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Foreword

This document presents the invited papers and proceedings of the fourth Industry Economics Conference (IEC). Held on 6-7 July 1995 and hosted this year by the Department of Economics of the University of Melbourne, the conference seeks to bring together leading researchers and policy makers to:

- present current work in the field of industry economics;
- examine new ideas and methodologies;
- encourage further industry economics research; and
- facilitate further communication between these participants.

This year's conference featured 10 invited speakers and an additional 30 contributed papers. The conference organisers were particularly pleased to include papers from Professor Allan Fels (Trade Practices Commission), Professor Robert Porter (Northwestern University) and Professor Christopher Snyder (George Washington University) in the conference program. The latter two presenters travelled from the USA specially to attend IEC '95. On behalf of the conference organisers I would like to thank all the participants who gave generously of their time and expertise.

In 1996 the conference will again be hosted by the Australian National University. The ANU and BIE are pleased to advise that Professor Oliver Hart of Harvard University has accepted our invitation to attend the conference as a keynote speaker.

Finally, I wish to acknowledge the efforts of individuals within the University of Melbourne's Department of Economics and the BIE who contributed to the organisation of the conference and the production of these proceedings. My thanks to Dr Jeff Borland, the convenor, and Karen Bennett for their administrative efforts which greatly contributed to the success of the conference. These proceedings were prepared within the BIE by Brett Janissen, with assistance from Anna George, Rosalie McLachlan and Harvey Anderssen. Thanks are also due to Tanya Hutchinson, Karin Mueck and Mary Kapotas for assembling and formatting the document for publication.

Bob Hawkins
Director
October 1995

Session 4

Invited paper 10

Empirical Studies of Vertical Foreclosure

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10.1 Introduction

This paper was prepared for the Industry Economics Conference at the University of Melbourne. I would like to thank Stephen King and Rohan Pitchford for useful references, financial support from the Centre for Economic Policy Research (Research School of Social Sciences, Australian National University) and the Bureau of Industry Economics is gratefully acknowledged.

10.2 The historical policy debate

Does vertical integration have anti-competitive effects? This question has generated a public policy debate spanning many decades and involving many industrialised countries. The U.S. example is particularly instructive.¹ In the early history of U.S. antitrust, vertical integration only rarely came under scrutiny. In the late 1950s through the early 1970s, antitrust authorities adopted a more hostile view of vertical integration, successfully preventing vertical mergers between General Motors and duPont, Brown Shoe and Kinney, and Ford and Electric Autolite.² During this period, the Federal Trade Commission prevented a series of vertical mergers between cement and concrete manufacturers and began an inquiry into the vertical structure of the petroleum industry.

In the 1980s, there was a shift back toward a more benign view of vertical integration. This policy shift can be clearly traced in the revision of the Department of Justice's Merger Guidelines. In 1968, the guidelines contained an extensive section on vertical mergers, stating that mergers would likely be challenged if the upstream firm had a ten percent share of the market and the downstream firm had a six percent share. Much less attention was devoted to vertical integration in the 1982 and 1984 guidelines, and the thresholds for challenge were raised. The 1992 guidelines, the latest revision, contains no mention of vertical mergers.

Significant trends in the policies of European countries regarding vertical integration have been less pronounced than in the U.S., though there have been a series of controversial cases.³ In the UK, the Monopolies Commission investigated vertical integration in oxygen production (1956), petrol supply (1965), brewing (1969) and baking (1976). Industrial and Medical Gases (1956-57); The Supply of Petrol to Retailers (1965); The Supply of Beer (1969); Flour and Bread (1976-77). Two opposing points of view regarding the petrol case, for example, are presented by Pass and Hawkins (1971) and Dixon (1973). The Commission's recommendations varied,

1 Perry (1989) and Kwoka and White (1994) provide surveys of U.S. antitrust policy regarding vertical integration.

2 U.S. v. E.I. duPont de Nemours & Co., 334 U.S. 495 (1948); Brown Shoe Co. v. U.S., 370 U.S. 294 (1962); Ford Motor Co. v. U.S., 405 U.S. 562 (1972).

3 See Perry (1989) and Boner and Krueger (1991) for surveys.

advocating limits on integration in the petroleum case while advocating no action in the case of baking.

European Economic Community law relating to vertical integration is contained in Article 86 of the Treaty of Rome. The case law seems to suggest that vertical integration can be regarded as illegal only if combined with an exclusionary practice such as a refusal to deal [Perry (1989)].

Regarding U.S. antitrust policy, White (1989) contends that the shifts in policy have mirrored shifts in legal scholarship, which in turn have mirrored shifts in economic scholarship. The policy of the 1950s and 1960s was based on what could be called a "naive" foreclosure theory: integration removes a competitor from the upstream level, leading to an increase in monopoly power for sellers; it also removes a competitor from the downstream level, leading to an increase in monopsony power for buyers. An unappealing aspect of the naive theory is its focus on the harm caused to competitors rather than to competition although integration was certainly assumed to harm the latter as well.

The policy shift from the 1970s to the 1980s corresponded to the publication of the "Chicago School" views of vertical integration. Propounded by Bork (1978) and others, this view contends that market power at one level of an industry cannot be leveraged into market power in another level. The contention was demonstrated formally in a model of vertical integration with a fixed-proportions technology. In addition, an alternative to the naive theory was offered by Williamson (1971) and Klein, Crawford and Alchian (1978), stressing efficiency rather than anti-competitive motives for vertical integration. Their theory suggests that buyers' and sellers' assets may be specific to the transaction under consideration—i.e., worth significantly more in the transaction than in alternative uses—creating problems of bilateral monopoly and opportunism, problems which can only be an mitigated through vertical arrangements such as vertical integration.

10.2.1 The current debate

The Chicago-School view, that vertical integration cannot have anti-competitive effects, has been attacked from several angles. Vernon and Graham (1971) and later authors⁴ argued that in a variable-proportions case, downstream firms would substitute away from the input produced by an upstream monopolist, leading to inefficient production of the final good. The monopolist would have an incentive to integrate in the downstream level in order to ensure the efficient input ratio was utilised. Another argument was that integration would allow a monopolist to price discriminate among downstream buyers [Coulter (1977)]. The monopolist would like to charge low input prices to the downstream firms serving a market with elastic demand and high prices to

⁴ Hay (1973), Schmalensee (1973) and Warren-Boulton (1974).

the downstream firms serving a market with inelastic demand, but may be prevented from so doing by arbitrage across the markets. The monopolist could prevent arbitrage by integrating vertically, serving the elastic market itself and raising the input price to the independent downstream firms.

