Managerial Firms, Vertical Integration, and Consumer Welfare[*]

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Abstract

We show that important organizational decisions – such as whether to integrate – undertaken by managerial firms may adversely affect consumers, even in the absence of monopoly power in supply and product markets. While the effect is likely to come about when there is a negative shock of supply relative to demand, it is also possible for consumer-welfare-reducing reorganizations in the form of outsourcing to be triggered by *entry* of upstream suppliers. The results have implications for current policy debates about corporate governance and international outsourcing.

1

1   Introduction

Do consumers have an interest in the internal organization of the firms that make the products they buy? Conventional economic wisdom says no, at least if product markets are characterized by a reasonable degree of competition: firms that fail to deliver the goods at the lowest feasible cost, whatever the reason, including inappropriate organization, will be supplanted by their more efficient competitors.

Yet if the sheer volume of scholarship is any indication, that same wisdom readily acknowledges conflicting interests between the managers and other stakeholders in the firm. For instance, the corporate finance literature, born of the separation of shareholder ownership and managerial control that characterizes the modern corporation, focuses on how private organizational resposes such as compensation packages or corporate governance rules can help mitigate the potential for managers to cheat shareholders. But as the recent corporate scandals in the US and in England have reminded us, these private remedies may not always succeed, and there has recently been much public debate concerning appropriate corporate governance regulation in order to protect shareholder interests.

There is also longstanding awareness – among economists, policymakers and the public alike – of potential interest conflicts between the firm and the consumer; indeed this is a central concern of the industrial organization literature. But the predominant view of the firm there is the classical one of the unitary profit maximizer; as a consequence, the effects of managerial discretion on market performance are generally absent from the analysis, and both the economic literature and policy practice have focused instead on the adverse effects of market power. In this context, mergers or other major reorganizations are worthy of concern only insofar as they increase the firm's market power.[1]

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[1] A notable exception is the work of Leibenstein (1966): basing his arguments in part on data from the 1950s, he suggested that losses due to "X-inefficiency, " attributable in large measure to

In reality, of course, top managers, even in "small" firms, have considerable discretion in designing the organization of their enterprises, and they can be prime movers of merger and acquisition decisions. The motives behind these reorganizations or mergers may therefore have more to do with managers' interests than those of shareholders or consumers. For instance, White (2002) shows that there is no evidence that mergers have increased aggregate concentration in the U.S. He offers as an explanation that "the net advantages of much vertical integration may be overblown and economies of scope in most areas may be weak". White explains this pattern of mergers and divestiture by "empire building" motives of managers. A somewhat different view is proffered by Bertrand and Mullainathan (2003), who argue – similarly to Leibenstein – that managers seem to prefer a "quiet life"; their conclusion is based on correlations between the kinds of reorganization decisions that firms make and the presence or absence of anti-takeover laws in the U.S. states in which the firms are located.

Though the evidence offered by these studies is suggestive, the question remains whether and how organizational decisions rendered by the managerial firm – in which there is a separation of ownership and control – can affect consumer welfare in ways that do not involve market power. After all, if firms compete both in the product market and factor markets, those that do not minimize costs are at a competitive disadvantage. Nevertheless, as we shall show in this paper, a competitive world of managerial firms may indeed be characterized by organizational outcomes that benefit managers at the expense of consumers. We build on the insights of the literature on the firm (Jensen and Meckling 1976, Grossman and Hart 1986, Hart and Holmström, 2002) that views organizational decisions as the purview of managers who trade off the usual pecuniary costs and benefits such as profits with private ones such as effort,

managerial slack, might be an order of magnitude larger than losses due to the exercise of market power.

3

working conditions or corporate culture.

The thrust of this literature is that in environments with imperfect or incomplete contracting, managerial firms may make organizational decisions that have little to do with profit maximization and the interests of shareholders. What we emphasize here is that these same choices can also have significant negative impacts on *consumer welfare*: mergers that enhance managerial welfare may reduce output, hurting consumers.

To make this point as simply as possible, we rule out market foreclosure effects altogether by assuming competitive product and supplier markets.[2] In the model we consider, production of consumer goods requires the combination of one "upstream" firm U and one "downstream" firm D, where a firm is identified with a set of its assets (or tasks), along with the manager who oversees them. When the firms form a joint enterpise, the managers will be respnsible for taking noncontractible decisions on each of the combined set of assets. The assignemnt of which assets go to which manger – the ownership structure – is decided at the time the joint enterprises form; this takes place in a competitive "matching" market for upstream and downstream firms. The ouput of these joint enterprises is sold in a competitive product market, wherein all firms and consumers are price-takers.

As in some recent models of managerial firms (e.g., Hart and Holmström, 2002), the production technology essentially involves the adoption of standards. We assume there is no objectively "right" decision; rather output is higher on average the more decisions are in the same "direction." The problem is that managers disagree about which direction they ought to go. For instance, a content provider may be enthusiastic about his programs, and feel that mass market programs will serve many

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[2]The model is inspired by earlier work (Legros and Newman 1996, 1999) where we show how competitive market conditions determine organizational design such as the degree of monitoring or the allocation of control. Those papers do not consider the interaction of organization with the product market or consumer welfare, however.

4

localities well; the local distributor may disagree, thinking that programming must be specifically tailored to a local market. Each party will find it costly to accommodate the other's approach, but if they don't agree on something, the market will not be served. Or the model may simply represent clashes of culture between suppliers and producers, especially if they come from different countries.[3]

Organizational design, of which the decision whether to merge is an instance, consists of an assignment to each manager of decision rights over assets, as well as a share of the revenues. No matter the assignment, the U manager bears the costs of decision made on the upstream assets, and the D manager bears costs on the downstream assets.

We say that the firms are nonintegrated when each manager makes decisions in his firm. The managers trade off the benefit from "conceding" and coordinating with the decisions of the other firm versus the cost of taking decisions that he does not like. The Nash equilibrium of the decision game within the joint enterprise depends on the share of the revenues that each manager will extract and on the price in the product market (which is taken as given by both managers). The equilibrium generally falls short of complete vertical coordination, although the willingness of a manager to concede is increasing in his financial stake in the firm, i.e., share of revenue.

By contrast, vertical integration enables the firms to trade assets and to reallocate decision rights. There are two consequences of giving manager D the right to make decisions on some assets of firm U. First, we assume that there is a *loss of specialization* σ that captures the idea that decisions made by a manager who is not a specialist in the sector will be less effective than by a manager who is. Second, we show a *benefit of commitment*: if manager D controls all decisions in firm U, he can ensure that they all go in his favored direction, leading to high degree of coordination. Now, U still

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[3]See for instance the analysis in Ghemawat (2001) of the purchase of STAR TV - an Asian based satellite TV company - by News Corporation - a US firm controlled by Rupert Murdoch.

bears the costs of decisions in the upstream firm, so in general the optimal merger form will entail some partial "swapping" of assets, and in this paper we focus for the most part on a special case called split control, wherein each manager controls the same number of upstream and downstream assets.

Thus, as is usual in organization models, the relative merits of integration and nonintegration, from the point of view of the firms' managers, will depend on exogenous technological and preference parameters such as σ, productivity, and costs, as well as endogenous ones such as sharing rules, all of which are *internal* to the firm. However, the story does not end there. The decision whether to integrate will depend on two types of *external* "pecuniary" variables as well: market prices and surplus division. If the value of output is high because prices are high, integration becomes relatively unattractive because the value of output loss is high relative to the cost saving. At the same time, nonintegration becomes more efficient, since managers are more willing to concede when the value of output, and therefore their financial stakes, become high relative to their private costs. Thus a fall in output prices may induce a flurry of integration.

As for surplus division between the managers, nonintegration is most efficient when the surplus division is relatively equal, since the costs, which are assumed to be convex, are shared equally. When the surplus division is skewed, costs are born disproportionately by the unfavored manager, and integration yields higher total surplus (albeit possibly with lower output).[4] Thus, a shift in bargaining power toward one side of the supplier market can also be a force for integration.

One goal of our analysis is to show how changes in market conditions, such as those arising from the growth of international trade, leads to merger and divestiture activity, and to distinguish cases in which these effects are harmful or helpful to consumers.

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[4]In addition, in the absence of efficient financial instruments, a large transfer of control to one manager under integration may be an effective way to transfer surplus to him.

To this end, we conduct a number of comparative static exercises involving changes in the supplier and product markets.

When both sides of the supplier market increase proportionally, product prices fall, but this may induce firms to integrate inefficiently. When there are changes in the relative scarcity of upstream and downstream firms, say because of entry of suppliers from abroad, this effect may be reinforced, as firms integrate in order to meet the surplus demands of domestic downstream firms. Though prices fall, the mergers prevent them from falling as far as they might.

