumed that there is a smallest monetary unit, denoted by ε. We assume that ties are randomly broken, and that all equalities like $v_i^{ik} = v_j^{jl}$ are ruled out. The smallest amount ε is chosen such that all inequalities are preserved if an ε is added or subtracted.

3. Acquisition Rules

To focus on the difference between the failing firm defense rules and the standard merger law, it is assumed that any merger between firms in the industry is blocked when the standard merger law is applied.[22] That is, the external firm is assumed to obtain the assets under the standard merger law rule.

Let us now turn to the formal interpretations of the different failing firm defense rules. I start with the US, where the case-law has established that the failing firm defense can be used if the two conditions described in the introduction are met. The first condition requires that the failing firm must be unable to meet its financial obligations

Yet another interpretation is that the alternative buyer would pose less severe danger to high prices. This interpretation would not be compatible with the analysis provided here. However, this criterion seems much more demanding for the competition authority, and is apparently not used in practise.

[22] This assumption puts restrictions on the underlying Cournot model. Basically, it means that the merger increases concentration in a non-neglible way and that cost savings associated with the merger are limited. In the analysis below, it will not be verified whether these restrictions are satisfied.

The analysis is also simplified by this assumption, since it certifies that no other merger than the possible merger with the failing firm takes place.

and is not viable in the long run. Condition 2 requires that no less anticompetitive acquisition is available. The 1992 Merger Guidelines seem to adopt this position: The first condition mentioned above corresponds to the two first conditions in the 1992 US Merger Guidelines. The second condition corresponds to the third and fourth conditions in the 1992 US Merger Guidelines.[23] However, since the rules in the Guidelines are more explicitly described, I will use these in my analysis.

The first condition in the 1992 US Merger Guidelines requires that the failing firm must be unable to meet its financial obligations. The second condition ensures that the firm does not only have short-term difficulties, but is also not viable in the long run. Since it is simply assumed in this set-up that the "failing firm" is failing, the first two conditions are fulfilled by assumption. Condition 3 refers to an alternative buyer that would pose *less severe danger to competition.* As assumed above, this corresponds to a firm with a smaller market share. Furthermore, this alternative buyer must make a reasonable offer, defined as follows: "Any offer to purchase the assets of the failing firm for a price above the liquidation value of those assets - the highest valued use outside the relevant market or equivalent offer to purchase the stock of the failing firm - will be regarded as a reasonable alternative offer." Moreover, in this set-up, Condition 4 is fulfilled if and only if Condition 3 is fulfilled, since it is assumed that the failing firm will be liquidated and exit if not acquired. We can therefore ignore Condition 4.[24] Hence, the US failing firm defense is valid here if and only if Condition 3 is satisfied.

Formally, this rule can be described in the following way. Recall that firm 1 is the largest firm, firm 2 the second largest, etc., and let h be defined: $h = \max\{i : b_i \geq b_e\}$. Thus, h is the smallest firm in the industry that posts a bid at least as high as the bid posted by the external firm. The selling rule, $w^{US}(\mathbf{b}, \mathbf{s})$, is then defined:

[23] According to Hovenkamp (1994, p. 496) (cited in note 3) the US 1992 Merger Guidelines generally adopt the position of the case-law concerning the failing firm defense.

[24] This seems reasonable, since the fourth condition is provided to ensure that the firm is not viable in the long run. Hovenkamp (1994) (cited in note 3) makes the following interpretation: "The fourth factor is an addition from the 1984 Guidelines, and suggests that the enforcement agencies are going to give assertions of the failing company defense even closer scrutiny than they have received in the past".

Definition 2. $w^{US}(\mathbf{b},\mathbf{s}) = \left\{ \begin{array}{c} h \text{ if } h \text{ exists} \\ e \text{ otherwise} \end{array} \right\}$

In the Kali and Salz case in the EU, the Commission stated that an otherwise anti-competitive merger may be permitted if three conditions, described in the Introduction, are met. More specifically: (i) The Commission considered that MdK was not competitive and constituted a failing firm, for the purposes of the application of the "rescue merger" principle. (ii) According to the Commission, it could reasonably be expected that if MdK no longer existed as a competitor, virtually all of its market share would go to Kali and Salz. (iii) Goldman Sachs was assigned the task of inviting tenders for MdK. None of the companies contacted by Goldman Sachs or the Commission was prepared to acquire MdK. On this basis, the Commission concluded that all requirements for the application of the concept of a "rescue merger" were met in this case.[25]

In this set-up, EU Conditions (i) and (iii) are identical with Conditions 1 to 4 in the 1992 US Merger Guidelines. Condition (ii) adds an extra restriction. The competition authority's strategy is therefore defined:

Definition 3. $w^{EU}(\mathbf{b},\mathbf{s}) = \left\{ \begin{array}{c} h \text{ if } h \text{ exists and } s_h(\mathbf{K}^h) \leq s_h(\mathbf{K}^0) \\ e \text{ otherwise} \end{array} \right\}$

The difference between the US and the EU rule is the EU Condition (ii) which adds an extra restriction to the EU requirement. This difference was explicitly discussed in the Joined Cases C-68/94,[26] which is the only case where the rescue merger concept has been discussed by the Court. The French Government argued that the Commission

[25] In one other case only, the De Havilland case, did the Commission examine whether a notified concentration would constitute a "rescue merger". The case concerned the joint acquisition of De Havilland, the regional aircraft division of Boeing, by Aérospatiale and Alenia The parties argued that if the proposed operation had not taken place, De Havilland's production might have been phased out by Boeing. However, on basis of the evidence made available, the Commission assessed that there was no such likelihood. The Commission then concluded that the concept of a "rescue merger" did not apply. See the Contribution by the European Commission Delegation in OECD Roundtables, Failing Firm Defense, OECD/GD(96)23.

[26] The Court of Justice of the European Communities, Judgment of the Court, Joined Cases C-68/94, available at http://www.curia.eu.int/en/index.htm

arbitrarily introduced the criterion of the absorption of market shares. However, the EU Court rejects this plea, as stated in Point 116:

"The criterion of absorption of market shares, although not considered by the Commission as sufficient in itself to preclude any adverse effect of the concentration on competition, therefore helps to ensure the neutral effects of the concentration as regards the deterioration of the competitive structure of the market. This is consistent with the concept of causal connection set out in Article 2(2) of the Regulation."

It is also interesting to note that the French Government criticized the Commission for incorrectly using the "failing company defense" in the U.S. antitrust legislation. However, the Court argued that this did not affect the lawfulness of the Commissions decision, as stated in Point 112:

"It must be observed, first of all, that the fact that the conditions set by the Commission for concluding that there was no causal link between the concentration and the deterioration of the competitive structure do not entirely coincide with the conditions applied in connection with the United States 'failing company defence' is not in itself a ground of invalidity of the contested decision. Soley the fact that the conditions set by the Commission were not capable of excluding the possibility that a concentration might be the cause of the deterioration in the competitive structure of the market could constitute a ground of invalidity of the decision."