That these and other arguments did not reverse the trend in policy toward vertical integration may be due to several factors. First, the welfare predictions from the models are often ambiguous; for example, it is well-known that price discrimination may be welfare-reducing or enhancing. Perhaps more importantly, the theories typically posited an upstream monopolist, whereas the typical situation confronting antitrust authorities involves industries with several firms. Authorities may prefer to address the problems of monopoly and monopolisation directly through regulation and horizontal-merger policy rather than relying on vertical-merger policy.

Recently, there has been a wave of theoretical papers that provide a rigorous foundation for the vertical foreclosure story. Salinger (1988); Ordoover, Saloner and Salop (1990); Hart and Tirole (1990) and Bolton and Whinston (1993) construct game-theoretic models in which both levels of the industry are oligopolies. The authors show that vertical integration may be associated with a variety of strategic effects on rivals, causing a decrease in the quantity supplied by rivals, in turn possibly causing an increase in the price of the final good and a decline in social welfare. We will discuss the models in more detail in Section II, focusing in particular on their empirical implications.

This "new" foreclosure theory does not appear to have influenced the policy debate. The current policy in the U.S. appears to be a continuation of the 1980s. As stated above, the Department of Justice and Federal Trade Commission made no mention of vertical integration in their 1992 guidelines, an indicator that the antitrust authorities would be reluctant to prohibit vertical mergers. Congress is currently considering a bill that would allow local telephone exchanges to re-integrate into the long-distance market [Bork, (1995)]. On the other hand, the Department of Justice has been questioning vertical ties between operating systems and software for personal computers [Kehoe (1995)], possibly an indicator of renewed interest in vertical issues.

There are several factors that might account for the lack of influence of the new foreclosure theory. First, its publication in academic journals has been fairly recent, so it may take time to filter into the policy debate. Second, the models may be perceived to be complex and their results not robust to changes in the underlying assumptions.⁵ Perhaps most importantly, there has been little empirical evidence verifying the theoretical existence of foreclosure and even less evidence on the pervasiveness of foreclosure in the economy.

⁵ For example, Carlton (1990) writes, "If the point of a paper is to show that foreclosure is not only theoretically possible but actually occurs and if the paper will be used for policy recommendations, then it matters very much what the strategy space is. I am especially wary when I know that the results may change significantly if there are changes in the strategy space."

10.2.2 An empirical approach

This paper attempts to remedy the last shortcoming by analysing the empirical side of the foreclosure question. Section II examines the models associated with the new foreclosure theory in more detail. To provide some intuition for the models' results, the main strategic effects behind the results are summarised. The testable implications are drawn out from each model. The main implications that may distinguish the theory from efficiency theories of vertical integration are (1) that vertical integration may increase the price and reduce the output of the final good and (2) that integration may benefit rival firms.

Section III summarises the existing empirical evidence on foreclosure. It is argued that the papers often consider tests that cannot distinguish between foreclosure and efficiency. It is also noted that the results of some papers can be interpreted as supporting the opposite conclusion from the one intended by the authors. Section IV presents some new evidence on vertical foreclosure from event studies in two industries, beer in the U.K. and oil in the U.S. These studies provide evidence in support of vertical foreclosure in certain industries. The generality of the results and their applicability for policy is discussed in the conclusion.

10.2.3 Some definitions

It will prove useful to define the terms used in the rest of the paper and also to set the limits of the discussion at the outset. *Vertical integration* will mean the combination of the supplier of an input (called the upstream firm or supplier) together with the firm that uses the input in the production of another good (called the downstream firm or buyer). The theoretical discussion usually abstracts from questions such as the percentage of stock ownership that establishes integration and supposes that the integrated units are operated by a single owner who maximises joint profits.

Vertical foreclosure will refer to the possible anti-competitive effects of vertical integration. These effects may be revealed in different ways by the various theoretical models. Foreclosure may show up as an increase in the price of the final good. It may show up as a decrease in the final-good output. Alternatively, foreclosure may be characterised by welfare measures; i.e., foreclosure occurs when vertical integration leads to a reduction in consumer surplus or total social surplus.

To limit the discussion, we will consider the integration between two levels of production rather than the integration between producers of complementary goods, the latter case referred to as *bundling or tying*.⁶ The two phenomena are related: for example, if the complementary goods must be consumed in fixed proportions, then the distinction between them is largely semantic. To further limit the discussion, we will ignore other vertical restraints besides integration — contractual provisions such as

6. Refer to Whinston (1993) for a theoretical examination of tying and foreclosure.

exclusive dealing, price and quantity restrictions, etc. — that could have strategic foreclosure effects.⁷ Vertical integration is clearly related to these other restraints: in some cases, contracts less restrictive than full integration may be sufficient to achieve vertical foreclosure; though Hart and Tirole (1990) argue that under some conditions nothing less than full integration is sufficient.

10.3 Models

In this section the new vertical foreclosure theories are summarised: Salinger (1988); Ordober, Saloner and Salop (1990); Hart and Tirole (1990) and Bolton and Whinston (1993). Special attention is paid to testable implications — implications that differentiate the foreclosure theories from efficiency theories — regarding the effect of vertical integration on output, prices and profits.

10.3.1 Salinger (1988)

In Salinger's (1988) model, there are N_f identical input producers and N_f final-good producers. n upstream units are integrated with downstream units, leaving $N_f - n$ unintegrated upstream firms and $N_f - n$ unintegrated downstream firms. The structure of the industry is exogenous in the model. One unit of the intermediate good can be transformed into one unit of the final good using a fixed-proportions technology. Upstream firms choose their quantities in a first stage. Given the quantity of the intermediate good, the downstream firms and the integrated firms act as price takers on the input market and act as Cournot competitors on the output market.⁸

Salinger analyses how the exogenous integration of one upstream and one downstream firm affects the equilibrium of the game. Under the timing assumptions, an integrated firm no longer participates in the market for the intermediate input, either as a buyer or supplier. Assuming linear demand and constant marginal costs, the intermediate-good price may rise or fall, and so may the final-good price and social welfare. Final-good price tends to rise if the upstream level is concentrated and the downstream level unconcentrated.

Two interesting strategic effects accompany a vertical merger. First, merger removes the double-marginalisation problem within the firm: the firm bases its output decision on the marginal cost rather than the market price of the intermediate input. This effect tends to increase the integrated firm's output (and final-good output as well). The second effect is that the number of independent upstream firms declines, increasing upstream concentration, increasing the input price, in turn leading the unintegrated

7. Refer to Bernheim and Whinston (1992), Chang (1992) and O'Brien and Shaffer (1992) for a theoretical treatment of the possible foreclosure effects of exclusive dealing.