As product market demand increases over time, say due to income growth or the product life-cycle, the industry will first be nonintegrated, then will become integrated; in the early stages these mergers are output enhancing, because nonintegrated firms are relatively inefficient given low product prices. As demand increases further and prices rise, integration becomes less efficient than nonintegration, but firms remain integrated. Finally, for large values of the demand, non-integration will be again the equilibrium structure in the industry.

When managers favor integration either because the terms of trade in the supplier market are extreme or because product prices are moderately high, reduced specialization can dominate improved coordination, and output is lower than without integration, hurting consumers. In other ranges of prices, managers prefer *not* to vertically integrate, and now because of lack of coordination, output is smaller than with integration.

We subject our model to a number of robustness checks and also give brief consideration to role that might be played by active stockholders. A firm that lowers expected output lowers expected profits; in principle, active shareholders might then oppose vertical mergers that have this effect. The same holds if shareholders can force integration if it leads to larger output but is costly from the managers' point of view. However, if managers can bribe key shareholders (modeled as adjustment to their

7

dividend payout rates), they will be able to share the surplus gain from integrating with shareholders. Thus even with shareholders who can veto or force mergers, our conclusions do not change; the externality managers impose on consumers need not be internalized by firms.

2   Model

Our model of integration highlights the standard tradeoff between gains from increased coordination and costs from losses of specialization.[5] There are two types of activities that are complementary. In each activity, U and D, there is a continuum of tasks (or assets) $i \in [0, 1]$ that have to be performed. A decision has to be made on how to do the tasks, and we denote by u the decision rule for the U activity and by d the decision rule for the D activity. Decisions are either 0 or 1. We write (with some abuse of notation) $u = \int u(i)\, di$ and $d = \int d(i)\, di$ to denote the average decision and we adopt the convention that on the U activity all tasks $i \leq u$ are set to $u(i) = 1$ and all tasks $i > u$ are set to $u(i) = 0$; similarly all tasks $i < d$ are set to $d(i) = 1$ and all tasks $i \geq d$ are set to $d(i) = 0$.

There is a manager for each activity, and this manager bears the cost of *all decisions* made on his activity. We assume that the manager of activity U prefers decision 1 while manager of activity D prefers decision 0. The *private costs* of decisions is $C(u) = \frac{1}{2}(1-u)^2$ for manager U and $C(d) = \frac{1}{2}d^2$ for manager D.

While combining the two activities leads synergies, it is important that on average decisions coincide. Otherwise there is loss in synergies that has the obvious interpretation in our model of a lack of vertical coordination: if $u \neq d$, then there is

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[5]See for instance Williamson (1986) and more recently Hart and Moore (1999) for the question of delegation of authority in hierarchies and the resulting trade-off between coordination and specialization. Our model is new to the literature, as is the emphasis on the joint determination of equilibria in the product market and in the supplier market.

a measure $u - d$ of tasks that are done differently in each activity. We assume that this loss is equal to $\frac{1}{2}(u - d)^2$.

In addition, if part of the decisions on an activity are made by the manager of the other activity, there is a loss due to the lack of specialization of this manager. If U controls tasks $i < \delta$ on the D activity and D controls $i > \mu$ on the U activity, the total loss from lack of specialization is $\sigma(1 - \mu + \delta)$. This cost is equal to zero if $\mu = 1$ and $\delta = 0$, i.e., if each manager retains decision power on all tasks of his activity. In addition to a measure of losses from overextension of managerial competence, σ could be a measure of transaction costs for reallocating control (due to financial market imperfection for instance; clashes of corporate (or international) cultures (following the opening of trade between two countries).

Output is then

$$Q(u, d) = 1 - \frac{1}{2}(u - d)^2 \text{ if there is nonintegration}$$

$$Q(u, d) = 1 - \frac{1}{2}(u - d)^2 - \sigma(1 - (\mu + \delta)) \text{ if there is reallocation of control}$$

(μ, δ).

It is best to interpret Q as the probability that a high output (equal to 1) will be achieved, $1 - Q$ being the probability that a zero output is produced.[6] Since there is a measure 1 of firms D, total output in the industry is equal to Q.

The demand side is modelled as an inverse demand function $P = D(Q)$, and the market price P is taken by given by all firms when they make contractual decisions. As usual, we assume that demand is decreasing. Now, in this competitive environment, managers D decide to match with a manager U in order to benefit from the synergies and can write contracts that stipulate first the control that each manager has on tasks and the share of high output that each will get. A contract is then a triple

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[6]This is mainly for a technical reason: if Q is verifiable it would be possible to fully contract on decisions. Since observation of output does not generate information about the decisions, such contracts cannot be used when Q is the probability of getting the high output.

(μ, δ, s) where μ and δ are the number of tasks in the U activity and the D activity over which the U manager makes decisions, and s is the share going to manager U.

We follow here Grossman and Hart (1986) who view ownership of assets as giving the right to exercise authority by imposing one's decision. We interpret a situation in which $\mu = 1$ and $\delta = 0$ as "non-integration" since the managers coordinate at arm length and keep full control on their decisions. By contrast, situations with $\mu < 1$ or $\delta > 0$ are interpreted as "integration" since one manager gives the right to the other manager to make decisions on his activity.[7]

Once a contract (μ, δ, s) is given, managers make their decisions (over the tasks they have control) and output is realized and shares are distributed. In the next two sections we analyze the game without integration, when $\mu = 1$ and $\delta = 0$, and the game with integration, where we assume that integration involves $\mu = \delta$.[8]

2.1 Nonintegration $(\mu = 1, \delta = 0)$

To a share contract s corresponds a game. Since each manager keeps control of all tasks on his activity, U chooses $u \in [0, 1]$, D chooses $d \in [0, 1]$ in a Nash fashion. The probability of high output is $Q(u, d) = 1 - \frac{(u-d)^2}{2}$ and profit functions are

$$\pi^U = Q(u, d) \, sP - \frac{1}{2}(1 - u)^2$$
$$\pi^D = Q(u, d)(1 - s) P - \frac{1}{2}d^2,$$

best responses are

$$u = \frac{1 + dsP}{1 + sP} \tag{1}$$

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[7]Note that our's is not a model of delegation since a manager bears the cost of all decisions on his activity, even if these decisions are made by someone else.

[8]This turns out to be without loss of generality. Our qualitative results are preserved when integration contracts can specify $\mu \neq \delta$; see Section 3.

10

for U and

$$d = \frac{u(1-s)P}{1+(1-s)P} \qquad (2)$$

for D. Note that the best responses are in the range $[0,1]$ for any values of u and d in $[0,1]$. Hence the FOCs characterize the Nash equilibrium:

$$u^{no} = \frac{1+(1-s)P}{1+P}$$
$$d^{no} = \frac{(1-s)P}{1+P}.$$

Note that $u^{no} > d^{no}$ and that the vertical coordination loss is

$$u^{no} - d^{no} = \frac{1}{1+P},$$

which is *independent* of s. Note that this loss from lack of vertical coordination is decreasing in the price P: as P becomes larger, the revenue motive becomes more important for managers and this pushes them to better coordinate vertically.

The probability of success is

$$Q^{no} = 1 - \frac{1}{2(1+P)^2} \qquad (3)$$

and the equilibrium payoffs are

$$\pi^U = Q^{no}sP - \frac{1}{2}s^2\left(\frac{P}{1+P}\right)^2 \qquad (4)$$
$$\pi^D = Q^{no}(1-s)P - \frac{1}{2}(1-s)^2\left(\frac{P}{1+P}\right)^2.$$

Varying s, one obtains the Pareto frontier in the case of nonintegration. We have $\partial\pi^U/\partial s = Q^{no}P - s\left(\frac{P}{1+P}\right)^2$, $\partial\pi^D/\partial s = -Q^{no}P + (1-s)\left(\frac{P}{1+P}\right)^2$ and simple computations show that the Pareto frontier is decreasing and concave since $\frac{\partial\pi^U/\partial s}{\partial\pi^U/\partial s}$ is decreasing in s.

Total welfare is

$$W^D(s) = Q^{no}P - \frac{1}{2}\left(s^2 + (1-s)^2\right)\left(\frac{P}{1+P}\right)^2 \qquad (5)$$

The maximum surplus is obtained at $s = 1/2$ and the minimum surplus is obtained at $s = 1$ (or $s = 0$).

2.2 Allocation of Control ($\mu < 1$, or $\delta > 0$)

Now, contracts can give the right to U to make decisions on the D activity and the right to D to make decisions on the U activity. Without loss of generality, allocation of decision rights take the form of two cutoff values $\mu \in [0, 1]$ and $\delta \in [0, 1]$ such that U makes decisions on the U activity for all $i < \mu$ and on the D activity for all $i < \delta$ while D makes decisions on the other tasks. Again, because only the average decision matters, there is no loss in assuming that agents make a constant decision over the tasks on which they have control. Let $G(\mu, \delta, s)$ be the game generated when the allocation of control is (μ, δ) and the sharing rule is s.