To illustrate the differences between these failing firm defense rules and the standard merger law rule in this set-up, consider the following example: There are three firms in a market, one failing firm and two viable firms, firms 1 and 2. Firm 1 has a larger market share than firm 2. There is also a fourth firm, e, which is active in another market. The table below shows how the different acquisition rules allocate the assets for a given vector of bids, (b_1, b_2, b_e). I use two combinations of bids in order to illustrate the main differences between the rules. In either case, firm 1 makes the highest bid. The difference between the two cases is that in case 1, firm 2's bid exceeds the external bid, whereas the opposite holds in case 2.

	Bid Vector	SML and EU Rule	US 1992 Rule
1	$b_1 > b_2 > b_e$	Firm e	Firm 2
2	$b_1 > b_e > b_2$	Firm e	Firm *1*

In both cases, the standard merger rule implies that firm e obtains the assets, since neither firm 1 nor firm 2 is allowed to acquire the assets, by assumption.

In Case 1, the US rule implies that firm 2 obtains the assets, since there is no "competitively preferable buyer" with a higher bid. Firm 1 does not obtain the assets, since its market share exceeds that of firm 2. In Case 2, according to the US rule, firm 1 will be allowed to acquire the assets, since these would otherwise exit the market.

If there are at least two firms in the industry, no firm take over the exiting firm's entire market share in a Cournot model. Thus, if at least two firms remain in the market, the EU rule implies that the assets are obtained by the outside firm.

3.1. The equilibrium

The firms' bidding behavior is dependent on the relation between their own valuation of obtaining the failing firm's assets and all other firms' valuations of obtaining these assets. All possible orderings of the different firms' valuations must first be considered as options in the analysis. In the case with two firms in the industry and one firm outside, there are 30 different orderings to consider, as is verified in Lemma A1 in the Appendix.

In order to make the analysis of the equilibrium more tractable, weakly dominated strategies are first eliminated. The weakly dominated respectively not weakly dominated strategies are described in the following Lemma:

Lemma 1. *(1) For w^{US} and w^{EU}, we have that (i) any bid $b_i \geq \max_j v_i^{ij}$ is weakly dominated by the bid $b_i' \equiv \max_j v_i^{ij} - \varepsilon$, (ii) any bid $b_i \leq b_i'$ is not dominated.*

Proof. See Appendix.

The following Lemma shows that the analysis can be even further restricted.

Lemma 2. *No firm will in equilibrium obtain the failing firm's assets for any bid $b_h > v_e^e$ under (i) w^{US} or (iii) w^{EU}.*

Proof. See Appendix.

Let us now turn to the identification of the equilibrium buyers under the different acquisition rules. The following Lemma identifies the equilibrium buyer under the US rule for the case of one and two firms, respectively, in the industry. To simplify the presentation, the ordering of inequalities has been denoted in the following way: For instance, when $n = 2$, $v_e^e \overset{1}{>} v_i^{ij}$ refers to all orderings where the first inequality is $v_e^e > v_i^{ij}$ as in the ordering: $v_e^e > v_1^{12} > v_1^{1e} > v_2^{21} > v_2^{2e}$ and $v_e^e > v_2^{21} > v_1^{12} > v_1^{1e} > v_2^{2e}$, etc.

Lemma 3. *Consider rule* w^{US}.

(I) Let $n = 1$. *Then*

(1) *the outside firm obtains the assets if* $v_e^e > v_1^{1e}$;

(2) *the monopolist obtains the assets if* $v_1^{1e} > v_e^e$.

(II) Let $n = 2$. *Then*

(1) *the outside firm obtains the assets if* $v_e^e \overset{1}{>} v_i^{ij}$, *or* $v_2^{21} \overset{1}{>} v_e^e$;

(2) *firm 1 obtains the assets if* $v_1^{12} > v_1^{1e} > v_e^e > v_2^{21} > v_2^{2e}$;

(3) *firm 2 obtains the assets if* $v_2^{2e} > v_e^e$ *or* $v_e^e \overset{4}{>} v_2^{2e}$;

(4) *the outside firm or firm 2 obtains the assets if*
$v_i^{ij} \overset{1}{>} v_j^{ji} \overset{2}{>} v_e^e$, *where* $i, j = 1, 2$ *and* $i \neq j$, *or* $v_1^{12} \overset{1}{>} v_e^e$

(5) *(1)-(4) exhaust all possible orderings of the valuations.*

Proof. See Appendix. ■

The Lemma thus establishes that if the incumbent is a monopolist, the assets will be obtained by either the incumbent or the external firm, depending on which of these firms evaluates the assets the most. When there are at least three potential buyers, however, the buyer with the highest maximum valuation does not necessarily obtain the assets. For instance, when $v_2^{21} > v_1^{12} > v_e^e > v_1^{1e} > v_2^{2e}$, it is possible that buyer e obtains the assets, even though another buyer evaluates the assets higher. The reason is that firm 2 evaluates the assets higher than buyer e, only if firm 1 will otherwise obtain the assets. But if buyer e will otherwise obtain the assets, firm 2's valuation is lower than buyer e's valuation. Note also that when there are two firms in the industry, the smaller firm is

more "likely" to obtain the assets than the larger firm.[27] Thus, the US 1992 rule favors smaller firms.

Now, let us consider the EU rule. The following Lemma describes the allocation of the failing firm's assets under the EU rescue merger law:

Lemma 4. *Under w^{EU} (1) Let $n = 1$. Then if (i), $v_1^{1e} > v_e^e$, the monopolist obtains the assets, and if (ii) $v_e^e > v_1^{1e}$ the outside firm obtains the assets. (2) Let $n \geqslant 2$. Then the outside firm obtains the assets.*

Proof. See Appendix.

The EU rule and the US 1992 failing firm defense rule are equivalent, when there is a monopolist in the industry. If there are at least two firms in the industry, no single firm will take over the exiting firm's entire market share. Thus, if at least two firms remain in the industry, the EU rule implies that the assets are obtained by the outside firm.[28]

3.2. An evaluation of the failing firm defense rules

I now turn to an evaluation of various aspects of the failing firm defense rules, starting with a welfare evaluation.

3.2.1. The failing firm defense and welfare

The failing firm defense rules do not guarantee that the socially preferred buyer obtains the assets, since the rules are based only on the firms' bids and on the firms' market

[27] Furthermore, in point (4), the Lemma demonstrates, that when $v_2^{21} > v_1^{12} > v_e^e > v_1^{1e} > v_2^{2e}$, there are two possible equilibria. One is discussed above, where firm e obtains the assets. But there is also an equilibrium where firm 2 obtains the assets and where firm 1 posts a bid higher than b_e. This is an equilibrium, since it is optimal for firm 2 to post a higher bid than firm e, if firm 1 posts a bid higher than b_e. More generally, as pointed out by Jehiel and Moldovanu, this is caused by the fact that the price each buyer is willing to pay in a so-called "auction with endogenous valuations" depends on which buyer he believes will obtain the assets if he does not. These beliefs are endogenously determined in equilibrium, and several consistent beliefs can be constructed.