8. Refer to Salinger (1989) investigates other timing assumptions.

downstream firms to cut back output. If the second effect dominates, total output may fall in response to the merger, i.e., vertical foreclosure may result.

The model also has implications for the effect of vertical integration on the profits of rivals, implications that are not explicitly analysed by Salinger. A proof of the following proposition is contained in the appendix.

Proposition 1 *Consider a vertical merger in Salinger's (1988) model. Profits of unintegrated upstream firms fall; profits of unintegrated downstream firms may rise or fall; profits of integrated firms rise if and only if the final-good price rises.*

10.3.2 Ordover, Saloner and Salop (1990)

In the model of Ordover, Saloner and Salop (1990), upstream firms $U1$ and $U2$ compete Bertrand to supply an input to downstream firms $D1$ and $D2$. The downstream firms engage in Bertrand competition in differentiated products. There are four stages to the model. First, the downstream firms bid for the right to integrate with $U1$. Let $D1$ be the winning bidder. Second, the input prices are set. Third, $D2$ may bid to integrate with $U2$. Fourth, the final good is sold.

The interesting foreclosure effects occur in the second stage. The authors allow the integrated firm $U1-D1$ to commit to c_{12} , an input price offered $D2$, before $U2$ offers its price to $D2$. $U2$'s price offer just undercuts c_{12} , so by raising c_{12} , $U1-D1$ can indirectly raise $D2$'s variable costs. $U1-D1$ chooses c_{12} so that $D2$ is just indifferent between merging with $U2$ and not.

Vertical integration thus raises downstream price and reduces social welfare in the model. The unintegrated downstream firm is partially foreclosed, and its profits suffer. The unintegrated upstream firm benefits from the reduced competition on the input market. The authors do not consider how the integration of $U1$ and $D1$ would affect integrated firms. To the extent that an integrated firm can satisfy its own input demands, it would benefit from the increase in the final-good prices. Integrated firms requiring some input from external sources (say due to upstream capacity constraints) would be harmed in the same way as $D2$.

⁹ Hart and Tirole (1990) and Reiffen (1992) object that the commitment technology afforded by vertical integration is artificial. Ordover, Saloner and Salop (1992) counter that the same outcome would emerge endogenously if $U1-D1$ and $U2$ competed to supply $D2$ in a descending-bid auction. It could be countered that a descending-bid auction is a suboptimal mechanism for $D2$, dominated by a simultaneous, sealed-bid auction.

The authors also consider other formulations, such as allowing the integrated firm to commit not to supply the input to $D2$ at all but allowing a competitive fringe to supply $D2$ with an inferior input

10.3.3 Hart and Tirole (1990)

Hart and Tirole's (1990) model has two upstream firms, $U1$ and $U2$, and two downstream firms, $D1$ and $D2$. The downstream firms engage in Cournot competition. $D1$ and $D2$ can costlessly transform one unit of the input into one unit of the final good. The upstream firms make contract offers to the downstream firms; contrasting the other theories in this section, here general non-linear contracts are allowed. $U1$'s (constant) marginal costs are given by c_1 .

The authors explore three variants of the basic model depending on the bargaining power of the upstream firms and the location of the binding resource constraints. In the *ex post monopolisation* variant, upstream firms have no bargaining power. Supposing $c_1 > c_2$, it is shown in the non-integration case that the efficient upstream firm, $U1$, supplies each downstream firm with the Cournot quantity $q(c_1, c_1)$, where $q(x, y) \equiv \text{argmax}_q [P(q, q(y, x)) - x/q]$. $U1$ would do better if it could credibly restrict the quantity transferred to one of the D_i , say giving the monopoly quantity to $D1$ and nothing to $D2$. This is not an equilibrium, however, since $U1$ would have an incentive to transfer some input to $D2$ secretly. Only the Cournot quantities are immune to this sort of secret deviation.

Suppose $U1$ and $D1$ integrate, forming $U1-D1$. It is assumed that the firms share profits under integration. Profit sharing allows $U1-D1$ to restrict credibly the quantity supplied to $D2$ since any secret transfer of the input to $D2$ increases $D2$'s production, decreasing the price of the final good. In equilibrium, $U1-D1$ produces $q(c_1, c_2)$ and $D2$ produces $q(c_2, c_1)$. $U1-D1$ cannot restrict output any further or else $U2$ will step in and supply $D2$.

As a result of integration, output and social welfare declines. Profits of the unintegrated upstream firm remain constant. The unintegrated downstream firm's profit and output declines.

In the *scarce needs* variant, upstream firms have some bargaining power. They are each able to retain $\beta - 1/2$ of the surplus from trade with each D_i , leaving D_i with $1 - 2\beta$ of the surplus. If one of the upstream firms exits, the remaining upstream firm obtains a fraction β' of the surplus from trade, where $\beta' > 2\beta$ so that a downstream firm is better off bargaining with two upstream firms than with one.¹⁰

Suppose $U1$ and $D1$ integrate. Then $U2$ loses its opportunity to supply $D1$, thus losing β times the duopoly profit. If this loss is sufficiently costly, $U2$ may not be able to cover its fixed costs of operating and may shut down. In that case, $U1-D1$ is able to monopolise the industry. Output would fall a result of the exit of $U2$. Both

¹⁰ These surplus shares can be thought of as expected shares with the winning party being determined randomly. To fix ideas, if the firms received their Shapley (1953) values in this game, then $\beta = 1/6$ and $\beta' = 1/2$. For simplicity, the authors set $c_1 = c_2$.

unintegrated firms are hurt as are consumers. Social welfare falls (unless the savings from $U2$'s fixed cost exceeds the loss of consumer surplus).

In the *scarce supplies* variant, the upstream firms are severely capacity constrained: the sum of their capacities, $q_1 + q_2$, is less than the monopoly quantity $q^m = \text{argmax}_q P(q)q$. Downstream firms obtain fraction β of the surplus from trade with each upstream firm. If only one of the downstream firms remains, it obtains β of the gains from trade, where $\beta > 2\beta$.

Suppose $U1$ and $D1$ merge. They profit by cutting $D2$ out of the bargain for $U1$'s capacity. $D2$ is hurt and may exit. If $D2$ exits, $U2$ now only has one competitor bargaining for its capacity, so $U2$ would be hurt as well. If $U2$ also exits, then output of the final good will decline and consumer surplus will fall.

Combining the results from the three variants, we see that integration results in a (weak) decline in final-good output and consumer surplus. Output of the integrated firms increases; output of the unintegrated firms declines. At least one of the unintegrated firms is hurt; the other may be hurt as well or may be unaffected.