Allocating decisions to the other party has two effects on output. A positive effect since by being able to decide jointly on decisions on tasks on both activities, agents have more incentives to increase vertical coordination. A negative effect since giving control to the other party induces a cost from lack of specialization. We illustrate this effect when one manager has full control on U and on D.

Example 1 (Full control by D) *Suppose that D has full control on decisions, that is, let $\mu = \delta = 0$. There is perfect vertical coordination since U will make decisions $u(i) = d(i) = 0$ for all i but the cost due to lack of specialization is maximum and is equal to σ. Only U bears the cost of decisions here, this cost is equal to $\frac{1}{2}$. The probability of success is $Q = 1 - \sigma$ and total welfare is*

$$W = (1 - \sigma) P - \frac{1}{2}$$

If agent U must get a payoff of v, the share solves $(1 - \sigma) sP - \frac{1}{2} = v$, or

$$s = \frac{v + \frac{1}{2}}{(1 - \sigma) P},$$

giving D a payoff of $(1 - \sigma) P - \frac{1}{2} - v$.

We show that this control structure is dominated by a split control structure, in which each agent gets half control on the other activity. (We analyze in Section 3 the general case and show that our results persist.) In split control, U has control on all tasks $i < \frac{1}{2}$ on both activities and D has control on the other tasks. It is a dominant strategy for U to set $u(i) = d(i) = 1$ and for D to set $u(i) = d(i) = 0$ on the tasks over which they have control. Like in the previous example, there is perfect vertical coordination and a probability of success of $1 - \sigma$. However, U and D both bear the cost of having the "wrong" decision made on his activity. Since the cost functions are convex, total cost is lower and total welfare is greater than with full control by U. Managers payoffs are

$$
\begin{aligned}
\pi^U &= (1 - \sigma)\, sP - \frac{1}{8} \\
\pi^D &= (1 - \sigma)\, (1 - s)\, P - \frac{1}{8},
\end{aligned}
$$

and welfare with split control is

$$
W = (1 - \sigma)\, P - \frac{1}{4}.
$$

Contrary to the no-integration case, the Pareto frontier is linear since the share s does not affect the decisions hence the costs and the total welfare.[9]

Cases of interest are when output under the organization chosen by managers is smaller than in the alternative organization. Output under integration $(1 - \sigma)$ is smaller than the output under non-integration $(1 - \frac{1}{2(1+P)^2})$ if and only if

$$
\sigma > \frac{1}{2\,(1 + P)^2}. \tag{6}
$$

The question is when consumer interest may come into conflict with managerial welfare.

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[9] For instance, to give a zero payoff to the U manager, simply choose s such that $(1 - \sigma)\, P\, (1 - s) - \frac{1}{4} = 0$.

Remember that under non-integration total welfare is given by (5), and is decreasing in s from its maximum at $s = \frac{1}{2}$ to its minimum value at $s = 1$. For a given price P, managerial welfare is larger under integration with split control than under the minimum nonintegration welfare if σ is not too large, that is,

$$(1 - \sigma) P - \frac{1}{4} > \left(1 - \frac{1}{2(1 + P)^2}\right) P - \frac{1}{2} \left(\frac{P}{1 + P}\right)^2,$$

$$\Leftrightarrow \sigma < \frac{1}{2(1 + P)} - \frac{1}{4P}. \tag{7}$$

It is always smaller than the maximum nonintegration welfare if σ is positive: $(1 - \sigma) P - \frac{1}{4} < \left(1 - \frac{1}{2(1+P)^2}\right) P - \frac{1}{4}\left(\frac{P}{1+P}\right)^2 \Leftrightarrow \sigma > \frac{2+P}{4(1+P)^2} - \frac{1}{4P}$, but the right hand side of this inequality is always negative. If both (6) and (7) are satisfied, there is a potential for conflict of interest between managers and consumers. (Of course, if (7) is violated, for instance if σ is large, managers never want to integrate.)

Lemma 2 *When σ is positive, managerial welfare with integration*

(i) is smaller than the maximum welfare with non integration

(ii) is greater than the minimum total welfare with non integration if and only if

$P < \underline{P}$ or $P > \underline{P}$, where $\underline{P}$ and $\underline{P}$ are the two solutions of the equation $\sigma = \frac{1}{2(1+P)} - \frac{1}{4P}$.

Conflict between managers and consumers welfare arise when the curves defined by the bounds in (7) and (6) cross. See Figure 1.

For a fixed value of σ, the region over which managerial welfare is greater under integration than under nonintegration is $[\underline{P}, \overline{P}]$; however when $P \in [P^*, \overline{P}]$, condition (6) holds and output is smaller with integration than with nonintegration. The set of pairs (σ, P) for which integration is managerial welfare maximizing and leads to a decrease in output with respect to nonintegration is the shaded area. Nonintegration may generate more output that integration (if $P \in [\underline{P}, P^*)$) but it is inflexible about how it distributes payoffs to the managers. It is most efficient from their point of view when their payoffs are relatively equal; when they are unequal, integration
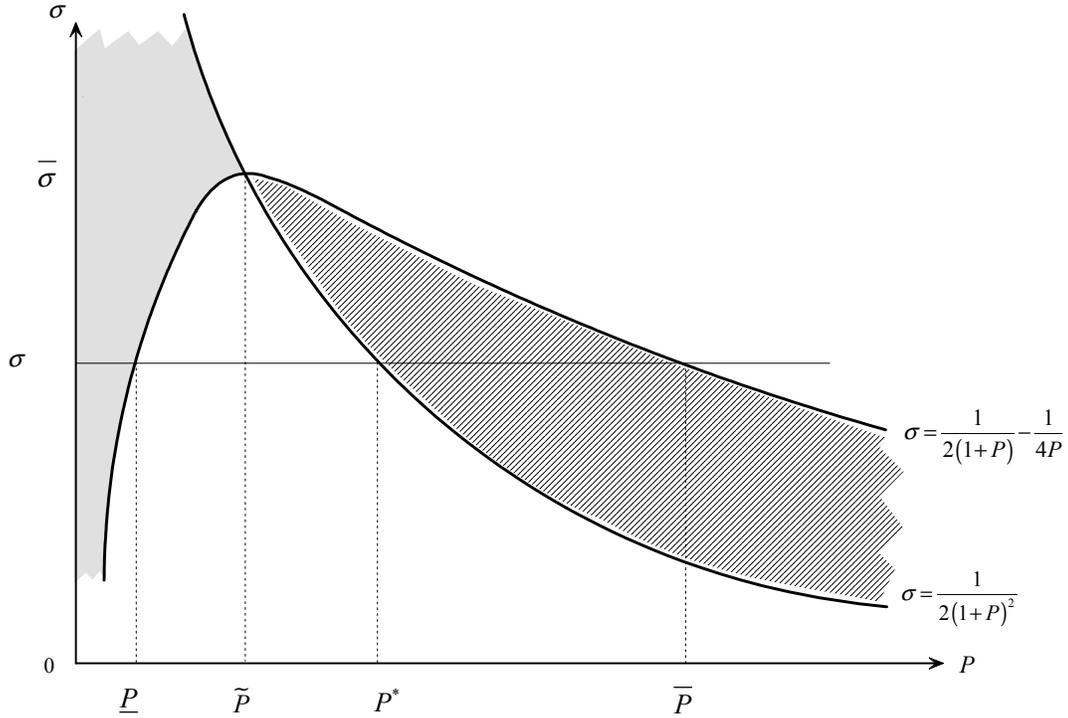
14

Figure 1:

will be preferred. We show this in Figure 2 below, where we represent the Pareto frontiers for the managers in the integrated and the nonintegrated cases.

When P is outside $\left[\underline{P}, \overline{P}\right]$ nonintegration maximizes managerial welfare; however when $P \in [0, \underline{P}]$ consumers would prefer integration to non integration while managers prefer not to integrate. The set of pairs (σ, P) for which integration is managerial welfare maximizing while non-integration would lead to a larger output is the grayed area.

Thus as conditions in the global economy change, e.g., if the supplier market becomes more competitive with the entry of potential suppliers from the rest of the world, there will be shifts in the apportionment of payoffs between the Ds and the Us, and this may lead to a rash of mergers, many of which may not be welfare enhancing for consumers. We will see this as well as other comparative statics at the end of this

15

section. The following Proposition summarizes the previous discussion.