[28] In a model with product differentiation, one firm may obtain the exiting firm's entire market share. However, in most oligopoly models, the remaining firms will share the exiting firm's market share. Moreover, the only case where the Commission accepted a merger with a rescue merger argument was in a monopoly situation. (Kali+Salz/MdK/Treuhand.)

shares; not on their underlying technologies. A bidding firm does not internalize the externalities it will exert on rivals and consumers, if it obtains the assets. It can be shown that this implies that the private and the social rankings of the potential buyers of the failing firm's assets do not coincide.[29]

By favoring buyers who *pose a less severe danger to competition*, i.e. smaller firms, as in condition 3 in the failing firm defense rules, the defenses do not perfectly compensate for the inefficiency caused by making the allocation dependent on the firms' bids. This condition will thus play a central part for the performance of the failing firm defense rules and will be referred to as the "least danger to competition" condition. The reason why the "least danger to competition" (LDC) condition does not perfectly compensate for the inefficiency, is illustrated by the cases where the firms' valuations are ranked as $v_2^{2e} > v_e^e$. Then firm 2 obtains the assets under the US rule according to Lemma 3. It might, however, be socially desirable to let the assets exit or to let firm 1 obtain them.

Let us first take a closer look at the comparison between firm 1 and firm 2. One might believe that the smallest firm is the socially most preferred buyer, but this is not necessarily true, as shown in the following observation.[30]

Observation 1 The socially most preferred buyer might be either the larger or the smaller firm

Proof. See Appendix.

The reason why society might prefer firm 1 is that the producer surplus might be higher if firm 1 obtains the assets. Note also that if firm 1 uses the assets much more efficiently than firm 2, the consumer surplus might also be higher if firm 1 obtains the assets. Thus, if firm 2 does not exert sufficiently stronger positive externalities on consumers, society will benefit if firm 1 obtains the assets.

It is interesting to note that the LDC condition might prevent the most welfare enhancing acquisitions from taking place. To see this, consider a situation where the

[29] To see this, consider a marginal transfer of assets in the linear model with $k_1 = 10$, and $k_2 \geq \frac{20}{11}$: $\frac{dv_1^{12}}{dk_1} > \frac{dv_2^{21}}{dk_2}$ for $k_2 < 4.4536$, and $\frac{dW}{dk_1} > \frac{dW}{dk_2}$ for $k_2 < 2.537$.

[30] This is a special case of results derived by Farrell and Shapiro (1990b) (cited in note 16).

smallest firm's cost savings from obtaining the failing firm's assets are very small. Thus, the smallest firm would not be willing to pay much for the assets if these were to exit. Assume also that a larger firm would lower its variable costs substantially if it obtained the assets. Let the cost savings be so large that the larger firm expands the output to the extent that the market price will be lower than if the smallest firm obtains the assets. But, the smallest firm's profit will then substantially decrease and it will consequently be willing to pay for preventing the larger firm from obtaining the assets. The LDC condition implies that the small firm could achieve this simply by overbidding the external firm.

Now, turn to the comparison between firm 2 and firm e. I have assumed that $v_2^{2e} > v_e^e$, thus firm 2's private valuation of obtaining the failing firm's assets instead of these exiting is higher than firm e's private valuation. It has been argued that in such cases, it is optimal to let firm 2 obtain the assets, since the social value of the assets in the industry is higher than the private value. However, this is not generally true. The expansion of assets by one firm does not only exert positive externalities on consumers, but also causes rent shifts from rivals towards the expanding firm. Depending on the strength of these effects, the social valuation might be higher or lower than the private valuation. Both firm 2 and firm e may exert negative externalities on rivals and positive externalities on consumers. If firm 2 exerts weak positive externalities or strong negative externalities, the welfare might increase if firm e, and not firm 2, obtains the assets.

However, it appears that from a social point of view, it would be preferable to keep the failing firm's *industry specific* assets in the industry instead of liquidating them. But this is not necessarily true. What is true is that the consumer surplus generally increases, since by Equation (2.3), an expansion of capital always increases aggregate output. But if one firm expands, it also steals business from other firms. If these firms produce more efficiently, the aggregate producer surplus may decrease with the capital expansion. As stated in the next observation, the decrease in producer surplus may even be larger than the increase in consumer surplus. That is not the case, however, when the largest firm

in the industry expands, as seen in Observation 2.[31]

Observation 2 It is possible that (i) welfare decreases when the smaller firm in the industry obtains the failing firm's industry specific assets, and (ii) welfare increases if the larger firm in the industry obtains the failing firm's industry specific assets.

Proof. See Appendix.

At least one of the rules may perform better than the standard merger law rule, even though the failing firm defense rules do not imply that the socially most preferred buyer obtains the assets. Basically, the failing firm defense rules imply that the failing firm's assets stay in the industry more often than when the standard merger rule is applied. But, as argued above, they do not guarantee that the assets stay in the industry when it is socially desirable, due to the "least danger to competition" condition. Nor do they imply that they stay in the hands of the right owner.

Thus, we have the following results:

Proposition 1. *(i) Neither the US failing firm defense rule, nor the EU rescue merger rule do necessarily imply that the socially most preferred buyer obtains the failing firm's assets. (ii) Neither the US rule nor the EU rule need yield a higher welfare level than the standard rule.*

Proof. See Appendix.

Whether the US rules perform better than the standard rule or not depends on the strength of the externalities that the use of the failing firm's assets exerts on other agents. The US rules tend to be more efficient than the standard rule if there are (i) strong positive externalities on consumers in the industry, but not on consumers in other industries; and (ii) only weak negative externalities on rivals in the industry, but strong

[31] This is a special case of a result derived by Farrell and Shapiro (1990b) (cited in note 16): if the cost of the investment equals the direct cost savings, welfare is always increased by an investment by the largest firm in the industry.

ones on rivals in other industries.[32]

The EU rule differs from the standard merger law rule only when there is a monopolist in the industry. Thus, the EU rule tends to be more efficient than the standard rule, if there are strong positive externalities on consumers in the industry, but not on consumers in other industries.

Let us turn to a direct comparison of the different failing firm defense rules. According to Lemma 3 and Lemma 4, it is more likely that the assets exit the industry under the EU rule than under the US rule. Thus, the US rule tends to be more efficient than the EU rule when there are (i) strong positive externalities on consumers in the industry, but not on consumers in other industries; and (ii) only weak negative externalities on rivals in the industry, but strong externalities on rivals in other industries.