Hart and Tirole do not consider how the merger of $U1$ and $D1$ would affect an integrated firm. Snyder (1995c) extends the model to allow for both integrated and unintegrated rivals. It is shown that an integrated firm benefits from such a merger in a wide variety of cases.

10.3.4 Bolton and Whinston (1993)

Bolton and Whinston (1993) posit one upstream firm, U , and two downstream firms, $D1$ and $D2$. $D1$ can produce one unit of the final good from which it receives profit $v_i(U, s)$, where U is $D1$'s investment and s is a random variable. Investment U costs $c_U(U)$ and is non-contractible. To produce its output, $D1$ requires a unit of input from U . U may produce enough for both downstream firms (two units), but with probability λ there is a shortage and U can only produce one unit. The firms engage in alternating-offers bargaining over the transfer of the input.

The incentives for a merger between U and $D1$ can be seen by examining the case in which the input is transferred only to $D1$ in equilibrium (this case occurs when there is a shortage and $v_i < v_j$). If $D1$ is not merged with U , $D1$ does not receive a return on its investment in this case. If $D1$ and U are integrated, the merged entity does receive a return on its investment since this investment improves its outside option vis-a-vis $D1$, allowing it to extract more surplus from $D1$ in the bargaining game.

Bolton and Whinston's results relate to equilibrium investment levels $I1$ and $I2$. Integration increases the integrated downstream unit's investment and increases the probability that it receives the input if there is a shortage. The opposite is true for the unintegrated downstream firm. Integration reduces the latter firm's profits. Vertical

integration does not affect final-good output; it only affects social surplus through the investments.¹¹

10.3.5 Summary

The details of four different models with their different variants may tend to obscure their underlying similarities. Foreclosure can be seen to arise from two main factors associated with vertical integration: a commitment effect and an investment effect.

The *commitment* effect refers to the ability of a vertically-integrated firm to commit to restrict output to downstream competitors. Commitment comes from profit sharing: because an integrated upstream unit shares the profit of its downstream counterpart, it is harmed by increases in the output of rival downstream firms. Therefore, it has an incentive to cut back input supplies to rivals of its downstream counterpart.

The commitment effect is especially valuable for an efficient upstream firm since such a firm can have a large impact on final-good price by restricting its output. This is the case in Hart and Tirole's ex post monopolisation variant. The commitment effect can still operate if the upstream firm is only of average efficiency, however. In that event, the firm can affect final good price by committing to remove itself as a competitor on the intermediate-good market (Salinger, and one variant Ordover, Saloner and Salop) or by committing to charge a high price (another variant of Ordover, Saloner and Salop).

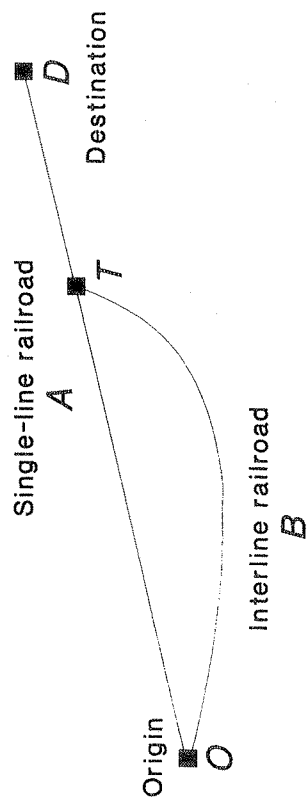
In brief, the *investment* effect is that vertical integration may allow the integrated firm to increase its share of the surplus at the expense of rivals.¹² If the harm to rivals is great enough, they will reduce their investment, possibly exiting the industry, leading to greater concentration.

The investment effect arises when the capacity of firms in one level of an industry greatly exceeds the capacity of firms in the other level. Relative scarcity results, either a scarcity of the intermediate input or a scarcity of outlets for the final good. Scarcity generates quasi-rents, the allocation of which depends on the bargaining position of the firms. Vertical integration changes the firm's bargaining position and thus changes the allocation of rents. For example, in Hart and Tirole's scarce needs variant, vertical integration between $U1$ and $D1$ cuts $U2$ out of the negotiations for $D1$'s custom, reducing $D1$'s surplus. In Bolton and Whinston, vertical integration leads $U1$ to invest more ex ante to improve its outside option in negotiations with $D2$. As demonstrated by Grossman and Hart (1986), such ex post reallocations of surplus

¹¹ It is possible to interpret v_i as a measure of consumer demand for the final good, and so increased investments could translate into increased sales. Given the flexible functional-form assumptions, it is impossible to draw implications about aggregate output from equilibrium investment levels.

¹² As will be clear from the discussion below, this effect could also be accurately labelled a "scarcity" or a bargaining" effect since these terms also identify essential elements of the theory. However, a reduction in investment is the proximate cause of foreclosure, so we will maintain the "investment effect" terminology.

Figure 10.1 Railroad interlining



change may reduce firms' incentives to invest ex ante. In the extreme, a firm may exit (i.e., reduce its investment to zero). In any case, reduced investment may cause a reduction in the output of the final good.

To summarise the testable implications from the model, vertical foreclosure (by definition) results in a reduction in output of the final good or an increase in the final-good price. Vertical foreclosure is also associated with a decrease in the production of the input. In every model, vertical foreclosure harms unintegrated downstream firms. Upstream firms and integrated rivals may be harmed by foreclosure, or they may in fact benefit.¹³

Most of the preceding testable implications differ from the implications of efficiency theories of vertical integration. Specifically, foreclosure theories — but not efficiency theories — imply that final-good output should fall and final-good price should rise as a result of vertical integration. Foreclosure theories — but not efficiency theories — imply that a rival firm's profit may rise as a result of integration. By contrast, the implication that a rival may be harmed by integration follows from both foreclosure and efficiency theories and thus cannot distinguish between them without further information.

10.4 Previous evidence on foreclosure

In this section, the few empirical studies on vertical foreclosure are summarised. The studies fall into two categories. The first category examines the effects of vertical integration on price in industries monopolised at either the upstream or the downstream level, i.e., industries that are characterised by the existence of an essential facility. Empirical studies in the second category consider industries that have oligopolies both upstream and downstream.

10.4.1 Studies involving essential facilities

Grimm, Winston and Evans (1992)

Grimm, Winston and Evans (1992) analyse railroad markets in which there is interlining (Figure 1). Railroad A serves both segments of the line from O to D. Railroad B is an interlining railroad, only serving one segment OT of the complete line OD. Although there is competition on the OT segment, railroad A is a monopolist on TD, and any traffic travelling from O to D must use A's essential facility.