Proposition 3 *Let $\widetilde{P}$ be the unique solution to the equation $\frac{1}{2(1+P)^2} = \frac{1}{2(1+P)} - \frac{1}{4P}$.*

(i) The set of parameters (σ, P) for which split control maximizes managerial welfare but leads to a lower output than nonintegration is nonempty and is defined by $\sigma \in \left[\frac{1}{2(1+P)^2}, \frac{1}{2(1+P)} - \frac{1}{4P} \right]$. where $P \geq \widetilde{P}$.

(ii) The set of parameters for which non integration maximizes managerial welfare but leads to a lower output than split control is nonempty and is defined by $\sigma \in \left[\frac{1}{2(1+P)} - \frac{1}{4P}, \frac{1}{2(1+P)^2} \right]$ where $P \leq \widetilde{P}$.

Of course in general, P is endogenous: if it clears the market in which the industry output Q is the sole supply, then in equilibrium P is a function of the measure of firms that choose integration, hence of σ; it is not clear then whether (7) and (6) can be satisfied at the industry equilibrium price. We turn next to the industry equilibrium and show that there exist market demand functions and parameters σ such that (6) and (7) hold; hence, integration arises in equilibrium and can generate lower output with respect to nonintegration.

As we pointed out before, in addition to the usual "technological" parameters that determine organization choices, we wish to underscore the role of "pecuniary" variables external to the firm that determine them. One is the product price: when it is sufficiently low, managers will not want to integrate; as it rises, they may be induced to integrate if the loss of specialization is not too severe; similarly, if the price is high enough, managers will not want to integrate but as it decreases, they will integrate. The other pecuniary variable is the division of surplus between the managers. When it is fairly egalitarian, they will prefer nonintegration. But as bargaining power shifts to one side of the supplier market, integration will tend to result. Both of these variables are determined in the industry equilibrium of the system, to be discussed next.
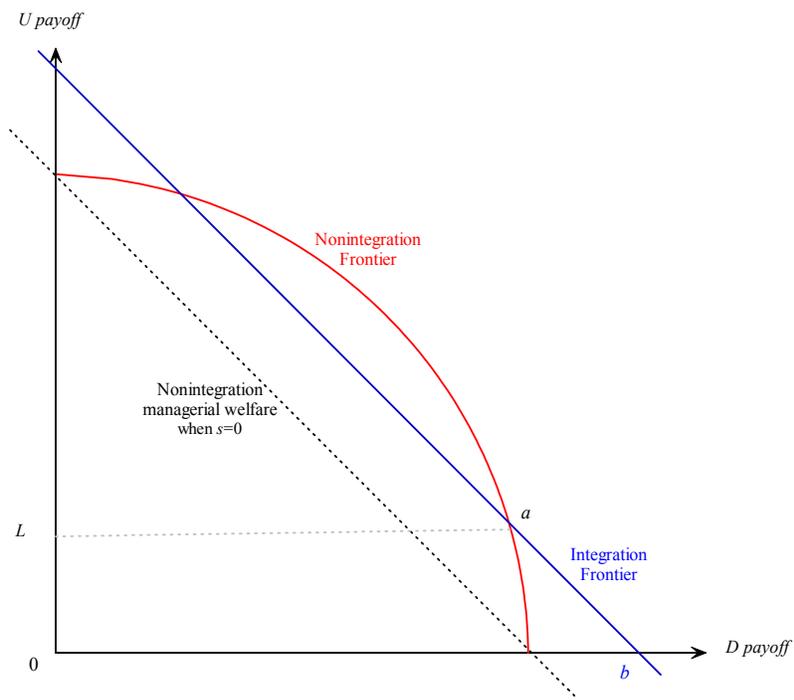
16

U payoff

Nonintegration
Frontier

Nonintegration
managerial welfare
when $s=0$

L

Integration
Frontier

a

0

b

D payoff

Figure 2:

17

2.3 Industry Equilibrium and Comparative Statics

There are two markets to consider in this model: the supplier market and the product market. In the supplier market, an equilibrium consists of "matches" of one upstream firm and one downstream firm, along with surplus allocation among all the managers. We continue to assume that no manager has any cash with which to augment the surplus possibilities generated by the two organizational arrangements (this assumption will be relaxed below), and that everyone takes the product market price P as given.

To simplify, assume that U agents are in excess supply and have no liquidity; then their competitive payoff must be equal to $v = 0$. A supplier market equilibrium consists of the measure α of firms that are integrated, $1 - \alpha$ being not integrated, and the contracts that firms use. In equilibrium, there is equal treatment among identical firms, that is all U firm managers get the payoff $v = 0$ and all D firm managers get the same payoff; for this reason, all non-integrated firms use the same sharing rule s, and U managers get a share $s = 0$. Since welfare under integration is transferable, if there is a positive measure of firms that are nonintegrated, equilibrium requires that these firms (using share $s = 0$) yield welfare that is not lower than an integrated firm.

In the product market output and price satisfy the two equalities:

$$Q\left(\alpha\right) = \alpha\left(1 - \sigma\right) + \left(1 - \alpha\right)\left(1 - \frac{1}{2}\left(\frac{1}{1 + P\left(\alpha\right)}\right)^{2}\right)$$

$$P\left(\alpha\right) = P\left(Q\left(\alpha\right)\right).$$

The industry equilibrium condition is

$$
\sigma \begin{array}{c} \geq \\ = \\ \leq \end{array} \frac{1}{2\left(1 + P\left(\alpha\right)\right)} - \frac{1}{4P\left(\alpha\right)} \ \text{as} \ \alpha \in (0, 1) \begin{array}{c} = 0 \\ \\ = 1. \end{array} \tag{8}
$$

this condition coincides with (7) when $\alpha = 1$, that is when all firms are integrated.

Note that at the left boundary ($\underline{P}$) of the integration region in Figure 1, firms produce more under integration than nonintegration; since firms are indifferent between the two structures, the supply jogs to the right there. It is then vertical inside the region, since all firms produce the integration output $1 - \sigma$. On the right boundary ($\bar{P}$), they are again indifferent, but now firms produce more under nonintegration, so the supply again jogs to the right. From there it is upward sloping again. If σ is too large, i.e. greater than $\bar{\sigma}$ ($\bar{\sigma} = -\frac{1}{2}\sqrt{2} + \frac{3}{4}$, the maximum value of $\frac{1}{2(1+P)} - \frac{1}{4P}$, which happens to be where the two curves in Figure 1 intersect), then integration is dominated by nonintegration, and the supply is upward sloping. An equilibrium always exists.

The supply curve is represented in Figure 3, as well as the three possible types of equilibria, those in which firms integrate (I), the mixed equilibria in which some firms integrate and others do not (M), and a pure nonintegration equilibrium (N). The dotted curve corresponds to the industry supply when all firms are not integrated.

The two regimes of Proposition 3 where conflicts between managers and consumers arise are easily illustrated. When $P \in [P^*, \overline{P}]$, there is inefficient integration and competition policy preventing integration will increase output; when $P \leq \underline{P}$, nonintegration leads to lower output than integration and here output would increase if shareholders forced integration.

In the left panel, we illustrate the effects of shifts in supply while in the right panel we illustrate the effects of demand shifts.

We can now begin to think about how or why the competition authority might be presented with a number of merger cases. It is often thought that waves of integration have something to do with globalization or with the life cycle of the industry, and the model offers a mechanism by which these might occur, namely through supply or demand shifts that will change the equilibrium price in the product market and the managers' incentives to integrate (so will supply and demand shifts that change the
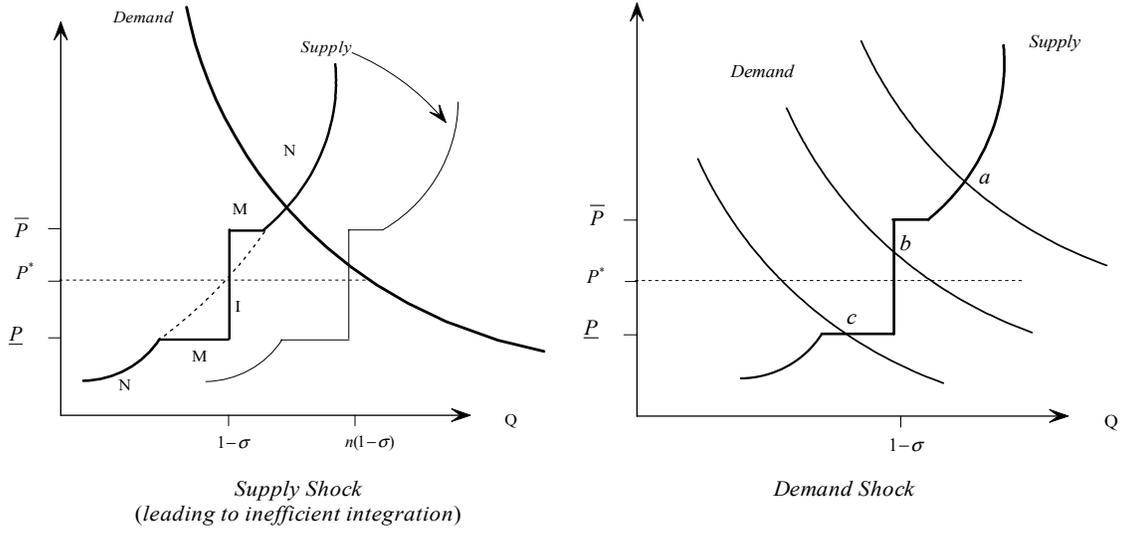
19

Figure 3:

relative scarcities of the two types of managers; we approach this issue in a simple way in Section 3.4).