3.2.2. The failing firm defense and consumer welfare

Some scholars have argued that the aim of the competition authorities should be to maximize consumer welfare. Let us therefore see whether the failing firm defense can be justified on the grounds that it protects consumers. Using the same reasoning as in the proof of Proposition 1, the following Corollary can be obtained:

Corollary 1. *(i) Neither the US rule nor the EU rule do necessarily imply that the most preferred buyer from the consumers' point of view obtains the failing firm's assets. (ii) Neither the US rule nor the EU rule need yield a higher surplus for the consumers than the standard rule.*

[32] Note that this result is also valid when the firms are symmetric. The differential efficiency issue will, of course, disappear. However, the US failing firm defense may still be inefficient, even in the case were the private and the social values outside the industry coincide. The reason is that the expansion of assets by one firm does not only exert positive externalities on consumers, but also causes rent shifts from rivals towards the expanding firm. Depending on the strength of these effects, the social valuation might be higher or lower than the private valuation. To see this, consider a marginal expansion in the linear model with $k_1 = k_2 = 5$, then $\frac{dv_1^{12}}{dk_1} = \frac{dv_2^{21}}{dk_2} = 2.133\,3 \times 10^{-2}$ and $\frac{dW}{dk_1} = 1.422\,2 \times 10^{-2}$. Let $\frac{dv_e^e}{dk_e} = \frac{dv_1^{12}}{dk_1} - \varepsilon$, which implies that the assets remain in the industry, since the firms in the industry are willing to pay a higher price. But the social value of the assets are higher outside the industry, since $\frac{dv_e^e}{dk_e} = \frac{dW}{dk_e} > \frac{dW}{dk_1}$.

By using the failing firm defense, competition authorities might make three kinds of mistakes from the consumers' point of view. Consumers may prefer that (i) a larger firm in the industry obtains the assets, since the cost reduction might be so large that the price will be lower; (ii) a smaller firm in the industry obtains the assets, since it may expand more, and therefore induce a lower price; and (iii) a firm outside the industry obtains the assets, since it may create a larger surplus for consumers. These results indicate that differential efficiencies also should be considered when the only efficiencies considered are those that are passed on to consumers. The reason is that consumers might prefer a larger firm in the industry to obtain the assets, since the cost reduction might be so large that the price will then be lower.

3.2.3. The failing firm defense and auction revenue

The failing firm defense has also been motivated by other distributional concerns. For instance, the benefits from permitting a loss of competition in order to save jobs, protect shareholders and other claimants have been discussed in relation to failing firm defense. Some of these groups would benefit if the failing firm's assets were sold at a high price. Thus, one might argue that one of the aims of the competition authority should be to generate the largest possible revenues. It follows directly from the definition of the standard merger law and the failing firm defense rules that the revenues from the selling of the failing firm under the failing firm defense are at least as high as under the standard merger law. But the revenues from the selling of the failing firm's assets under the failing firm defense are limited, as shown in Lemma 2. The maximum price for the failing firm's assets under the failing firm defenses rules is never higher than the external firm's valuation of obtaining the assets since, firms in the industry only compete with the outsider, and not with each other, due to the "least danger to competition" condition. On the other hand, the revenue would be higher if the assets were sold under a bankruptcy rule, where the bidder with the highest bid typically obtains the assets. Thus we have the following result:

Proposition 2. *The revenues from the selling of the failing firm's assets are lower under the failing firm defense than under a bankruptcy rule.*

The failing firm defense may thus harm employees, debt holders, taxpayers etc., who are claimants of these revenues. It may also make it difficult for financially weak firms to raise capital, since the debt holders' expected payoff is low if the firm goes bankrupt. Thus, there also seems to be scope for improvement of the selling procedure, if the aim is to maximize revenues.[33]

4. Concluding Remarks

In this paper, I have shown that the US failing firm defense leads to cost inefficiencies, due to a "least danger to competition" (LDC) condition which favors small, and thus inefficient, firms.

The additional drawback with the EU failing firm defense is that productive assets exit the industry, due to a "market share" condition, which implies that the defense is only applicable when the purchaser is a monopolist. However, the European Commission has recently considered oligopolistic dominance in merger cases, as in the Nestle/Perrier case,[34] and thus, this clause might be rejected in the future. Then, the EU rule will have the same drawbacks as the US rule, since the EU rule contains the LDC condition.

The results suggest the importance of taking efficiency considerations into account when evaluating mergers where one of the parties is failing.

The failing firm defense has also been motivated by distributional concerns. The US failing firm defense rule tends to be good for consumers when the cost savings do not differ among the potential buyers, since these favor small firms in the industry, which typically exert strong positive externalities on consumers. The results in this paper also indicate that if the competition authority considers auction revenues to be important, the

[33] Jehiel, Moldovanu and Stacchetti (1996a) (cited in note 13) construct a revenue-maximizing auction for the seller in such a situation.

[34] See Morgan, E. J., "The Treatment of Oligopoly under the European Merger Control Regulation," *The Antitrust Bulletin*, Spring 1996, 203-247.

failing firm defense rules are not well chosen, since they restrict the bidding competition between firms within the industry. Thus, there seems to be scope for improving the selling procedure, also if the aim is to maximize revenues.

The findings in this paper also have implications for the dynamic efficiency of the failing firm defense. Saloner (1987)[35] showed that a potential monopolist's incentive to predate increases under the failing firm defense, since the defense makes it possible for the predator to acquire the target's assets. His analysis did not, however, consider the case with competition in the acquisition stage, i.e., with more than one potential buyer of the target. If there is competition in the acquisition stage, the price of the target may be higher, and the benefit from predation may be smaller. Thus, predation for partial monopoly differs fundamentally from predation for monopoly, and the effects of the merger laws on predation in multi-firm settings are much more intricate. These relationships are more closely investigated in the companion paper Persson (1998b)[36].

The issue of optimal design of the merger policy in the context of a failing firm has neither been addressed here nor in the literature. The complexity of the externalities involved in the selling of a failing firm indicates that informational constraint will be important for deriving optimal policies. A natural step, however, is to explicitly model this restriction and to investigate whether merger law rules incurring a higher welfare level than the one used today, might be found. This approach may be applied to the issue of a merger with a failing firm, but also to more general questions of merger policy.

It seems as if the model employed above could also be applicable to other instances where assets are sold to firms already competing in an oligopolistic market, such as privatization, or the selling of different kinds of quotas: import or export quotas, landing slots, or spectrum rights.

[35] Saloner, G., "Predation, mergers, and incomplete information," *RAND Journal of Economics*, Summer 1987, Vol. 18, 165-186.

[36] Persson, L., "Predation and Mergers: Is Merger Law Counterproductive?," 1998b. In L. Persson, Ph. D. Thesis, Stockholm University. Monograph Series, No. 35.

Appendix

Lemma A1 Let $n = 2$. Then, there are 30 different orderings of the valuations.

Proof. Let $n = 2$, then using that $\frac{dv_i^{ie}}{dk_i} \equiv \frac{d\pi_i(\mathbf{K}^0)}{dk_i}$ and $\frac{dv_i^{ij}}{dk_i} \equiv \frac{d\pi_i(\mathbf{K}^0)}{dk_i} - \frac{d\pi_i(\mathbf{K}^0)}{dk_j}$ where $\frac{d\pi_i(\mathbf{K}^0)}{dk_i}$ is positive according to Equation 2.4 and $\frac{d\pi_i(\mathbf{K}^0)}{dk_j}$ is negative according to Equation 2.5 and we have that $v_1^{12} > v_1^{1e}$ and $v_2^{21} > v_2^{2e}$. First, ignore firm e. Then we can order the values of firm 1 and 2

$$\begin{aligned} v_i^{ij} &> v_i^{ie} > v_j^{ji} > v_j^{je} \\ v_i^{ij} &> v_j^{ji} > v_i^{ie} > v_j^{je} \\ v_i^{ij} &> v_j^{ji} > v_j^{je} > v_i^{ie}, \ i, j = 1, 2 \end{aligned}$$

Now introduce firm e. The value v_e^e can be positioned at five different positions. Thus there are $6 \times 5 = 30$ orderings to consider. ■

Proof of Lemma 1

(1) Let w^* be all selling rules such that (i) a bidder can only affect the allocation of the assets by changing his own ownership, and (ii) the allocation is only determined by direct bid comparisons: $b_i > b_j$, and by the identity of the bidders. According to Definition 2 and Definition 3 both w^{US} and w^{EU} belong to w^*.