¹³ As discussed below, care must be taken in interpreting firms as "upstream" or "downstream" in practical applications. A firm may be commonly called "upstream", yet the theory may better apply if the same firm is labelled "downstream".

Grimm, Winston and Evans study the effect of increased interline competition on the full-line price. In terms of Figure 10.1, if there are more railroads serving OT, does this affect the price charged OD traffic? The authors collected data on 395 routes in the U.S. served by exactly one single-line railroad. The dependent variable is a welfare-distortion measure ΔW , the difference between shippers' welfare if competitive prices were charged on the OD route and shippers' welfare under the prevailing prices.¹⁴ The important independent variables are the number of interlining railroads at the origin and the number of interlining railroads at the destination, interacted with distance.

The authors find that an additional interline carrier reduces the welfare distortion ΔW by about three cents per ton mile. The authors suggest that the result may provide evidence of vertical foreclosure: forming a single-line railroad by vertical merger results in a reduction of interline competitors and therefore a reduction in shippers' welfare.

There are several problems with this interpretation of the results. First, the implicit experiment behind the regression equation is not the formation of a single-line carrier from two interlining ones; rather it is the removal of an interline carrier while maintaining the one single-line railroad. Second, the existence of independent routes formed by linking an interlining railroad at the origin and one at the destination would appear to pollute the results. The authors control for this by including the number of

¹⁴ ΔW was estimated from a separate modal choice model. Given the underlying model used to estimate ΔW , it is essentially a weighted average of price-cost margins for different modes of travel (motor carrier and rail).

independent routes that actually carried traffic, but it may be difficult to capture the effect of competition in a simple variable.¹⁵ A third problem regards the application of the new foreclosure theory to the railroad industry. As Hart and Tirole (1990) note, the variant that best applies to essential railroad facilities is probably ex post monopolisation.¹⁶ Vertical integration in this variant would allow the essential facility to restrict output on the OD market. Vertical integration should reduce the dependence of the price of OD traffic on the number of interlining competitors. A finding of a significant effect of interlining competitors would appear to run counter to the new foreclosure theory, or at least not support it.

Grimm, Winston and Evans provide a second interpretation of the results that seems more plausible. They note the existence of regulatory constraints and constraints provided by standard business practice in rail¹⁷ that reduce the ability of an essential facility to extract monopoly rents from interliners. Vertical integration allows these constraints to be partially avoided.

Waterman and Weiss (1994)

Waterman and Weiss (1994) study the U.S. cable television industry, characterised by competing program suppliers upstream and monopoly cable systems downstream. The program suppliers can be further divided into basic and pay. Basic programs such as ESPN generate revenue through advertising and are offered with the basic package to consumers at a single bundled price. Consumers pay an additional charge to receive a pay program such as HBO. In most communities, the downstream cable system is an essential facility. Another interesting feature of the industry is that the downstream systems are often horizontally integrated into multiple system operators (MSOs).

The authors employ data on 1,646 cable systems owned by the 25 largest MSOs in 1989. They first estimate the effect of vertical integration on the probability of a system's carriage of pay programs, specifically movie channels HBO and Cinemax (owned at the time by ATC) and Showtime and The Movie Channel (owned by Viacom). They run a probit, where the dependent variable is an indicator for carriage and the independent variables of interest are ownership dummies. Systems that were integrated with upstream program suppliers were more likely than non-integrated firms to carry the supplier. They were less likely to carry the rivals of their integrated supplier. An ordered probit showed that integrated systems owned by ATC supplied fewer pay channels in total than others (the results for Viacom were not significant).

¹⁵ A way around this problem, conditional on data availability, would be to include only routes on which no independent competitor could be formed from the interliners.

¹⁶ Salinger (1988) and Ordover, Saloner and Salop are not applicable to the essential facility case. Bolton and Whinston (1993) does not have clear testable implications here.

¹⁷ For example, refusals to deal may be prohibited by the Interstate Commerce Commission. The division of revenue between the essential facility and the interliner may be required to be in proportion to the mileage covered. See Grimm and Harris (1988) for further details.

Finally, the authors attempt to capture the effect of vertical integration on the promotional effort directed at various pay channels. They regress the pay channels' subscriber penetration (the percentage of homes passed by the cable system which subscribe) ownership dummies using a tobit technique.¹⁸ The *subscriber-penetration* results are consistent with carriage results: integrated systems have higher penetration for their upstream supplier and lower penetration for rivals of their upstream supplier.

As with the railroad results, it is difficult to interpret the results for cable as a confirmation of the new foreclosure theories. One problem is that cable systems can offer more than one pay channel simultaneously and pay channels are differentiated goods. To circumvent this problem, it may be easier to think of the industry in reverse of what is usual: consider cable system as the upstream firm that supplies an essential input, program carriage, to downstream program suppliers. Following the discussion with the railroad case, the relevant theories would be Hart and Tirole's scarce supplies and ex post monopolisation variants. Scarce supplies could arise because of constraints on the number of channels a cable system could provide. By integrating, some of the bargaining surplus accruing to program suppliers could be appropriated. Unless a system is strictly capacity constrained, however, it is a puzzle why the system would eliminate the program from its offerings entirely rather than offering the channel but appropriating the bargaining surplus through some other means, say a fixed fee. As discussed in the railroad case, the ex post monopolisation variant should imply a positive effect of integration on the carriage of rival channels: an integrated system should be better able to commit to restricting output without resorting to exclusivity than a non-integrated system.

The authors also note that efficiency motives for vertical integration may account for their results. If the cost of providing an integrated program declines sufficiently, it may become profitable to supply that channel alone and not its competitors. See Waterman and Weiss (1993) and Waterman (1995) for a further discussion.

Chipy (1995)

Chipy (1995) also studies the U.S. cable industry, using 1991 data on the universe of about 1600 MSOs. Her results are largely consistent with Waterman and Weiss's (1994). In a regression of number of pay channels offered on variables measuring integration, she finds that the more pay channels with which a system is integrated, the fewer pay channels it offers. A probit regression shows that systems are less likely to offer basic programs that may serve as substitutes for their integrated pay programs.

An estimate of consumer surplus for each market, controlling for demographic information shows that welfare may be higher in integrated markets. It is argued that the quality of the programs offered by integrated systems may be higher; evidence that

¹⁸ A tobit is needed because of a censoring problem: if a program is not carried on a system, the subscriber penetration is censored at zero.

program variety (the number of genres of programs offered) is higher for integrated systems supports this view.