An industry is characterized by the measure of U and D firms and the demand schedule. The initial industry characteristics are $(m, 1, P)$ where $m > 1$ is the measure of U firms.

Definition 4 *The equilibrium of the industry* $(m, 1, P)$ *exhibits high demand when the equilibrium price is greater than* $\overline{P}$, *exhibits low demand when the equilibrium price is less than* $\underline{P}$.

Supply Shocks: industry (nm, n, P)

Suppose that the effective supply of firms expands, say because international markets open. To simplify, assume a balanced supply shock – both sides of the supplier market expand so as to keep the ratio of U's to D's the same. The sequence of events can be gleaned from Figure 3 when we are initially in a regime of high demand. As illustrated in the left panel, following the increase in supply, the industry moves

20

from a nonintegration equilibrium to an integration equilibrium. Hence, in industries when demand is high and firms are nonintegrated, balanced positive supply shocks yield merger activity. If the equilibrium price does not decrease too much (i.e., is in the interval $[P^*, \overline{P}]$), these mergers lead to higher prices and lower output than what would have happened with the initial nonintegrated structure. Hence, globalization can be a force for the generation of merger activity without further assumption about changes to technology or regulation.

Other comparative statics results are summarized in the following Proposition.

Proposition 5 *Suppose that the industry $(m, 1, P)$ is in a high demand regime. There exist cutoff values n_0, n^*, n_1, $1 < n_0 < n^* < n_1$ such that in the industry (nm, n, P)*

- *there is a positive measure of firms that are integrated when $n \in [n_0, n^*]$ and that produce less than if they were not integrated*

- *there is a positive measure of firms that are not integrated when $n \geq n_1$ and that produce less than if they were integrated.*

Demand Shocks: industry $(m, 1, P/\beta)$

To simplify, consider demand shocks that are multiplicative, that is the demand schedule becomes P/β. : This formulation is consistent with two types of effects. For instance, if one views globalization as providing additional outside options for local consumers, then as these opportunities increase, the residual demand on the domestic market decreases, which is captured by $\beta < 1$. Demand shocks are also consistent with the life cycle of an industry, and a growing demand as the market for the product matures, this is captured by $\beta > 1$.

The right panel of Figure 3 illustrates how starting from a high demand regime, globalization will lead the industry from a nonintegrated equilibrium (point a) to an integrated equilibrium (point b). More generally, when demand is high and firms are

nonintegrated, negative demand shocks can lead to inefficient integration in the industry. The same panel illustrates how when demand is initially low and the product matures and demand increases, firms will begin to integrate (point b) and the synergies will first benefit all stakeholders (managers, shareholders and consumers) but then as demand continues to grow, integration becomes detrimental to consumers, and towards the end of the life cycle of the product, when demand is high enough, we will observe a series of "divestitures" and the firms will be nonintegrated (point a). This dynamic seems consistent with observed patterns.

This discussion is summarized below for the situation of initial high demand.

Proposition 6 *Suppose that the industry is in a regime of high demand. There exist values $\beta_0, \beta^*, \beta_1, 1 > \beta_0 > \beta^* > \beta_1$ such that*

- *As $\beta \in [\beta^*, \beta_0]$, there is a positive measure of firms that are integrated and that produce less than if they were not integrated*

- *As $\beta < \beta_1$, there is a positive measure of firms that are not integrated and that produce less than if they were integrated.*

3 Extensions

3.1 General Integration Contracts

Split control maximizes vertical coordination but also minimizes the gains to specialization. More general control allocation structures may increase managerial welfare. A general integration contract specifies control allocations (μ, σ) together with a share s going to U. We show below that our qualitative results hold with general contracts: there are parameter values (σ, P) such that managerial welfare is greater but output is lower with integration as compared to non-integration. A first observation is that

managerial welfare maximization requires that U has more control on his activity than on the D's activity.

Lemma 7 *A contract maximizing managerial welfare involves $\mu \geq \delta$.*

Proof. See the Appendix. ■

There is therefore no loss in considering games $G(\mu, \sigma, s)$ where $\mu \geq \delta$. The strategy of U is to select a cutoff value $u \leq \mu$ and the strategy of D is to select a cutoff value $d \geq \delta$ since it is a dominant strategy for U to set $d(i) = 1$ on $i < \delta$ and for D to set $u(i) = 1$ on $i > \mu$.

First observe that since $\sigma > 0$, if $\mu < 1$, $u = \mu$ must be the optimal response of U for otherwise the best response is $u \in [\delta, \mu)$ and (u, d) is still an equilibrium in $G(1, \delta, s)$, but the surplus of both agents is greater since the cost due to lack of specialization is lower. The same reasoning shows that $d = \delta$ if $\delta > 0$. Since the best responses when the agents are not constrained are given by (1) and (2), we have the incentive compatibility conditions

$$\mu < 1 \Rightarrow u = \mu < \frac{1 + dsP}{1 + sP} \tag{9}$$

$$\mu = 1 \Rightarrow u = \frac{1 + dsP}{1 + sP} \tag{10}$$

$$\delta > 0 \Rightarrow d = \delta > \frac{u(1-s)P}{1 + (1-s)P} \tag{11}$$

$$\delta = 0 \Rightarrow d = \frac{u(1-s)P}{1 + (1-s)P}. \tag{12}$$

When U must obtain a non-negative payoff, the problem to D is to solve:

$$\max_{\mu, \delta, u, d, s} \left(1 - \frac{(u-d)^2}{2} - \sigma(1 - \mu + \delta) \right)(1-s)P - \frac{d^2}{2}$$

$$s.t. \, (9), \, (10), \, (11), \, (12)$$

$$\left(1 - \frac{(u-d)^2}{2} - \sigma(1 - \mu + \delta) \right)sP - \frac{(1-u)^2}{2} \geq 0. \tag{13}$$

Clearly at the maximum of this program managerial welfare is greater than with split control. We will give below an upper bound on output consistent with the incentive compatibility conditions (9)-(12); we will then show that it is possible to have this bound lower than the output with non-integration while having at the same time welfare greater with split control. This shows that the result in the text is robust.

It is straightforward to show that there are only two candidate control allocations of interest: when $\mu < 1$ and $\delta > 0$ and when $\mu < 1$ and $\delta = 0$.

Consider the case $\mu < 1$ and $\delta > 0$. Then, by (9), (11) $u = \mu$ and $d = \delta$, and output is

$$Q = 1 - \frac{\Delta^2}{2} - \sigma(1 - \Delta),$$

where $\Delta = \mu - \delta$.

This output is maximum when $\Delta = \sigma$ and an upper bound on output is then

$$\overline{Q} = 1 - \frac{\sigma}{2}(2 - \sigma).$$

Hence, output is lower with integration when

$$\frac{\sigma}{2}(2 - \sigma) > \frac{1}{2(1 + P)^2},$$

and solving for σ leads to

$$\frac{1 + P - \sqrt{P(P + 2)}}{1 + P} < \sigma < \frac{1 + P + \sqrt{P(P + 2)}}{1 + P}.$$

The right hand bound is not relevant because it is greater than 1. Remember that the managerial welfare with split control is greater than the managerial welfare with non-integration when $\sigma < \frac{1}{2(1+P)} - \frac{1}{4P}$; this is also a sufficient condition for managerial welfare to be greater with integration and general contracts. That condition is consistent with the condition $\sigma > \frac{1+P-\sqrt{P(P+2)}}{1+P}$ when $P > 2.4517$ (with split control the condition was $P \geq 1 + \sqrt{2} \approx 2.4142$.)

