Managerial Firms, Vertical Integration, and Competition Policy*

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Abstract

We show that vertical integration may be chosen by managers to the detriment of consumers even in the absence of monopoly power in either supply or product markets. This effect is most likely to come about when demand is initially high and there is a negative supply shock or when demand is low and there is a positive demand shock. There is therefore a need for scrutiny of vertical mergers even in the absence of market power. The result is robust to the introduction of active shareholders who may oppose the merger and to other extensions.

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1 Introduction

One goal of competition policy is to discourage mergers that will adversely affect consumer welfare. Concerns typically arise when the restructuring firms are already dominant in the product market and the merger threatens to increase their market power. For horizontal mergers, relatively simple guidelines for evaluating the effects of a potential merger have been developed and put into practice; these involve a trade-off between cost-reducing scale economies and price-increasing market power (Farrell-Saloner 1990).

In the case of vertical or conglomerate mergers, dominance and market power have not been as easy to identify as in the case of horizontal mergers. The main concerns here revolve around various ways for the merged entity to foreclose markets to competitors. Though sound theoretical arguments for these effects have been laid out (Bolton-Whinston 1993, Rey and Tirole 2002), it is usually difficult in an actual merger case to establish whether they are operative. The prevailing practical view has come to be that, absent significant market dominance, vertical or conglomerate mergers are a small concern for competition policy: the costs are hard to ascertain, and the possible benefits (reduction of contractual costs, increased coordination in production, elimination of double markups) are presumed to explain the firms' desire to merge in the first place.

We show in this paper that this prevailing attitude toward vertical mergers may be too sanguine: "synergies" that spawn vertical integration can benefit management without benefiting consumers, and the latter may be harmed by output or quality reductions resulting from managerial overextension. We build on the insights of the literature on the firm (Jensen and Meckling 1976, Grossman Hart 1986, Hart and Holmstrom, 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, working conditions or corporate culture.[1]

When contracting is imperfect or incomplete, organizational choices by the managerial firms may have little to do with profit maximization, much less 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: firms make their organization decisions without regard to their effect on input or output prices.[2] Consumer goods are produced by complementary enterprises, each headed by a manager who have divergent preferences over the direction in which decisions affecting the productivity of the joint enterprise should go. There are gains to managerial specialization, which favors nonintegration. But there are also gains to coordination of managerial decisions, and this favors integration. Mergers and the concomitant reallocation of managerial control result in reduced managerial costs and better coordination, but output falls, hurting consumers, due to reduced specialization. Policies that prohibit mergers may increase output and lower market prices. Thus, if the goal of competition policy is to protect consumers, there is a potentially significant need for the competition authority to scrutinize vertical mergers.

In the model we consider, production requires the combination of one "upstream" firm U and one "downstream" firm D. There is a large, competitive "matching" market for upstream and downstream firms, as well as a competitive product market, wherein all firms and consumers are price-takers. A firm is identified with the set $[0, 1]$

[1] In a recent paper, 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" and that the pattern of mergers and divestiture may be explained by "empire building" motives of managers.

[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 allocation of control. See also recent work by Grossman and Helpman (2002) and Marin and Verdier (2002).

of its assets (or tasks) along with the manger who oversees them. A noncontractible binary decision has to be made about each asset prior to production. As in some recent models of managerial firms (e.g., Hart and Holmstrom, 2002), the production technology 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 localities well; the local distributer 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 an something, the market will not be served.[3] Or the model may simply represent clashes of culture between suppliers and producers, especially if they come from different countries.

Organizational design, of which the decision whether to merge is an instance, consists of an assignment to each manager of decision rights over assets. 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 its output.

[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.

By contrast, vertical integration enables the firms to trade assets and to reallocate decision rights. There are two consequence 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 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 manger 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 it 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.

These results have a number of implications for competition policy. We consider the general equilibrium of the product market-supplier market system and display regimes under which product prices are higher, and total output and consumer welfare lower, in equilibrium than they would be if a competition authority prohibited mergers.

Recently, there has been concern that growth of international trade may induce merger activity. One goal of our analysis is to show how this comes about, and to help distinguish cases in which merger effects are harmful or helpful to consumers. 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, prohibiting the mergers would cause them to fall further still.

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. Competitive concerns arise in third regime,

[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.

before we observe a wave of "divestitures.

We then subject our model to a number of robustness checks. We consider the 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. However, if managers can adjust their dividend payouts, they will be able to share the surplus gain from integrating with shareholders. Thus even with shareholders who can veto mergers, our conclusions do not change; the externality managers impose on consumers need not be internalized by firms.