10.4.2 Studies of oligopolies

Allen (1971)

Allen (1971) provides a case study of the U.S. cement industry. Cement is an input into the production of concrete, the final good sold to demanders such as contractors. The Federal Trade Commission's investigation concerning vertical integration in cement forms the background for Allen's paper. In response to shortages of cement in the 1950s, cement-making capacity was increased by over a third between 1955 and 1959. Capacity expanded even though demand for cement was slackening in the mid-1960s. A wave of integration of cement manufacturers into concrete production followed.

Allen catalogues the mergers in the cement industry, paying particular attention to the mergers which were alleged to be associated with foreclosure. For these, he examines the stated motives for integration and the company performance after the merger.¹⁹ Given the over-capacity at the upstream cement level, the motives given appear to support Hart and Tirole's scarce needs variant, as Hart and Tirole (1990, p.249-52) note.

McBride (1983)

McBride (1983) employs data on 17 regional markets for cement over the years 1958-67 in the U.S. He regresses the average cement price on the number of vertical mergers in the regional market, the cumulative number of vertical mergers in the market and other controls. The coefficient on cumulative number of mergers is negative and significant, suggesting the opposite of the foreclosure hypothesis. If the effect of vertical mergers is to reduce the number of competing input suppliers as in Salinger (1988), then the input price should rise. Johnson and Parkman (1987) question McBride's specification. They note that price had a negative trend, and cumulative number of mergers is by definition a positively trended variable; so the negative correlation between the two may be spurious. Indeed, the negative correlation disappears when a time trend is added.

Rosengren and Meehan (1994)

Rosengren and Meehan (1994) study a sample of 19 vertical mergers challenged by the Federal Trade Commission in the U.S. between 1962 and 1982. They use the event-

¹⁹ For example, Allen writes of the River Cement Company: "With most of River's market sewed up by its competitors (in large part by vertical integration in the Memphis and Kansas City areas), the company needed its own cement-using outlets to elbow its way in".

study methodology, looking at the effect of a vertical merger on the returns of rival firms. For each merger, they create an equally-weighted portfolio of unintegrated upstream rivals and a portfolio of unintegrated downstream rivals. They compute the standardised excess return for each portfolio, and then form the statistic z , which is cumulated across the 19 mergers. They split the sample to compute z in several different ways. First, they cumulate the excess returns from all the portfolios, both the upstream and downstream. Second, they cumulate the excess returns of the upstream and downstream portfolios separately. Third, they cumulate the excess returns of the rivals of the merger target separately from the rivals of the acquiring firm.

The authors contend that if a vertical merger is for foreclosure reasons, the merger should cause harm to unintegrated downstream rivals. They find that z is small and insignificant for all cases and take this as evidence against the foreclosure theory. They also examine the effect of the announcement of an FTC complaint against the merger. Here, the FTC complaint is shown to have insignificant effects for wide event windows; but for narrow windows there is a significant result, suggesting that rivals of the target firm were harmed by the complaint (meaning that this group of firms must benefit from the merger). The authors regress the excess returns against a dummy for rivals of acquiring firms and a dummy for downstream, in addition to structural variables (concentration, capital requirements, economies of scale). No significant results are obtained.

Rosengren and Meehan take the lack of a significant negative coefficient as evidence against the foreclosure theories. This interpretation of the results is suspect on a number of grounds. Recall from the discussion in Section II that both foreclosure and efficiency theories are consistent with the reduction in a rival's profits. Thus, the empirical finding that a rival is harmed by integration cannot distinguish between the two theories. The novel prediction of the foreclosure theories is that a rival may benefit from the vertical merger. The authors perform the opposite of the proper test.

Further, the authors place too much emphasis on a literal interpretation of "upstream" and "downstream" in the models. Indeed, the common usage of "upstream" and "downstream" may bear no relationship to the usage in the theories [see Salinger (1989) for more on this point]. For example, in the discussion of the cable studies above, the relevant models fit better if the common usage of "upstream" and "downstream" were reversed, i.e., if the cable system were considered the upstream firm and the program supplier were considered the downstream firm. With this in mind, aggregating the excess returns of what are "downstream" firms in the common usage will add together excess returns of upstream and downstream firms. Significantly positive excess returns may wash out significantly negative ones, perhaps giving an insignificant aggregate result.

The results in Rosengren and Meehan's Table IV indicate that aggregation has indeed obscured significant effects for individual events. The table contains the disaggregated excess returns for each merger. The disaggregated results are economically significant

and quite probably statistically significant as well: exactly half of the excess returns, 19 of them, are one percent or more in absolute value. There is an even split of these between negative and positive. To give some indication of the magnitude of the results, there are positive excess returns of 2.4, 7.6 and 8.1 percent. These are substantial effects for a merger to have on a portfolio of rival firms.

Indeed, these large positive excess returns can be taken as evidence in support of the foreclosure theory. If the vertical integration had only efficiency effects, rivals should be harmed by the mergers, not helped as is the case, for example, with the Budd-Gindy merger and the Inco-ESB merger.

Summary

The empirical work outlined in this section provides limited evidence supporting the new foreclosure theories. The results of Waterman and Weiss (1993, 1994) and Chipy (1995) suggest that the investment effect of vertical integration may operate in the cable industry: integrated cable operators may exclude competitors' channels in order to appropriate bargaining surplus. More information is needed to understand why integrated firms would resort to crude measures such as exclusion to appropriate bargaining surplus. The commitment effect does not appear to characterise vertical integration in cable: the commitment effect is a substitute for exclusion, so in theory the two should not be observed together.

The Allen (1971) and Rosengren and Meehan (1994) studies, which purport to reject the foreclosure theories, provide facts in support of the opposite conclusion. Allen offers several statements from firms that they were integrating to avoid being foreclosed from the market. Rosengren and Meehan show that vertical mergers can increase the profits of rivals significantly.

10.5 New evidence on foreclosure

This section describes in detail two new studies, Snyder (1995a, 1995b), offering evidence in support of the new vertical foreclosure theories. Both are event studies of particular industries. The industries chosen were the subjects of government inquiries into their vertical structures. In particular, the British brewing industry was the target of a Monopolies and Mergers Commission inquiry in the 1980s, and the U.S. oil industry was the target of a Congressional inquiry in the 1970s. A priori, the industries were likely environments in which vertical foreclosure might be observed.

10.5.1 British beer industry

The British beer industry can be divided into two levels: upstream production and downstream retailing. Most of the production, 75 percent by volume, was undertaken

by the six integrated majors: Allied, Bass, Courage, Grand Metropolitan, Scottish & Newcastle and Whitbread. Eight percent of production was undertaken by unintegrated majors. The rest was produced by an unconcentrated fringe of regional brewers. Downstream, pubs accounted for the bulk of retail beer sales (85 percent in 1986). An interesting feature of pubs is that expansion in their numbers was limited by licensing restrictions.