Consider the case $\mu < 1$ and $\delta = 0$. Substituting (12) in (9) and solving for μ yields

$$\mu < \frac{1 + (1-s)\,P}{1 + P} \tag{14}$$

$$\Leftrightarrow$$

$$sP < (1-\mu)\,(1+P)\,.$$

Individual rationality (13) requires

$$sP \geq \frac{(1-\mu)^2}{2Q}. \tag{15}$$

where the inequality is strict when $s > 0$. Therefore in an optimal solution,

$$1 - \mu < 2Q\,(1+P)\,. \tag{16}$$

Subtracting (12) from (9), we have

$$\mu - d = \mu \frac{1}{1 + (1-s)\,P}, \tag{17}$$

therefore output is

$$\begin{aligned}
Q &= 1 - \frac{(\mu - d)^2}{2} - \sigma\,(1-\mu) \\
&= 1 - \frac{\mu^2}{2\,(1 + (1-s)\,P)^2} - \sigma\,(1-\mu)\,.
\end{aligned}$$

The loss

$$L = \frac{\mu^2}{2\,(1 + (1-s)\,P)^2} + \sigma\,(1-\mu)$$

is minimal when sP is minimal; hence using (15),

$$L \geq L^I = \frac{\mu^2}{2\left(1 + P - \frac{(1-\mu)^2}{2Q}\right)^2} + \sigma\,(1-\mu)\,.$$

By contrast the loss with non-integration is $L^N = \frac{1}{2(1+P)^2}$. Clearly, as P increases, $L^I - L^N \to \sigma\,(1-\mu)$; hence for P large enough integration leads to a lower output level than non-integration. Because general integration contracts lead to a higher managerial welfare than split control, there exist (σ, P) such that managerial welfare is greater but leads to lower output with integration than with nonintegration.

3.2 Active Shareholders

If output is lower with integration, shareholders will oppose it unless they can be compensated by the managers. Dividends can play this role. The following argument is heuristic, but should make the issues clear. There are two production plans: integration yielding a revenue of R_I and nonintegration yielding a revenue R_N; (where $R_i = Q_i P$). Suppose nonintegration is the status-quo and shareholders obtain dividends $\rho_N R_N$.

In the anlysis above, managers were getting all of the revenue; we noted that output under integration is fixed at $1 - \sigma$ regardless of the output price. Since giving managers a reduced fraction of the revenue is formally identical to lowering the output price, we conclude that *the dividend rate has no effect on the output of an integrated firm.*

In a large firm top mangement and key shareholders may get a small share of the profits. Suppose that a fraction ω goes to various claimants who have no say over the firm's ownership structure, ρ_i goes to (active) stockholders, who do have such say, and the rest goes to the managers. The case if interest is when $R_N - C_N > R_I - C_I$ but $(1-\omega)R_N - C_N < (1-\omega)R_I - C_I$, where C_i is the total private cost of managers under plan i. Since managers intially receive $1 - \omega - \rho_N$ of the revenue, this implies that they prefer integration to nonintegration at the going dividend rate but shareholders have opposite preferences (note the two inequalities imply $R_N > R_I$).

A plausible model is that the merger opportunity arises due to any of the reasons we cited (e.g. P moves into the range $(\underline{P}, \overline{P})$) and the managers "negotiate" with the shareholders (or their board). Because costs are private to the managers, they cannot be contracted upon and contracts between managers and shareholders are limited to a dividend share $\rho_i \in [0, 1]$ of revenues paid out to shareholders. Even if revenues are lower with integration, managers may convince shareholders to agree on the reorganization by paying out a higher dividend if integration is realized.

Case 1. Shareholders compete. Then we require that $\rho_N R_N = \rho_I R_I$, for otherwise shareholders will invest elsewhere, and managers have no need to pay out more. Shareholders have no reason to oppose the reorganization (and could be induced to opt for integration for an infinitesimal increase in the dividend). Provided ρ_N is small enough to begin with, it will be possible to choose large enough dividends to keep shareholders happy, and the managers choose the production plan I because
$$(1 - \omega - \rho_N)R_N - C_N < (1 - \omega - \rho_I)R_I - C_I \Longleftrightarrow (1 - \omega)R_N - C_N < (1 - \omega)R_I - C_I$$
(since $\rho_N R_N = \rho_I R_I$ by assumption).

Case 2. Managers compete. Assume they get 0 if they aren't hired. Hence in the status-quo situation we must have $(1 - \omega - \rho_N) R_N - C_N = 0$, which yields shareholders $\rho_N R_N = (1 - \omega)R_N - C_N$. As the shareholders now get the rent, they will opt for reorganization under the same conditions that the mangers did above: they impose a dividend rate ρ_I satisfying $(1 - \omega - \rho_I) R_I - C_I = 0$, collecting $\rho_I R_I = (1 - \omega)R_I - C_I > (1 - \omega)R_N - C_N = \rho_N C_N$.

Hence, if it is possible to commit to pay higher dividends after integration, managers and (controlling) shareholders have aligned interests, and having active shareholders alone need not protect consumer interests. Note that if contracts between those shareholders and managers are less sophisticated, e.g. ρ is inflexible, active shareholders will veto inefficient integration: in this case, active shareholders may maximize consumer welfare since only integration consistent with higher output will happen. This last conclusion should be mitigated by the observation that in practice managers need only convince the controlling shareholders, or the members of the board not to oppose integration; and there are other instruments besides higher dividends to "bribe" these controlling shareholders.

Note that the case in which managers initially prefer non-integration while revenue is higher under integration requires a more subtle analysis, because compensating shareholders via dividend rate increases must take accountof the fact that that raising

the dividend rate under non-integration will also lower output. This limits both the feasiblity and desirability of compensating shareholders for the change in organization.

The critical question then seems to be to what extent shareholders are adequately organized to have effective control over organizational decisions and to exercise it in ways that happen to coincide with consume interests. Full answers to this and related questions of corporate governance are beyond the scope of the present paper.

3.3 The Role of Liquidity

One important difference between integration and nonintegration is the degree of transferability in managerial surplus: while managerial welfare can be transferred 1 to 1 with split-control (that is one more unit of surplus given to D costs one unit of surplus to U), this is no longer true with nonintegration. Going back to Figure 2, if D needs to obtain a surplus greater than the surplus at point a, then integration must be chosen. This is no longer true if U managers have access to liquidity,[10] or another monetary instrument that can be transferred without loss to the D manager before production takes place. Imagine indeed that a U manager has liquidity L; then a D manager would be indifferent between having an integration contract with a share of 1 giving him the payoff at point b or a nonintegration contract corresponding to point a together with a lump sum payment of L. A U manager having liquidity greater than L could then provide the D manager his equilibrium payoff by transferring his liquidity and choosing a nonintegration contract that yields a greater welfare.

Below, we take the distribution of liquidity as given; liquidity can be thought as cash available to managers from retained earnings. We ignore the possibility for managers to borrow liquidity from the financial market. This is without loss of generality; when firms are integrated, borrowing is equivalently replaced by an

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[10]See Legros-Newman (1996), (1999) for the role of liquidities in equilibrium models of organizations.

28

increase in the share going to the D manager; when firms are not integrated borrowing creates a debt overhang problem, reduces the possibilities of coordination and is strictly Pareto dominated by an increase in the share going to the D manager.

Lemma 8 *Borrowing liquidity on the financial market is weakly dominated by not borrowing. Contracts in which the U manager borrows B and transfers B to the U manager in a non-integration contract are strictly dominated by a contract in which the U manager does not borrow.*

Proof. The only case of interest is when a U manager borrows B in order to make lump sum payment to the D manager. Assuming a competitive financial market, the creditor will insist in the case of success on a repayment R such that $pR = D$ where p is the probability of success given the contract (μ, δ, s) chosen by the managers. Note that the U manager effective share when there is success is $s - R$. If there is integration, the probability of success is independent of s and payoffs to the managers are given by

$$
\begin{aligned}
\pi^U &= (1-\sigma)(sP - R) - \frac{1}{8} \\
\pi^D &= (1-\sigma)(1-s)P + B - \frac{1}{8}.
\end{aligned}
$$

Since $(1-\sigma)R = B$, we can define $\hat{s} = s - \frac{R}{P}$ and obtain

$$
\begin{aligned}
\pi^U &= (1-\sigma)\hat{s}P - \frac{1}{8} \\
\pi^D &= (1-\sigma)(1-\hat{s})P - \frac{1}{8},
\end{aligned}
$$

that is that the same payoffs can be obtained without borrowing and a smaller share of output to manager U. If there is no integration, payoffs are

$$
\begin{aligned}
\pi^U &= Q(u,d)(sP - R) - \frac{1}{2}(1-u)^2 \\
\pi^D &= Q(u,d)(1-s)P + B - \frac{1}{2}d^2.
\end{aligned}
$$