Consider selling rule belonging to w^* and a vector of bids, $\mathbf{b}$. (i) $b_i \geq \max_j v_i^{ij}$. We have two cases to consider: (A) The case where firm i has made a bid such that it obtains the assets. (B) The case where firm i does not obtain the assets. (1) Let $b_i > b_{j^*}$, $\forall j^*$, where j^* is all j : if $b_j > b_i$ buyer i will not obtain the assets. Buyer i's payoff is $v_i^{i\mathbf{0}} - b_i$. But buyer i might then deviate, bidding b_i', and not decrease his payoff since if $b_i' > b_{j^*}$ $\forall j^*$ he still obtains the assets but pays less, and if $b_i' < b_{j^*}$, for some j^* he improves his payoff, since $v_i^{j^*\mathbf{0}} - (v_i^{i\mathbf{0}} - b_i) > -v_i^{ij^*} + b_i > 0$. (2) Let $b_i < b_{j^*}$, for some j^*. Buyer i's payoff is $v_i^{j^*\mathbf{0}}$. But buyer i might then deviate, bidding b_i', without changing his payoff.

(ii) $b_i \leq b_i'$. Let $b_i > b_{j^*}, \forall j^*$. Buyer i's payoff is $v_i^{i\mathbf{0}} - b_i$. Then, we cannot find a b_i'' such that $\Pi_i(\mathbf{b}'') \geq \Pi_i(\mathbf{b})\ \forall \mathbf{b}$, since if $b_i'' > b_i$, $\Pi_i(\mathbf{b}'') < \Pi_i(\mathbf{b})$, and if $b_i'' < b_i$, it is possible that firm j^* obtains the assets and that $b_{j^*} \leq v_i^{ij^*}$. Thus $\Pi_i(\mathbf{b}'') < \Pi_i(\mathbf{b})$ and b_i is not dominated. ■

Proof of Lemma 2

(i) First, we know from Lemma 1 that firm e will never play $b_e > v_e^e$.

Secondly, consider w^{US} and the vector of bids, $\mathbf{b} : i = h$. Then buyer i obtains the assets according to Definition 2 and his payoff is $v_i^{i\mathbf{0}} - b_i$. But buyer i might then deviate, bidding $b_i' = v_e^e$, and improving his payoff since $b_i' = v_e^e \geq b_e$, according to the first part of the proof and by Definition 2, he still obtains the assets but pays less.

(ii) This follows directly from the fact that w^{EU} is a combination of w^{US} and the standard merger law, where firm e obtains the assets. ■

Proof of Lemma 3

(I) (1) $v_e^e > v_1^{1e}$. Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_e^*)$, where $b_e^* = v_1^{1e}$ and $b_1^* = v_1^{1e} - \varepsilon$. Then firm 1's payoff is $v_1^{e\mathbf{0}} = 0$. By deviating to $b_1' < b_e^*$, firm 1's payoff does not change. We know that $b_1 \leq v_1^{1e}$ by Lemma 1. Thus firm 1 has no incentive to deviate. By deviating to $b_e' \leq b_1^*$, firm e will not obtain the assets and its payoff will decrease since $v_e^{1\mathbf{0}} - (v_e^{e\mathbf{0}} - b_e) < 0$. By deviating to $b_e'' > b_1^*$, it will still obtain the assets but pay a higher price. Accordingly, firm e has no incentive to deviate. Thus $\mathbf{b}^*$ is a Nash equilibrium.

Let $\mathbf{b} = (b_1, b_e)$ be a Nash equilibrium. Assume that $b_1 > b_e$. Then firm e's payoff is 0. We know that $b_1 \leq v_1^{1e}$ by Lemma 1. But by bidding $b_1 + \varepsilon$ buyer e might improve his payoff since $v_e^{e\mathbf{0}} - (b_1 + \varepsilon) > 0$ due to the fact that $v_e^e > v_1^{1e}$. This contradicts the assumption that $\mathbf{b}$ is a Nash equilibrium. Similar reasoning applies to the case where $b_1 = b_e$. Thus, it has been shown that $b_e > b_1$.

(2) $v_1^{1e} > v_e^e$. The same reasoning as above applies.

(II) (1) $v_e^e \overset{1}{>} v_i^{ij}$, or $v_2^{21} \overset{1}{>} v_e^e$. Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_2^*, b_e^*)$, where $b_1^* = v_1^{1e} - \varepsilon$, $b_2^* = v_2^{2e} - \varepsilon$ and $b_e^* = \max\{v_1^{1e}, v_2^{2e}\}$. According to Definition 2, firm e obtains the assets. Then $\Pi_1(\mathbf{b}^*) = v_1^{e0} = 0$. By deviating to $b_1' < b_e^*$, firm 1's payoff does not change. By deviating to $b_1' \geq b_e^*$, firm 1 obtains the assets but since $b_e^* = \max\{v_1^{1e}, v_2^{2e}\} \geq v_1^{1e}$, firm 1's payoff does not increase. Thus, firm 1 has no incentive to deviate. The same reasoning applies to firm 2 and thus firm 2 has no incentive to deviate. By deviating to $b_e' \leq \max\{b_1^*, b_2^*\}$ firm e will not obtain the assets and its payoff will decrease since $v_e^e > b_e^*$. By deviating to $b_e'' > \max\{b_1^*, b_2^*\}$, firm e will still obtain the assets but will pay a higher price. Accordingly, firm e has no incentive to deviate. Thus $\mathbf{b}^*$ is a Nash equilibrium.

Let $\mathbf{b} = (b_1, b_2, b_e)$ be a Nash equilibrium. Assume that $h = 1$. According to Definition 2 $b_e > b_2$, otherwise firm 2 will obtain the assets. If $b_1 > v_1^{1e}$, firm 1 will benefit by deviating to $b_1' < b_e$, since firm e will then obtain the assets. If $b_1 \leq v_1^{1e}$, firm e will have the incentive to deviate to $b_e' = b_1 + \varepsilon$ since $v_e^e > v_1^{1e}$. This contradicts the assumption that $\mathbf{b}$ is a Nash equilibrium.