There was a great deal of integration in the British beer industry during the 1980s. In 1986, 57 percent of pubs were owned by producers. Of the unintegrated pubs, a majority had long-term contracts with the majors involving loan ties and/or exclusive-dealing provisions.

Three competing hypotheses could account for the extensive vertical integration in brewing. First, integrated firms may produce, distribute and retail beer more efficiently. Second, integrated pubs may have more of an incentive to invest in service amenities to increase consumer demand.²⁰ Third, integration may foreclose rivals. The first two hypotheses are really two incarnations of the classic efficiency story: the first hypothesis deals with cost reduction; the second with value enhancement.

Snyder (1995b) does not offer direct evidence on the issue, but indirect evidence against the first hypothesis is provided by the Monopolies and Mergers Commission (1989): the MMC found that retail prices were higher for integrated pubs on average than for unintegrated pubs. Further evidence against the first hypothesis comes from the historical pattern of waves of integration following licensing restrictions dating back to 1787. If integration were for efficiency reasons, there would be no reason for vertical mergers to occur in response to licensing restrictions. The brewers themselves appear to have forwarded the second hypothesis most forcefully in their own defence during the MMC investigation.

It is possible to distinguish between the second and third hypotheses using an event study. Vertical integration should help rivals if the second hypothesis is true. Improving the service amenities in a pub should benefit all brewers that distribute their beer through the pub whether integrated or not. Vertical integration may harm rivals if it is for foreclosure reasons. The sign of the effect of an integration event on rival stock returns provides a test of the two hypotheses. It should be emphasized that the test proposed in this study (determining if a firm is harmed by a rival's vertical integration) is different from the test suggested in Section II (determining if a firm's benefits from a rival's vertical integration). The reason that the test proposed in this

²⁰ The second hypothesis arises as a theoretical result in Bernheim and Whinston (1992); see Snyder (1995b) for a summary. In the model, the contracts offered by upstream manufacturers to a downstream retailer tend to undermine each other by offering too much insurance and too little performance pay. Exclusive dealing is a crude way to circumvent the problem. Vertical integration would circumvent the problem and allow the retailer to distribute both goods, beneficial if the products are differentiated and consumers' tastes heterogeneous.

Table 10.1 Announcement effects from event study of British brewing

Firm	Dummy Coefficients ^b (Normalised)			Aggregate Effect ^c
	k = 1	k = 2	k = 3	
A. Integrated Majors				
Allied	-0.23 (0.52)	-2.86** (0.85)	-0.50 (0.33)	-12.06** (5.36)
Bass	-0.29 (0.38)	-1.22** (0.54)	-0.23 (0.25)	-6.77** (3.88)
Courage	-2.59** (1.17)	-3.31** (1.30)	-0.49 (0.55)	-31.75** (10.92)
Grand Metropolitan	0.17 (0.47)	-0.37 (0.71)	-0.37 (0.33)	-2.70 (4.98)
Scottish & Newcastle	-0.80 (0.55)	-12.87** (1.36)	-0.83* (0.46)	-39.55** (6.60)
Whitbread	-0.71 (0.56)	-1.67** (0.77)	-0.49 (0.46)	-13.45** (6.30)
B. Unintegrated Major				
Guinness	1.42** (0.63)	2.30** (0.79)	0.26 (0.37)	18.30** (6.21)

a Results from FGLS estimation allowing the coefficients on the market model to change between each announcement. Optimal window widths $w_1 = 7$, $w_2 = 1$, $w_3 = 8$ were used [see Snyder (1995b) for a discussion]. Standard errors are in parentheses.

b The estimate of the dummy coefficient for the third event has been multiplied by -1 for comparison purposes.

c The aggregate effect adds the three announcements, weighting them by their associated window width w_k . The term for the third announcement enters the sum with a minus sign.

* Significant at the ten-per cent level. ** Significant at the five-per cent level.

10.5.2 U.S. oil industry

Snyder (1995a) applies the event-study methodology to the U.S. oil industry. The industry can roughly be divided into the upstream crude-production level and the downstream refining level. Like brewing in the U.K., the oil industry in the U.S. is extensively vertically integrated.

This study takes as events all the mergers in the industry from 1963 to 1988 above a certain size and having a significant vertical component. Eleven mergers survived the

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study is appropriate is that other information has been used to rule out some forms of the efficiency hypothesis.

The main unintegrated rivals were three majors: Guinness, Carlsberg and Northern (Clubs Federation Brewery). Of these, only Guinness was publicly traded and thus available as an observation for an event study.

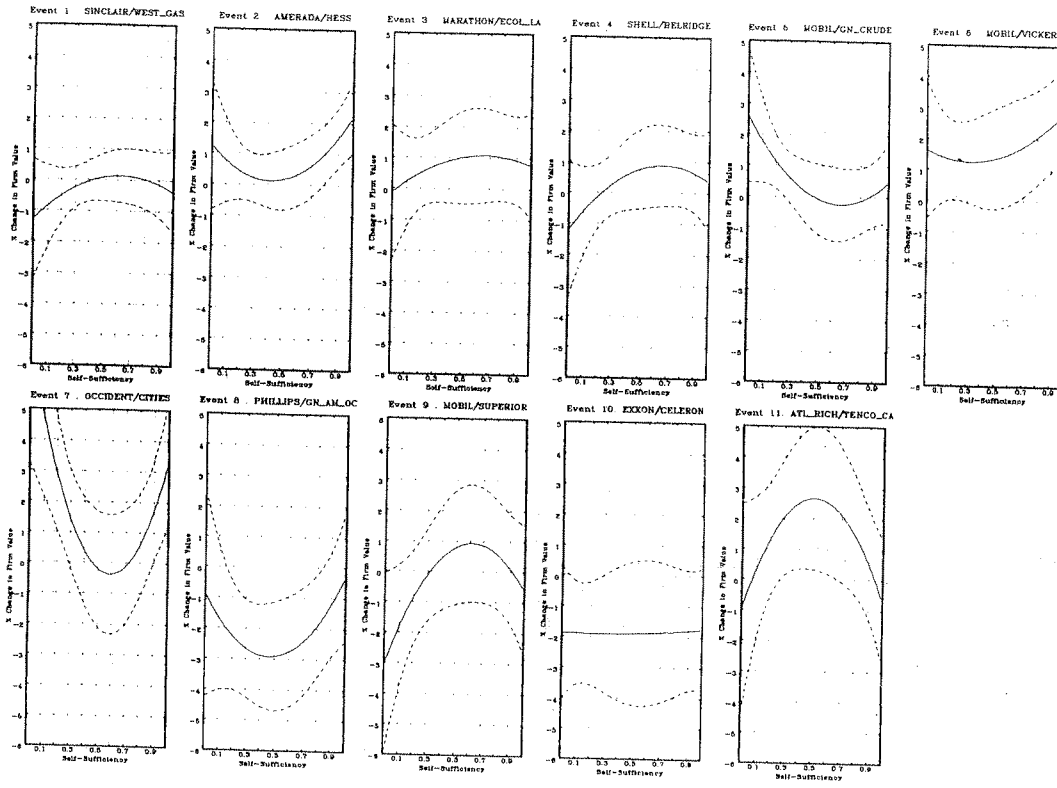
Three announcements used for this study, indexed by k , were associated with the MMC's inquiry into brewing. On December 11, 1987, the MMC released its preliminary findings of a "complex monopoly" in brewing. On March 22, 1989, the MMC published its report containing detailed recommendations that the breweries should be divorced from the pubs and loan ties eliminated. These events represent decreases in the likelihood that the majors would remain integrated. On July 11, 1989, the government replaced these stringent recommendations with more lenient ones. This latter announcement represents an increase in the likelihood of integration.