29

Note that in this case the equilibrium choices of u and d are

$$u = \frac{1 + (1 - s) P}{1 + P - R}$$
$$d = \frac{(1 - s) P}{1 + P - R}$$

and therefore $u - d = \frac{1}{1+P-R}$. Like for integration, if we define the sharing rule $\hat{s} = s - \frac{R}{P}$, for *the same* values of u and d, payoffs are the same with $\hat{s}$ and no borrowing than with s and borrowing. However, since $\hat{s} < s$, $1 - \hat{s} > 1 - s$ and therefore the best response of the D manager is greater with $\hat{s}$ than with s. Indeed, payoffs when the sharing rule is $\hat{s}$ are

$$\pi^U = Q(u, d) \hat{s} P - \frac{1}{2} (1 - u)^2$$
$$\pi^D = Q(u, d) (1 - \hat{s}) P + B - \frac{1}{2} d^2,$$

leading to equilibrium choices of

$$\hat{u} = \frac{1 + (1 - \hat{s}) P}{1 + P}$$
$$\hat{d} = \frac{(1 - \hat{s}) P}{1 + P}.$$

Hence, going from s to $\hat{s}$ increase incentives for coordination since $\hat{u} - \hat{d} = \frac{1}{1+P}$ with $\hat{s}$ while $u - d = \frac{1}{1+P-R}$ with s and borrowing. Note that since $\hat{u} > u$, $Q(\hat{u}, \hat{d}) > Q(u, \hat{d}) > Q(u, d)$ and therefore in equilibrium the U manager must be strictly better off since he has the same effective shares in the initial contract and in the new contract. Since $\hat{d} > d$, we also have $Q(\hat{u}, \hat{d}) > Q(\hat{u}, d) > Q(u, d)$ and manager D must also be strictly better off since he could have chosen d and since $B = Q(u, d) R < Q(\hat{u}, \hat{d}) R$. Therefore the initial contract is strictly Pareto dominated as claimed. ∎

Note that liquidity is a more efficient instrument for surplus allocation than the sharing rule s only when firms do not integrate. Indeed, under non integration, a change of s affects total costs. By contrast, when firms are integrated (with split control), a change in s has no effect on output or on costs and therefore surplus is

30

perfectly transferable by using s. Hence, the introduction of liquidity seems to favor non integration and we should observe in equilibrium less firms that are integrated. However, this intuition is only partial since the product price also changes when liquidity changes.

Consider a distribution of liquidity $F(l)$ among U managers, where $\int dF(l) = m > 1$, and let l_F be the *marginal liquidity*, that is $F(l_F) = m - 1$. There is no loss of generality in assuming that only U firms with liquidity greater than l_F will be active on the matching market.

Since there is a measure $m-1$ of U firms that will not be matched, U managers will try to offer the maximum payoff consistent with being matched with a D firm while getting a nonnegative payoff. Fix the product price at P. The maximum surplus that a D manager can obtain via integration is $1 - \sigma$ and the maximum he can obtain from the marginal liquidity U manager is (we assume that l_F is less than the maximum surplus under non integration)

$$
\begin{aligned}
\max_{s} \pi^D &= Q^{no}(P)(1-s)P - \frac{1}{2}(1-s)^2 \left(\frac{P}{1+P}\right)^2 + l_F \\
\pi^U &= Q^{no}(P)sP - \frac{1}{2}s^2 \left(\frac{P}{1+P}\right)^2 - l_F = 0
\end{aligned}
$$

where

$$
Q^{no}(P) = 1 - \frac{1}{2(1+P)^2}
$$

is the probability of success under non-integration (remember that this probability is independent of s).

Referring to Figure 2, if $l_F < L$, the maximum payoff to a D manager is less with nonintegration and an ex-ante transfer of l_F than with integration (point b). Hence, U firms with $l_F \leq l \leq L$ will still offer integration contracts in order to be matched;

31

however, firms with $l > L$ will offer non integrated contracts. If $l_F > L$, then all firms will be integrated.

Because L depends on P, we have in fact three regimes. First, when $P \leq \underline{P}$, or when $P \geq \overline{P}$, integration is dominated by non integration (Lemma 2) and therefore liquidity has no effect on the supply curve: each firm produces $Q^{no}(P) = 1 - \frac{1}{2(1+P)^2}$ and the role of liquidity is to increase managerial surplus since the transfer of liquidity enables firms to choose s closer to $1/2$.

When $P \in (\underline{P}, \overline{P})$, as in Figure 2, let $L(P)$ be the value of liquidity for which a D manager is indifferent between integrating and receiving a share of 1 or not integrating with a sharing rule of $s(P)$ and a lump sum payment of $L(P)$. The sharing rule $s(P)$ equates welfare under integration and non-integration, that is,

$$s(P) : Q^{no}(P) P - \frac{1}{2} \left(s^2 + (1-s)^2 \right) \left(\frac{P}{1+P} \right)^2 = (1-\sigma) P - \frac{1}{4}. \qquad (18)$$

$L(P)$ is the transfer that gives a zero surplus to the U manager when the sharing rule is $s(P)$ under non integration; that is,

$$L(P) = Q^{no}(P) s(P) P - \frac{1}{2} s(P)^2 \left(\frac{P}{1+P} \right)^2. \qquad (19)$$

For a given liquidity distribution F, the measure of firms that integrate is the measure of U managers with liquidity greater than $L(P)$. Hence, there is a measure $m - F(L(P))$ of firms that do not integrate and a measure of $F(L(P)) - F(l_F) = F(L(P)) - m + 1$ of firms that integrate. Note that $L(\underline{P}) = L(\overline{P}) = 0$ since managerial welfare with integration and no integration are by definition equal at those prices. Since there are always fewer integrated firms than with no liquidity, the output with integration is larger than with non integration when $P < P^*$ and smaller when $P > P^*$, we conclude that adding a nontrivial liquidity distribution causes the supply curve to "rotate" at P^*.

Proposition 9 *Compared to the case in which all firms have zero liquidity, with a nondegenerate liquidity distribution, the supply curve is unchanged where $P \notin (\underline{P}, \overline{P})$.*
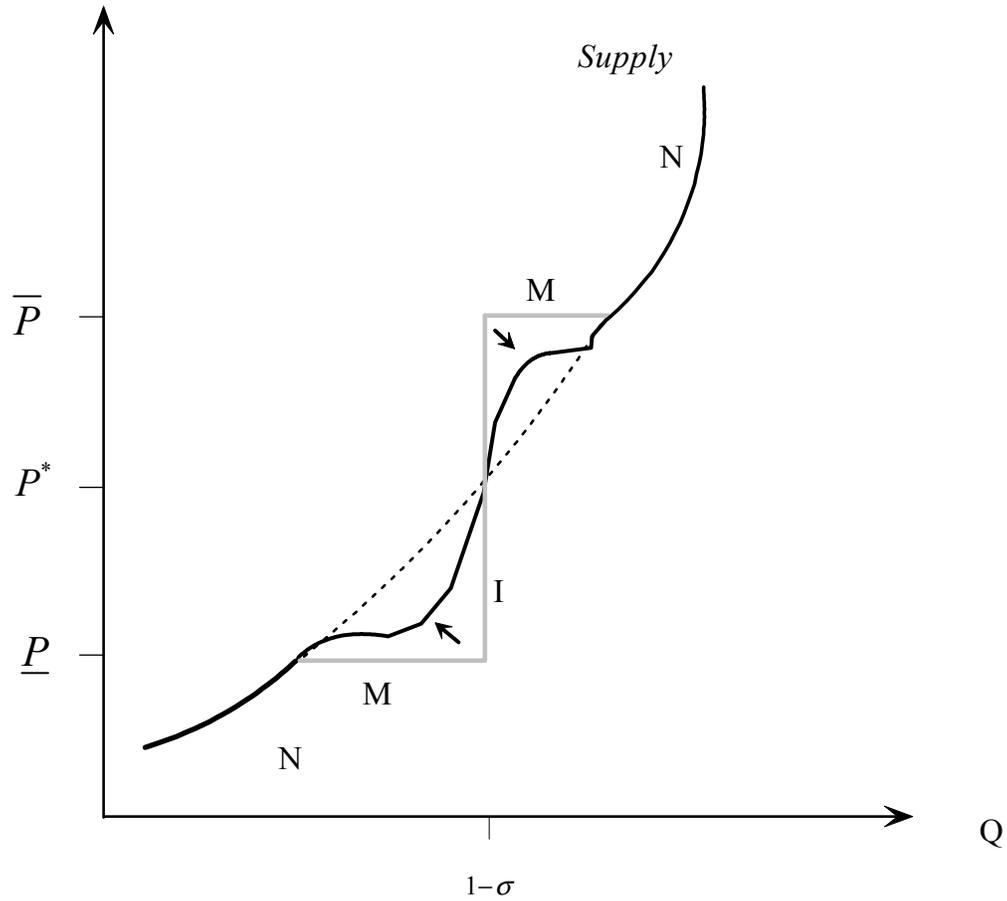
Figure 4:

When $P \in (\underline{P}, P^*)$ the supply curve shifts to the left and when $P \in (P^*, \overline{P})$ the supply curve shifts to the right.