Assume that $h = 2$. Note first that according to Lemma 2 $b_2 \leq v_e^e$. Then note that $b_1 \leq v_1^{12} < v_e^e$ according to Lemma 1 and to the fact that $v_e^e \overset{1}{>} v_i^{ij}$ or $v_2^{21} \overset{1}{>} v_e^e$. If $b_2 < v_e^e$, then firm e will have an incentive to deviate to $b_e = \max\{v_1^{12} + \varepsilon, b_2 + \varepsilon\}$ since firm e will obtain the assets and since $v_e^e > \max\{v_1^{12} + \varepsilon, b_2 + \varepsilon\}$ firm e will benefit. If $b_2 = v_e^e$, then firm 2 has an incentive to deviate to $b_2' = v_e^e - \varepsilon$. If $b_e = v_e^e$ firm e obtains the assets and firm 2 benefits since $b_2 > v_2^{2e}$ if $b_e \leq v_e^e - \varepsilon$, firm 2 still obtains the assets since $b_1 \leq v_1^{12} < v_e^e$, and pays a lower price.

This contradicts the assumption that $\mathbf{b}$ is a Nash equilibrium. Thus, it has been shown that firm e obtaining the assets is the only Nash equilibrium.

(2) $v_1^{12} \overset{1}{>} v_1^{1e} \overset{2}{>} v_e^e \overset{3}{>} v_2^{21} \overset{4}{>} v_2^{2e}$. The same reasoning as above applies.

(3) (i) $v_2^{2e} > v_e^e$. The same reasoning as above applies.

(4) $v_i^{ij} \overset{1}{>} v_j^{ji} \overset{2}{>} v_e^e$, or $v_1^{12} \overset{1}{>} v_e^e$. Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_2^*, b_e^*)$,where $b_1^* = v_1^{1e} - \varepsilon$, $b_2^* = v_2^{2e} - \varepsilon$ and $b_e^* = \max_i v_i^{ie}$. According to Definition 2, firm e obtains the assets. By deviating to $b_1' < b_e^*$, firm 1's payoff does not change. By deviating to $b_1' > b_e^*$,

firm 1 obtains the assets but since $b_e^* = \max_i v_i^{ie} \geq v_1^{1e}$ firm 1's payoff does not increase. Thus firm 1 has no incentive to deviate. The same reasoning applies to firm 2 and thus, firm 2 has no incentive to deviate. By deviating to $b_e' < b_i^*$ for any $i = 1, 2$, firm e will not obtain the assets and its payoff will change to $v_e^{i0} - (v_e^{e0} - b_e) = \max_i v_i^{ie} - v_e^e < 0$. By deviating to $b_e'' > b_i^*$, firm e will still obtain the assets but will pay a higher price. Thus buyer e has no incentive to deviate, and $\mathbf{b}^*$ is a Nash equilibrium.

Consider the equilibrium candidate $\mathbf{b}^{**} = (b_1^{**}, b_2^{**}, b_e^{**})$, where $b_1^{**} = v_e^e$, $b_2^{**} = v_2^{2e}$ and $b_e^{**} = v_2^{2e}$. According to Definition 2, firm 2 obtains the assets. Firm 1's payoff does not change, by deviating. Thus firm 1 has no incentive to deviate. By deviating to $b_e < b_2^*$, firm e's payoff does not change. By deviating to $b_e' \in (b_2^{**}, v_e^e]$, firm 1 obtains the assets and firm e's payoff does not change. Thus firm e has no incentive to deviate. By deviating to $b_2' < b_e^{**}$, firm 1 will obtain the assets and firm 2's payoff will decrease since $v_2^{21} - b_2^{**} = v_2^{21} - v_e^e > 0$. By deviating to $b_2'' > b_e^{**}$, firm 2 will still obtain the assets but will pay a higher price. Thus firm 2 has no incentive to deviate, and $\mathbf{b}^{**}$ is a Nash equilibrium.

Let $\mathbf{b} = (b_1, b_2, b_e)$ be a Nash equilibrium. Assume that $h = 1$. Note first that according to Lemma 2, $b_1 \leq v_e^e$. First, consider the case when $v_i^{ij} \overset{1}{>} v_j^{ji} \overset{2}{>} v_e^e$. Then firm 2 has an incentive to deviate to $b_2' = b_e$, since it will obtain the assets and since $b_1 \leq v_e^e < v_2^{21}$. Next, consider the case when $v_1^{12} \overset{1}{>} v_e^e$. Note that $b_e > b_2$, otherwise firm 2 will obtain the assets. If $b_1 > v_1^{1e}$, firm 1 will have an incentive to deviate to $b_1' = v_1^{1e}$. Accordingly, if $b_1' > b_e$, firm 1 still obtains the assets but pays less, and if $b_1' < b_e$ firm e obtains the assets and firm 1 benefits since $b_1 > v_1^{1e}$. If $b_1 < v_1^{1e}$, firm e has an incentive to deviate to $b_e' = b_1 + \varepsilon$ since $b_e' < v_e^e$. This contradicts the assumption that $\mathbf{b}$ is a Nash equilibrium. Thus it has been shown that either firm e or firm 2 obtaining the assets are the only Nash equilibria.

(5) Summing up all ordering in (1)-(4) gives 30 and Lemma A1 shows that the proof is complete. ■

Proof of Lemma 4

(1) (i) From Definition 3, we have that the EU rescue merger rule is identical to the US 1992 rule and thus Lemma 3 is applicable.

(2) From Definition 3 we have that the EU rescue merger rule is identical to the standard merger law rule if $s_j(\mathbf{K}^j) \leq s_j(\mathbf{K^0})$. From equations (2.2) and (2.3) we have that the firm obtaining the assets increases its output with a capital expansion, whereas the competitors' output decreases. ■

Proof of Proposition 1

(i) Let $n = 2$ and $v_2^{2e} > v_e^e$. Note that this puts no restrictions on the Cournot model, since v_e^e can be chosen freely. Firm 2 obtains the failing firm's assets under the US 1992 rule by Lemma 3. But it is possible that $W(K^2) < W(K^e)$, since $W(K^e)$ can be chosen freely, or that $W(K^1) > W(K^2)$ according to Observation 1, since the restriction $v_2^{2e} > v_e^e$ does not contradict the assumptions in the proof of Observation 1. Under the EU rule, firm e obtains the assets according to Lemma 4. But it is possible that $W(K^1) > W(K^e)$ or that $W(K^2) > W(K^e)$ since $W(K^e)$ can be chosen freely.