We also show that our conclusions are largely unaffected by admitting more general control structures than the simple split control structure we consider in the main section of the paper, and we give some attention to the effects of liquidity on managerial decisions.

2 Model

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 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

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

$Q(u,d) = 1 - \frac{1}{2}(u-d)^2 - \sigma(1 - (\mu + \delta))$ 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.[5] 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

[5] 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.

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 (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.[6]

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 $\mu = \delta$.[7]

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

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

[6] 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.

[7] 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.

best responses are

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

for U and

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

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:

$$\begin{aligned} u^* &= \frac{1 + (1 - s)\,P}{1 + P} \\ d^* &= \frac{(1 - s)\,P}{1 + P}. \end{aligned}$$

Note that $u^* > d^*$ and that the vertical coordination loss is

$$u^* - d^* = \frac{1}{1 + P},$$

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

$$Q^* = 1 - \frac{1}{2\,(1 + P)^2}$$

and the equilibrium payoffs are

$$\begin{aligned} \pi^U &= Q^* sP - \frac{1}{2} s^2 \left(\frac{P}{1 + P} \right)^2 \\ \pi^D &= Q^* sP - \frac{1}{2}\,(1 - s)^2 \left(\frac{P}{1 + P} \right)^2. \end{aligned}$$

Varying s, one obtains the Pareto frontier in the case of nonintegration. Since $\partial \pi^U / \partial s = Q^* P - s \left(\frac{P}{1+P} \right)^2$, $\partial \pi^U / \partial s = Q^* P - (1 - s) \left(\frac{P}{1+P} \right)^2$ it is immediate 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

$$W^D(s) = Q^* P - \frac{1}{2}\left(s^2 + (1-s)^2\right)\left(\frac{P}{1+P}\right)^2 \tag{3}$$

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, in fact the difference is welfare is equal to $\frac{1}{4}$. 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.[8]

The case of interest to us is when output under integration with split control is smaller than output under nonintegration. This occurs if and only if

$$\sigma > \frac{1}{2\,(1+P)^2}. \tag{4}$$

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

The question is when consumer interest may come into conflict with managerial welfare. Remember that under no-integration total welfare is given by (3), 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,

$$(1-\sigma)\,P - \frac{1}{4} > \left(1 - \frac{1}{2\,(1+P)^2}\right) P - \frac{1}{2}\left(\frac{P}{1+P}\right)^2,$$
$$\Leftrightarrow \sigma < \frac{1}{2(1+P)} - \frac{1}{4P}. \qquad (5)$$

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 (4) and (5) are satisfied, there is a potential for conflict of interest between managers and consumers. (Of course, if (5) is violated, for instance if σ is large, managers never want to integrate.) The conflict arises when the curves defined by the bounds in (5) and (4) cross. See Figure 1: for a fixed value of σ, the region over which managerial welfare is greater under integration than under nonintegration is $\left[\underline{P}, \overline{P}\right]$; however when $P \in \left[P^*, \overline{P}\right]$, condition (4) 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. When P is outside $\left[\underline{P}, \overline{P}\right]$ nonintegration maximizes managerial welfare.

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 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. 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,

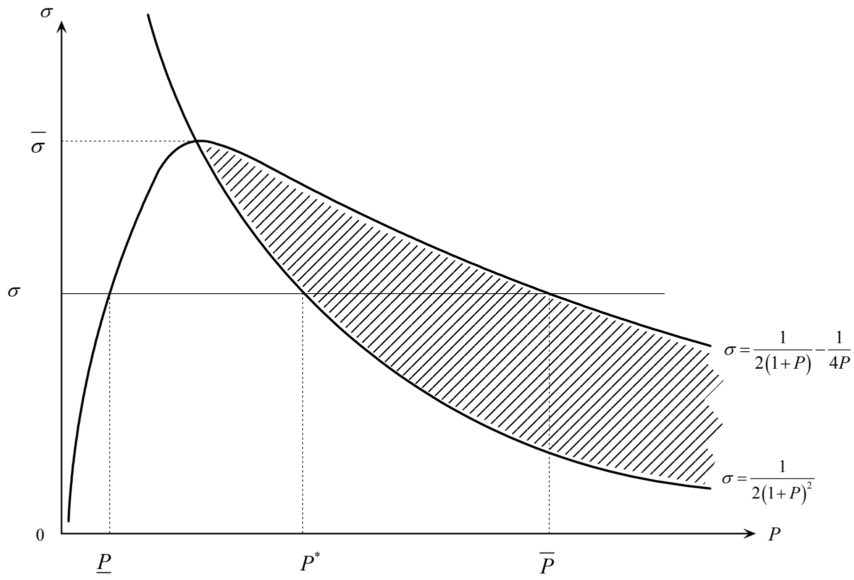

Figure 1:

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 section. The following Proposition summarizes the previous discussion.