Going back to the characterization of the conflict between managers and the other stakeholders in Proposition 3 we note two opposite effects of liquidity. First, there is less often inefficient integration in the region $P \in (P^*, \overline{P})$ and therefore output is larger and prices lower. Second, there is more inefficient non-integration since firms stay non integrated in the price region $(\underline{P}, P^*)$ while they were integrated before; since integration is output maximizing in this region, inefficiencies increase

from the point of view of consumers and shareholders. This result is squarely in the second-best tradition: giving the managers an instrument of allocation that is more efficient for them may induce them to minimize *their costs* of transacting, but this may exacerbate the inefficiency of the equilibrium contract. Here while liquidity reduces the over-internalization of the benefits of coordination, it increases the over-internalization of the benefits of specialization. This role of liquidity is new to the literature, so far as we are aware.

Proposition 9 has an interpretation in terms of *unbalanced* supply shocks. Imagine that there is entry of upstream firms into the supplier market; to keep things simple, suppose that the new set of suppliers is a (possibly fractional) replication of the old set. This corresponds to a rightward shift in the liquidity distribution: as described in the proposition, the result is a shift away from integration, and we have

Corollary 10 *A replicative increase in the set of U firms, with the measure of D firms fixed, reduces the degree of integration; if $P \in \left(P^*, \overline{P}\right)$, output increases and prices fall; if $P \in (\underline{P}, P^*)$, output decreases and prices rise.*

The first statement suggests that increased availability of suppliers in the international marketplace should have effects opposite those predicted by a balanced supply shock: globalization now generates a trend toward outsourcing (i.e., away from integration). Moreover, despite the fact that there are now *more* suppliers than before, it is possible (in the case $P \in (\underline{P}, P^*)$) that this move adversely affects consumers via increased prices and reduced output. The suppliers have greater control than before, but the resulting loss of coordination reduces output. Of course, since the effect is driven by an increase in the terms of trade for downstream managers, the latter benefit: the greater cash payments they receive more than compensates for the control they have given up.

3.4 Changes in Outside Options

In the basic model we assume that firms that do not find a partner have an outside option normalized to zero. If this is not the case and firms are differentiated with respect to their outside options, changes in these outside options will affect the organizational choices of the firms that are matched. Let v be the outside option of the U managers, that is the payoff they can attain if they are not matched with a D partner. Suppose that U managers have different outside options and that v is distributed with distribution G, where $G(\infty) > 1$, (1 being the measure of D firms). Let us assume that managers have no liquidity. In the matching equilibrium, D firms will match with the U firms having the lowest outside option. Hence, the *marginal* U manager has outside option v^* with $G(v^*) = 1$. Observe that if v^* is greater than L, all firms with be nonintegrated; in general, a *higher outside option to the marginal U firm creates a positive externality for the inframarginal U firms.*

This seems opposite to the conclusion we reached when we considered changes in liquidity. However, if we think that liquidity modifies the outside option of U firms (say because of financial market imperfection creating a multiplier effect to liquidity) we have in fact two opposite effects from an increase in liquidity at the margin; if the "multiplier" effect of liquidity on the outside option is small, then the negative externality effect will dominate, otherwise the positive effect will dominate.

4 Conclusion

In our basic model, managers trade off the coordination benefits brought by reallocation of decision rights with the loss from lack of specialization. The main result of the analysis is that integration decisions (in favor or against) can lead to lower output levels and higher prices than the alternative decision. This result is obtained assuming a competitive product market, i.e., firms or managers do not take into ac-

count the effect of reorganization or vertical integration on product prices. It is the desire of managers to minimize their private costs that leads them to over internalize the benefits of coordination brought by vertical integration or to over internalize the benefits of specialization brought by nonintegration.

We believe that these effects can be identified in practice. For instance, we show conditions under which inefficient integration is most likely to be present : when a nonintegrated industry is subject to positive supply shocks that push the market price down or when there are positive demand shocks that push the market price up. The main result is robust to the introduction of active shareholders (whose disciplining role might be undermined by the managers' ability to bribe them, for instance by adjusting their dividend policy), or to the ability of firms to make ex-ante transfers. Similar characterizations can be made for inefficient lack of integration.

Our analysis also suggests policy remedies in cases in which managers' organizational choice is inconsistent with maximizing consumer welfare. When managers favor integration either because the terms of trade in the supplier market are extreme or because product prices are moderately high, reduced specialization can dominate improved coordination, and output is lower than without integration, hurting consumers. Vertical merger policies that are conventional in the sense that they assume the form of blocking a potentially harmful merger may be effective in increasing output and lowering market prices. In other ranges of prices, managers prefer *not* to vertically integrate, and now because of lack of coordination, output is smaller than with integration. This is a case where conventional merger policy is rather ineffective (there is no merger to prevent).

But corporate governance regulation that strengthens shareholders' ability to force integration may improve consumer welfare. In our competitive world, shareholders and consumers interests are aligned. Shareholders take the product price as given and favor organizations that increase output, hence leading eventually to lower in-

dustry prices. Consumers favor industry equilibria with low product prices, hence organizational choices that increase output. When managerial discretion yields to inefficient integration, competition policy is a sufficient instrument to correct these inefficiencies. When managers inefficiently do not integrate, corporate governance codes making shareholders active participants in the integration decision may be a sufficient instrument for correcting the inefficiency. Hence we may be tempted to view corporate governance and competition policy as substitute instruments in a competitive world. This is subject to the caveat we pointed out above that corporate governance may be subject to a commitment problem with respect to the dividend policy or other forms of "bribery."

Though the effects we have identified can occur absent market power, this is not to say that market power is irrelevant to the effects of – or its effects on – major organizational decisions. When firms have market power, incentives to integrate may be also linked to efficiency enhancements, such as the desire to eliminate double markups. However firms may also recognize that by reducing output they will raise prices, and some of the effects we describe happen all the more strongly. Indeed our results suggest that in an oligopolistic product market, firms may use the organizational decision as a way to commit to lower output levels, thereby facilitating the collusive outcome.[11] Moreover, the effects of "effective" corporate governance may be quite different in this case. In a noncompetitive world, shareholders and consumers interests are no longer aligned, and as we have already noted, managerial discretion may be a way for shareholders to commit to low output and therefore high profits. The relative effects of corporate governance regulation and competition policy may therefore depend non trivially on the intensity of product market competition. These

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[11]Obviously, commitments to limit competition could take other forms, e.g. product bundling. Nevertheless, there are appealing reasons for focusing on mergers as commitment devices: first, mergers are easy to identify and, second, they are easy to prevent, which is not the cases with other forms of (explicit or implicit) commitments.

points warrant further investigation in future research.

5   Appendix

Proof of the Lemma

Suppose that $\mu < \delta$. U chooses decisions $u\left(i\right),$ on $i \leq \mu$ and $d\left(i\right)$ on $i < \delta$, while D makes the other decisions. Since the probability of success is decreasing in the degree of vertical coordination and since U prefers decisions 1 on his activity while D prefers decisions 0 on her activity, it is a dominant strategy for U to set $u\left(i\right) = d\left(i\right) = 1$ for $i \leq \mu$ and for D to set $u\left(i\right) = d\left(i\right) = \delta$ on $i \geq \delta$. In the interval $\left(\mu, \delta\right),$ U has control of decisions for the D activity tasks and D has control of decisions for the U activity tasks. Let d be the cutoff strategy of U and u be the cutoff strategy of D. Payoffs are then

$$\pi^{U}\left(d, u\right) = \left(1 - \frac{1}{2}\left(u - d\right)^{2} + \sigma\left(1 - \mu + \delta\right)\right) Ps - \frac{1}{2}\left(1 - u\right)^{2}$$

$$\pi^{D}\left(d, u\right) = \left(1 - \frac{1}{2}\left(u - d\right)^{2} + \sigma\left(1 - \mu + \delta\right)\right) P\left(1 - s\right) - \frac{1}{2}d^{2}.$$

Since

$$\frac{\partial \pi^{U}}{\partial d} = \left(u - d\right)s$$

$$\frac{\partial \pi^{D}}{\partial u} = \left(d - u\right)\left(1 - s\right),$$

it is immediate that an equilibrium requires $u = d$. There is a continuum of equilibria indexed by $u \in [\mu, \delta]$. Consider such an equilibrium and define $\hat{\mu} = u = \hat{\delta}$. The game $G\left(\hat{\mu}, \hat{\delta}, s\right)$ is a split-control game and the loss from allocating decision rights is $1 < 1 - \mu + \delta$ since $\mu < \delta$; therefore each agent obtains a larger surplus in this game than in the equilibrium of the initial game $G\left(\mu, \delta, s\right).$

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