(ii) This follows from (i) and the fact that $W(K^2) \gtreqless W(K^e)$, since $W(K^e)$ can be chosen freely. Note also that Observation 2 may apply when $v_2^{2e} > v_e^e$ and thus $W(K^2) < W(K^e) = W(K^0)$. ■

Proof of Observation 1

Consider a marginal expansion in the linear model with $k_1 = 10$, and $k_2 \geq \frac{20}{11}$, then $\frac{dW}{dk_1} > \frac{dW}{dk_2}$ for $k_2 < 2.537$ and $\frac{dW}{dk_1} < \frac{dW}{dk_2}$ for $k_2 \in (2.537, 10)$. ■

Proof of Observation 2

Consider a marginal expansion in the linear model with $k_1 = 10$, and $k_2 \geq \frac{20}{11}$. Then $W(\mathbf{K}^2) - W(\mathbf{K^0}) = \int_{k_2^0}^{k_2^0+\Delta k_2} (\frac{dW}{dk_2})dt < 0$, since $\frac{dW}{dk_2} = \frac{1}{90}\frac{47k_2-110}{k_2^3} < 0$, $k_2 < \frac{110}{47}$. Second, we have from equation (2.6): $\frac{dW}{dk_1} = -p'(Q)\frac{\delta_1}{1+\Lambda}(q_1(1+\Lambda) - \sum_{i=1}^n \lambda_i q_i) - c_k^1 > 0$ if $q_1(1+\Lambda) - \sum_{i=1}^n \lambda_i q_i > 0$ since $c_k^1 \leq 0$. The LHS can be rewritten: $q_1 + \sum_{i=1}^n \lambda_i(q_1 - q_i) > 0$

which is true if $q_1 - q_i \geqslant 0 \ \forall i$ which is true by definition. The total welfare effect $\Delta W = \int_0^{\Delta k_1} \frac{dW}{dk_1} dt > 0$, since $\frac{dW}{dk_1}$ is positive over all the path. ■

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5. The failing firm defense and predation

In this Section, I analyze how different merger laws affect the incentives for predation .More specifically, three merger law rules are considered. The first rule is a restrictive merger law, according to which all mergers are assumed to be forbidden in the present case. This is referred to as the restrictive merger rule. The second and third rules are versions of the failing firm defense doctrine. The second rule is the existing US failing firm defense rule. The third rule, which is suggested here, is a modified version of the US rule, called the modified failing firm defense rule.

The interaction takes place over three periods. In period 1, the firms compete in the Cournot industry and generate profits. In this period, strong firms may predate in order to make the weak firm bankrupt. In the second period, the weak firm might be sold to firm 1 or firm 2 if it is bankrupt.. Finally, in period 3, the remaining firms compete in standard fashion.

It is assumed that only firm d is vulnerable to predation by firm 1 and 2. The source of the superiority in "strength" of the former is not formally modeled, but could be seen as resulting from e.g. large financial resources, strong R & D departments, advantageous in lobbying, or superior information.[37] The relationships between the incentive for predation and mergers are more closely investigated in the companion paper Persson (1998b)[38].

5.1. The restrictive merger law

Period 2. I restrict the analysis to symmetric equilibria, and therefore it is sufficient to consider one of the strong firms' incentive to predate, firm 1, say. Firm 1's profits over

[37] For instance, Bolton and Scharfstein (1990) present a model with one financially strong and one financially weak firm. In this model a creditor offers the weak firm an optimal long-term contract. In order to provide managerial incentives, the creditor must punish a firm that makes a low profit in the first period by increasing the risk of terminating the credit. The weak firm is then vulnerable to predation by the strong firm.

[38] Persson, L., "Predation and Mergers: Is Merger Law Counterproductive?," 1998b. In L. Persson, Ph. D. Thesis, Stockholm University. Monograph Series, No. 35.

periods 2 and 4 when predating are $\pi_1(1,1,1,d) - \frac{\bar{x}}{3} + \pi_1(1,1,1,0)$, since no mergers are allowed in period 3 and firm d exits after predation. If firm 1 does not predate, its profits over periods 2 and 4 are $\pi_1(1,1,1,d) + \pi_1(1,1,1,d)$, since no mergers are allowed in period 3. Thus firm 1 predates in period 2 if and only if C3' holds:

C3' $\pi_1(1,1,1,d) - \frac{\bar{x}}{3} + \pi_1(1,1,1,0) > 2\pi_1(1,1,1,d)$

Period 1. No mergers are allowed in period 1 according to the restrictive merger law.

The market structure in period 4 will thus be a quadropoly if predation does not occur in period 2 and a triopoly if predation occurs in period 2. Let x^s be the cost at which the strong firms are indifferent to predating or not predating in period 2. Thus we have the following result:

Lemma 5. *Under the restrictive merger law, the equilibrium market structure is (i) a quadropoly if* $\bar{x} > x^s$ *and (ii) a triopoly if* $\bar{x} < x^s$.

5.2. The US failing firm defense

Let us turn to the case where interaction between the firms takes place under the US 1992 Merger Guidelines, which state that an otherwise anti-competitive merger may be permitted if four conditions are met: *1) the allegedly failing firm would be unable to meet its financial obligations in the near future; 2) it would not be able to reorganize successfully under Chapter 11 of the Bankruptcy Act; 3) it has made unsuccessful good-faith efforts to elicit reasonable alternative offers of acquisition of the assets of the failing firm*[39] *that would both keep its tangible and intangible assets in the relevant market and pose a less severe danger to competition than does the proposed merger; and 4) absent the acquisition, the assets of the failing firm would exit the relevant market.*

[39] *Any offer to purchase the assets of the failing firm for a price above the liquidation value of those assets – the highest valued use outside the relevant market or equivalent offer to purchase the stock of the failing firm – will be regarded as a reasonable alternative offer.*

The first condition requires that the failing firm must be unable to meet its financial obligations. The second condition ensures that the firm does not only have short-term difficulties, but is also not viable in the long run. These two conditions are fulfilled if the prey is bankrupt. Moreover, in this set-up, Condition 4 is fulfilled if and only if Condition 3 is fulfilled, since it is assumed that the failing firm will be liquidated, and thus exit, if not acquired. Hence, the 1992 failing firm defense is valid in my set-up if, and only if, Condition 3 is satisfied. Condition 3 refers to an alternative buyer that would pose *less severe danger to competition.* It is assumed that this is interpreted by the authority as a firm with a smaller market share. Furthermore, this alternative buyer must make a *reasonable offer*, which I interpret as the highest bid from a firm outside the industry.

In order to incorporate these restrictions into the merger formation model, some more notation is required.[40] Let owner e be an owner who will use the prey's assets outside the industry. The valuation of obtaining the bankrupt firm's assets for owner e is denoted $v^e_{ed^p}$, and owner e's bid is denoted b^d_e. It is assumed that the assets in the industry are partly industry specific: owner e's valuation of obtaining the assets is lower than the value for firms in the industry of obtaining the assets if the assets would otherwise exit the industry, i.e. $v^e_{ed^p} < v^{ie}_{id^p}$. In order to ensure that owner e does not obtain any of the strong firms' assets, it is assumed that the insiders' assets are of no value to owner e and to ensure that no insider obtains owner e's assets, it is assumed that owner e's assets are of no value to the insiders.