Proposition 2 *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* $\sigma \in \left[\frac{1}{2(1+P)^2}, \frac{1}{2(1+P)} - \frac{1}{4P}\right]$.

Of course in general, P is endogenous: if it clears the market on 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 (5) and (4) 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 (4) and (5) hold; hence, integration arises in equilibrium and can generate lower output with respect to nonintegration.

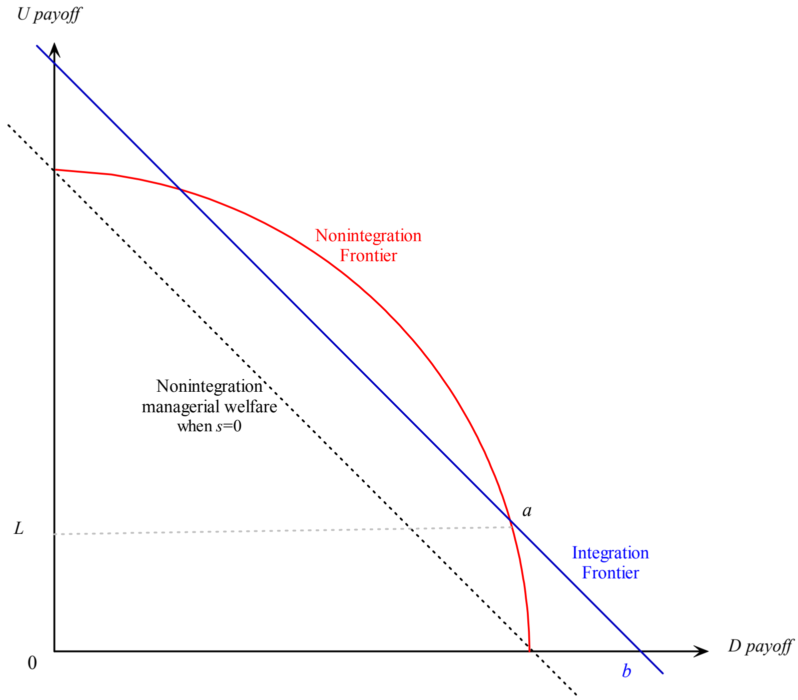

Figure 2:

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.

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 shares for each manager between and can be computed in terms of the surplus shares to each manager. We continue to assume that no manager has any cash with which to augment the surplus possibilities generated by the two organizational arrangements, nonintegration and split control and depicted in Figure 2, 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:

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

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

The industry equilibrium condition is

$$\sigma \begin{matrix} \geq \\ = \\ \leq \end{matrix} \frac{1}{2(1+P(\alpha))} - \frac{1}{4P(\alpha)} \text{ as } \alpha \begin{matrix} = 0 \\ \in (0,1) \\ = 1. \end{matrix} \tag{6}$$

this condition coincides with (5) 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). 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 tht change the relative scarcities of the two types of managers; we approach this issue in a simple way in Section 3.4).

Suppose that the effective supply of firms expands, say because international markets open. Specifically, assume that both sides of the supplier market expand so