Daily stock price data was used. A market index was included (the FT-SE 100) to account for economy-wide movements in returns.

The effect of the announcements on publicly-traded majors, the six integrated majors and Guinness, is given in Table 10.1. As expected, the integrated majors were harmed by announcements that increased the probability that they would have to sell off their pubs. The second announcement in particular had a significant effect on virtually all the integrated majors at the five percent level. The effect of the three announcements taken together ranged from about a three percent loss to almost a forty percent loss in firm value. Guinness benefited from the announcements. The aggregate effect on Guinness was an eighteen percent gain in firm value, significant at the five-percent level.

The results are consistent with the foreclosure theory of integration and inconsistent with the service-amenity theory. Any strong conclusions, however, must be tempered by the fact that there was only one unintegrated rival in the study.

Figure 10.2 Merger effects from event study of the US oil industry



selection criteria. The effect of these mergers on rivals was examined. A finding that the merger caused rivals to gain would support the foreclosure hypothesis and counter the efficiency hypothesis. Since the theories suggest the effect of vertical mergers depends on the location of the rival in the industry (i.e., upstream, downstream or integrated), the event effect was constrained to be a function of the level of the industry in which the rival operated. To measure the location of a firm's operation in the industry, a self-sufficiency measure was constructed for each firm i :

$$SSR_i = \frac{PROD_i}{PROD_i + REF_i} \quad (1)$$

where $PROD_i$ is i 's yearly crude production and REF_i is i 's yearly refinery runs in barrels. For example, a firm that is solely a refiner would have an SSR of zero, a firm that is solely a crude producer would have an SSR of one; an integrated, self-sufficient firm would have an SSR of one half.

Figure 10.2 graphs the effect of the merger announcement on rival stock returns, constrained to be a quadratic function of SSR . The dotted line is a five-percent, one-sided prediction interval around the curve. The graphs suggest that rivals at some level of the industry benefited significantly in mergers 2, 5, 6, 7 and 11.²¹ In most of the cases, the unintegrated upstream rivals or the integrated rivals were the beneficiaries. Mergers 8 and 10 significantly harmed rivals at some level of the industry.

21. The claims made in this section are verified by formal hypothesis tests in Snyder (1995a).

The fact that rivals benefited from the mergers in some cases supports the foreclosure theories. The study does not suffer from the problem in the beer study that there was only one publicly-traded rival; here there are about 40 rivals for each event. A factor that may pollute the results here is that the mergers were not purely vertical, between unintegrated upstream and downstream firms. In merger 4, for instance, the target firm Belridge was an unintegrated producer but the acquirer Shell had both producing and refining interests. The mergers might have benefited rivals not because of vertical foreclosure but because of increases in horizontal concentration. Further examination of the evidence contradicts this interpretation, though: rivals did gain in the purely vertical merger between Amerada and Hess, and the rivals which gained in some of the other mergers were in the opposite level from the increase in horizontal concentration (mergers 5 and 6 for example).

10.6 Conclusion

The results from the new studies of vertical integration presented in the previous section (and some of the results from other studies, suitably reinterpreted) supports the existence of vertical foreclosure in certain industries. The industries chosen for study were not chosen at random: the U.S. oil and U.K. beer industries, for instance, were subjects of government inquiries into their vertical structures. Thus, no claims can be made regarding the generality of the results or the prevalence of vertical foreclosure in the economy. To analyse such issues, the event studies would need to be replicated in other industries. In addition to event studies, future work should quantify the effects of vertical integration on final-good output.

Given the limited nature of the results, it is difficult to argue for engaging in a costly review of vertical mergers. The current U.S. policy, where vertical mergers are *per se* legal unless the industry is particularly concentrated or some other mitigating factors are present, may be appropriate subject to the findings of future studies.

Appendix

Proof of Proposition 1:

Equations (3a) through (9) from Salinger (1988) can be used to compute firm profits. The expressions can be simplified by setting inessential constants b and $a - MC_I - MC_F$ equal to 1. Differentiating these expressions with respect to n shows the effect of a vertical merger on profits.

The profit of an unintegrated final-good producer is

$$\pi_F = \left[\frac{N_I - n}{(N_F + 1)(N_I - n + 1)} \right]^2$$

It is easy to show that $d\pi_F/dn < 0$.

The profit of an integrated firm is

$$\pi_I = \left[\frac{1}{N_F + 1} \left(1 + \frac{N_F - n}{(N_I - n + 1)(n + 1)} \right) \right]^2$$

Differentiating, we are left with an expression identical to Salinger's condition (10), a condition which determines the effect of integration on final-good price.

The profit of an unintegrated producer of the intermediate good is

$$\pi_I = \frac{(N_F - n)(N_I - n)}{(N_F + 1)(N_I - n + 1)^2(n + 1)}$$

The sign of $d\pi_I/dn$ is ambiguous. If $N_I = 3n/2$, then $d\pi_I/dn > 0$ for $n > 5$ and large N_F . On the other hand, if $N_I = 2n + 1$, then $d\pi_I/dn < 0$ for all n and N_F .²²

22. Note that the condition $N_I = 2n + 1$ may be consistent with a rise in the final-good price; so there exist cases where foreclosure occurs but the upstream firms are hurt by integration.

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