Some more notation is needed, in order to formalize the US failing firm defense rule. Let firm i's market share be denoted by $s_i \equiv \frac{q_i}{Q}$. Furthermore, let $\mathbf{s}$ be an arbitrary vector of market shares in the industry. Let firm 1 be the largest firm in the industry, firm 2 the second largest, etc., and let h be defined: $h = \max\{i : b_i \geq b^d_e\}$. Then h is the smallest firm in the industry that posts a bid at least as high as the bid posted by the external firm. If the firms are identical, it is assumed that after the bidding has taken place, the competition authority picks one of the firms with equal probability of being

[40] For a more detailed discussion of the failing firm defense doctrine see Persson (1998).

the smallest.[41] The failing firm defense allocation rule, $S^f(\mathbf{b},\mathbf{s},i)$, is defined:

Definition 4. $S^f(\mathbf{b},\mathbf{s},i) = \left\{ \begin{array}{c} i;\ \textit{for } i \neq d \\ h \textit{ if } h \textit{ exists, } e \textit{ otherwise; for } i = d \end{array} \right\}$

Thus, all assets owned by non-bankrupt owners stay with their original owners, and owner d's assets are sold either to one of the strong firms or to the outside firm.

Period 4. The remaining firms have no incentive to predate, since this is the last period. The firms thus compete in standard fashion and generate profits.

Period 3. There are four firms in the industry, since no mergers are allowed in period 1 according to the US failing firm defense rule. For the same reason, no mergers are allowed in period 3, if firm d is not bankrupt. If firm d is bankrupt, its assets are sold. The outcome under the US failing firm defense rule is described in the following Lemma:

Lemma 6. *If firm d is bankrupt in period 3, owner $i \neq d, e$ obtains owner d's assets at a price equal to the value of the assets outside the industry, $v^e_{ed^p}$.*

Proof. See Appendix.

Note that the US failing firm defense rule restricts the bidding competition between the firms in the industry, since the assets can only be obtained by the smallest firm in the industry with a bid above the outsider's.[42]

Period 2. There are four firms in the industry since, according to the US failing firm defense rule, no mergers are allowed in period 1. Since I restrict the analysis to symmetric equilibria, it is sufficient to look at one of the strong firm's incentive to predate, firm 1 say. Firm 1's profit when predating is given by $\pi_1(1,1,1,d) - \frac{\overline{x}}{3} + \frac{2}{3}\pi_1(1,1+d^p,1,0) +$

[41] This assumption seems compatible with the situation where the competition authority cannot perfectly observe the firms' market share, but uses estimates.

[42] Note that this type of auction with externalities gets much more involved when the potential buyers are asymmetric. However, the important thing for the result here is that the acquisition price under the failing firm defense never exceeds the value of the assets outside the industry. This is shown to hold also for asymmetric firms, see Persson (1998).

$\frac{1}{3}(\pi_1(1+d^p,1,1,0)-v^e_{ed^p})$, since owner 1 obtains the prey's assets with the probability of $\frac{1}{3}$, and does not with the probability of $\frac{2}{3}$, when firm d is bankrupt in period 3. The profit for firm 1 when not predating is $\pi_1(1,1,1,d)+\pi_1(1,1,1,d)$, since no mergers are allowed in period 3 if firm d is not bankrupt. Consequently, firm 1 predates if and only if C3" holds:

C3" $\pi_1(1,1,1,1)-\frac{\bar{x}}{3}+\frac{2}{3}\pi_1(1,1+d^p,1,0)+\frac{1}{3}(\pi_1(1+d^p,1,1,0)-v^e_{ed^p})$
$> 2\pi_1(1,1,1,d)$

Period 1. Since no firm is bankrupt, no mergers are allowed according to the US failing firm defense.

The market structure in period 4 is hence a quadropoly if the strong firms do not predate in period 2, and a triopoly if the strong firms predate in period 2. Let x^f denote the cost at which the strong firms are indifferent to predation or non-predation in period 2. Thus we have the following result:

Lemma 7. *Under the US failing firm defense, the equilibrium market structure is (i) a quadropoly if* $\bar{x} > x^f$ *and (ii) a triopoly if* $\bar{x} < x^f$.

5.3. The modified failing firm defense

Let us now turn to a modified version of the US failing firm defense, a rule that is presented here. It is identical to the rule in the US 1992 Merger Guidelines, apart from the last two conditions being omitted. Thus, only mergers with bankrupt firms are allowed and the bidder with the highest bid obtains the bankrupt firm's assets. This corresponds to the situation under the bankruptcy rule, described in Section **??**, with the restriction that no mergers between non-bankrupt firms are allowed.[43]

Period 4. The remaining firms have no incentive to predate, and thus compete in standard fashion.

[43] Note that the merger formation model in this situation corresponds to the auction models provided by Jehiel and Moldovanu (1996).

Period 3. There are four firms in the industry, since no mergers are allowed in period 1. If firm d is not bankrupt, no mergers are allowed. If firm d is bankrupt, Lemma **??** applies, since no other mergers are allowed and since it is assumed that $v^{e}_{ed^p} < v^{ie}_{id^p}$. Thus, firm d is acquired by one of the strong firms at the price $v^{ij}_{id^p}$.

Period 2. There are four firms in the industry, since no mergers are allowed in period 1. Since I restrict the analysis to symmetric equilibria and since all mergers between non-bankrupt firms are forbidden, Lemma **??** applies. Thus the strong firms predate iff C3 holds.

Period 1. No mergers are allowed according to the modified failing firm defense rule.

Consequently, the market structure in period 4 is a quadropoly if the strong firms do not predate in period 2 and it is a triopoly if the strong firms predate in period 2. Let x^l be the cost at which the strong firms are indifferent between predating or not predating in period 2. Then, there is no predation when $\bar{x} > x^l$ and predation when $\bar{x} < x^l$. Thus we have the following result:

Lemma 8. *Under the modified failing firm defense, the equilibrium market structure is (i) a quadropoly if* $\bar{x} > x^l$ *and (ii) a triopoly if* $\bar{x} < x^l$.

5.4. The equilibrium market structure under the different merger laws

Let us now compare how the different merger laws affect the emerging market structure. The following result can be derived from Lemma 5, Lemma 7 and Lemma 8:

Proposition 3. *The equilibrium market structure is (1) at least as concentrated under the restrictive merger law as under the modified failing firm defense and more concentrated for some parameter values (2) at least as concentrated under the US failing firm defense as under the modified failing firm defense and more concentrated for some parameter values (3) more concentrated under the US failing firm defense than under the restrictive merger law for some parameter values.*

Proof. See Appendix.

The results suggest that a restrictive merger policy, the restrictive merger law, might be counterproductive, in the sense that it leads to concentration. It may increase the incentives for predation by helping predators avoid a bidding competition for the prey after predation has occurred. Consequently, the incentive for predation for mergers under a failing firm defense is limited if the potential buyers compete to acquire the failing firm. On the other hand, the incentive for predation for merger under the US failing firm defense might be strong since it allows mergers but limits the bidding competition by favoring small firms in the acquisition process.

Under the restrictive merger law, the market structure might not only be the one with the smallest number of firms, but also the one with the smallest industry capital stock. This is due to the fact that the prey's assets exit under the restrictive merger law, whereas they might be obtained by a rival under the failing firm defense policies. Thus, the restrictive merger law might not only lead to few firms in the industry, but also to a situation where these small firms only have a small amount of capital.

Conditions C3, C3' and C3" can be generalized to the n-strong-firm case. Hence, the logic of the proof of Proposition3 may be applied to show that the results here generalize to situations with a larger number of firms.