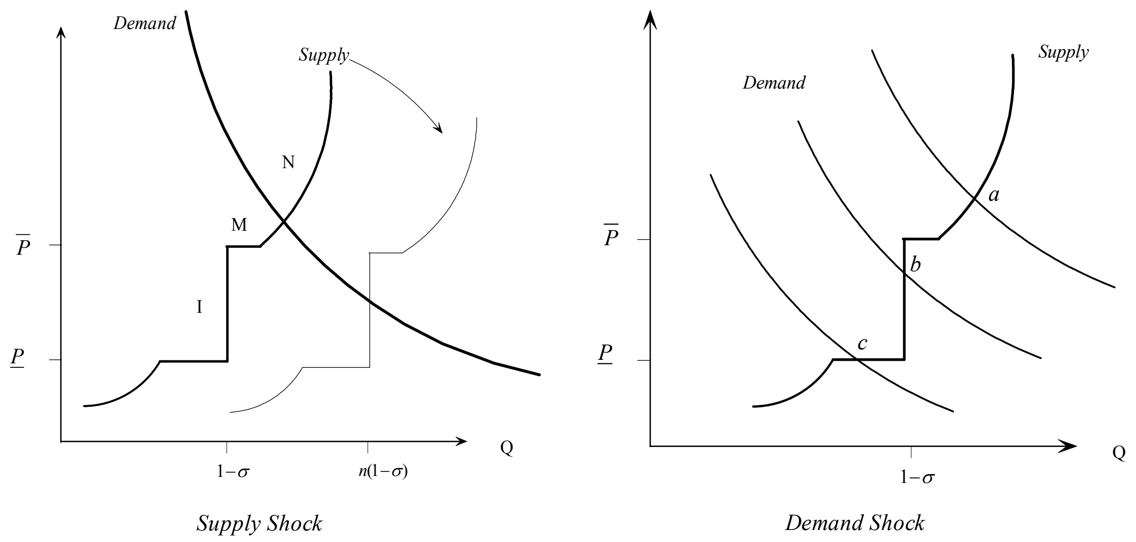

Figure 3:

as to keep the D side short – call such a supply shock *balanced.* The sequence of events can be gleaned from Figure 3. As illustrated in the left panel, following the increase in supply, the industry moves 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 $\left[P^{*}, \overline{P}\right]$), these mergers lead to higher prices and lower output than what would have happened with the initial nonintegrated structure.

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. The right panel of Figure 3 illustrates how this shift in demand may lead the industry from a nonintegrated equilibrium (point a) to an integrated equilibrium (point b). Hence, when demand is high and firms are nonintegrated, negative demand shocks can lead to inefficient integration in the industry. Demand shocks are also consistent with the life cycle of an industry. At the early stages of the market, demand is low and firms are nonintegrated (point c). As the product matures and demand increases, firms will begin to integrate (point b) and the synergies will first benefit the managers and the 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.

To summarize our discussion:

Proposition 3 *(i) Globalization can be a force for the generation of merger activity without further assumption about changes to technology or regulation.*
(ii) Merger activity parallels the life cycle of the product and follows either additional entry of firms in the industry or increases in demand.
(iii) In the face of such changes, the competition authority ought to scrutinize vertical mergers, since they are not always efficiency enhancing:
(iv) for each σ between 0 and $\bar{\sigma}$ there is an interval of prices such that firms integrate and consumer welfare would increase if they were prohibited from doing so. There always exist a demand function such that prices in this interval are equilibrium prices.

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 4 *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

$$\mu < 1 \Rightarrow u = \mu < \frac{1 + dsP}{1 + sP} \tag{7}$$

$$\mu = 1 \Rightarrow u = \frac{1 + dsP}{1 + sP} \tag{8}$$

$$\delta > 0 \Rightarrow d = \delta > \frac{u(1-s)P}{1 + (1-s)P} \tag{9}$$

$$\delta = 0 \Rightarrow d = \frac{u(1-s)P}{1 + (1-s)P}. \tag{10}$$

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

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

$$s.t. \text{ (7), (8), (9), (10)}$$

$$\left(1 - \frac{(u-d)^2}{2} - \sigma(1 - \mu + \delta)\right)sP - \frac{(1-u)^2}{2} \geq 0. \tag{11}$$

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 (7)-(10); 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 (7), (9) $u = \mu$ 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 (10) in (7) and solving for μ yields

$$\mu < \frac{1 + (1-s)P}{1+P} \tag{12}$$

$$\Leftrightarrow$$

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

Individual rationality (11) requires

$$sP \geq \frac{(1-\mu)^2}{2Q}. \tag{13}$$

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

$$1 - \mu < 2Q(1+P). \tag{14}$$

Subtracting (10) from (7), we have

$$\mu - d = \mu \frac{1}{1 + (1-s)P}, \tag{15}$$

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 (13),

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

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 one type of organization, shareholders will oppose reorganization unless they can be compensated. Dividends play this role. The argument below can be adapted straightforwardly to our model (replace R by QP). There are two production plans: integration yielding a managerial revenue of R_2 and nonintegration yielding a managerial revenue R_1; nonintegration is the status-quo and shareholders obtain dividends $\beta_1 R_1$. Suppose that $R_1 > R_2$ but that $R_1 - C_1 < R_2 - C_2$, where C_i is the total private cost of managers under plan i. Then managers prefer integration to nonintegration at the going dividend rate but shareholders have opposite preferences. Suppose that shareholders "lend" a unit of financial capital to the managerial team. They require at least the safe return r in order to agree to do this.

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

Case 1. Shareholders compete. Then we require that $\beta_1 R_1 = r = \beta_2 R_2$, for otherwise shareholders will invest in another enterprise or the safe asset, 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 $R_2 > r$ (production is always efficient), dividends can always be chosen to keep shareholders happy, and the managers choose the production plan 2 because $(1 - \beta_1)R_1 - C_1 > (1 - \beta_2)R_2 - C_2$ (since $\beta_1 R_1 = \beta_2 R_2$ by assumption).

Case 2. Managers compete. Assume they get 0 if they aren't hired. Hence in the status-quo situation we must have $(1 - \beta_1) R_1 - C_1 = 0$, which yields shareholders

$\beta_1 R_1 = R_1 - C_1$. The shareholders will opt for reorganization: they impose a dividend rate β_2 satisfying $(1-\beta_2)\,R_2 - C_2 = 0$, that is $\beta_2 = \frac{R_2 - C_2}{R_2}$, so that $\beta_2 R_2 = R_2 - C_2 > R_1 - C_1$.

Hence, if it is possible to commit to pay higher dividends after integration, managers and shareholders have aligned interests, and having active shareholders is not a substitute for competition policy. Note that if contracts between shareholders and managers are less sophisticated, or if it is not possible to commit to pay higher dividends following integration, active shareholders will veto inefficient integration: in this case, active shareholders may indeed be a substitute for competition policy 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. In any case, these remarks suggest that the corporate governance structures of the merging firms may have to be taken into account in order to assess the competitive effects of mergers.

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,[9] or another monetary instrument that can be transferred without loss to the D manager before

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

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.

Consider therefore a distribution of liquidity $F(l)$ among U managers, where $\int dF(l) = m > 1$. Assume to simplify that managers whose firm does not find a partner get a zero payoff. In equilibrium, 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. It follows that in equilibrium, the surplus that the D managers obtain is determined by the liquidity of the *marginal firm U*, that is the firm with liquidity l^* such that $F(l^*) = m-1$. If $l^* < L$, the maximum payoff to a D manager is less with nonintegration and an ex-ante transfer of l^* than with integration (point b). Hence, U firms with $l^* \leq l \leq L$ will have to offer integration contracts in order to be matched. If $l^* > L$, then all firms will be integrated. Note that if l^* increases, an inframarginal firm U whose liquidity has not changed will be forced to integrate more or to go down the nonintegration frontier in order to be matched. Hence, *increases in the liquidity to the marginal U firm creates a negative externality to the inframarginal U firms.* Hence the competitive worries should be the strongest when the liquidity of the financial market is low or when the liquidity reserves of the merging firms are low.

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. (See Legros and Newman 1999 for similar comparative statics.)

4 Conclusion

In our basic model, managers tradeoff the coordination benefits brought by reallocation of decision rights with the loss from lack of specialization. The main result from the analysis is that integration can lead to lower output levels and higher prices than nonintegration. This result is obtained assuming a competitive product market, i.e., firms or managers do not take into account 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. We believe that this effect can be identified in practice. We show conditions under which the inefficiency 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 (who may play a disciplining role), or to the ability of firms to make ex-ante transfers.

Since consumers may be hurt by vertical mergers, our model calls for an active competition policy scrutiny of these mergers.[10] Since the effect appears absent any product market power by firms, the inefficiency of such mergers should not be dismissed on the basis of lack of market dominance by the merging firms. This is not to say obviously that market power does not matter. In fact, if firms have market power and recognize that by reducing output they will raise prices, then the effects we describe happen all the more strongly. Indeed vertical integration effectively allows firms in an oligopolistic product market to commit to lower output levels, thereby facilitating the collusive outcome. This point warrants further investigation in future research.[11]

5 Appendix

Proof of the Lemma

Suppose that $\mu < \delta$. U chooses decisions $u(i)$, on $i \leq \mu$ and $d(i)$ on $i < \delta$, while D

[10]Often management opposes a (possibly efficient) merger because of loss of control. This isn't really modelled here, but there is a region in the parameter space in this model in which integration is more efficient from the consumer point of view but managers prefer nonintegration. There is not much role for competition policy in the usual sense here, although other sorts of regulation may be useful.

[11]Obviously, commitments to limit competition could take other forms. (For instance, Farrell et al. 1998 show the possibility that firms may benefit from competing on bundles rather than on individual components.) 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.

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 $u(i) = d(i) = 1$ for $i \leq \mu$ and for D to set $u(i) = d(i) = \delta$ on $i \geq \delta$. In the interval (μ, δ), 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

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

Since

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

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 $G(\mu, \delta, s)$.

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