Competitive Prices and Organizational Choices*

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Abstract

We construct a price-theoretic model of integration decisions undertaken by managerial firms and show that these choices may adversely affect consumers, even in the absence of monopoly power in supply and product markets. A key observation is that the price of output helps to determine the organizational form chosen. At low prices, managers may be resistant to integration, even if it efficiently coordinates decisions, because it imposes high privates costs on them. At higher prices, they may choose integration even if nonintegration would produce more output, because nonintegration leads to a managerially undesired *distribution* of private costs. Moreover, organizational choices affect output and therefore prices. Since shocks to industries affect product prices, reorganizations are likely to take place in coordinated fashion and be industry specific, consistent with the evidence. The model identifies conditions under which hostile (shareholder initiated) versus friendly (manager initiated) takeovers are more likely, and shows that there are instances in which entry of suppliers can hurt consumers by changing the terms of trade in the supplier market and thereby inducing harmful reorganizations. Measures of the welfare loss due to managerial control are discussed. The results have implications for current policy debates about corporate governance and international outsourcing.

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.[1]

Yet if the sheer volume of scholarship is any indication, that same wisdom readily acknowledges conflicting interests among the various 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 responses such as compensation packages or corporate governance rules can help mitigate the potential for managers to cheat shareholders. Recent corporate scandals in the US and in England have vidly illustrated that these private remedies will not always keep these interest conflicts in check, and they have led to a resurgent public debate about appropriate corporate governance regulation in order to protect shareholder interests.

There are, of course, potential interest conflicts between the firm and the consumer: this is a central concern of the industrial organization literature and the competition policy. But the predominant view of the firm there is the classical one of the unitary profit maximizer; as a consequence, the effects of organizational design and/or 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. In particular, it is hard from this point of view to see how firms might be characterized by *too little* integration.

In reality, of course, even in "small" firms, top managers have consider-

[1]For instance, as Fama and Jensen (1983) aver, "the form of organization that survives... is the one that delivers the product demanded by customers at the lowest price while covering costs."

able discretion in designing the organization of their enterprises, and they can be prime movers of merger, acquisition and divestiture decisions. The motives behind these reorganizations or mergers may have more to do with managers' interests than those of shareholders or consumers. Indeed, forty years ago, Leibenstein (1966) argued that the power of managers could have a considerable impact on consumer welfare: in particular, he suggested that losses due to "X-inefficiency," attributable in large measure to managerial slack, might be an order of magnitude larger than losses due to the exercise of market power. More recently, Bertrand and Mullainathan (2003) provide evidence that managers prefer a "quiet life" at the possible expense of productivity-enhancing reorganizations.

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. Both too much and too little integration are possible outcomes from the consumer point of view.

We build on the insights of the literature on the firm (Grossman and Hart, 1986; Hart and Moore, 1990; 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, 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 and divestitures that enhance managerial welfare may reduce output and raise prices, 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 exactly two complementary suppliers, each consisting of a manager and his collections of assets. When the suppliers form a joint enterprise (or "firm"), the managers operate the assets by taking noncontractible decisions.

As in some recent models of managerial firms, in particular Hart and Holmström (2002), the production technology essentially involves the adoption of standards. While there is no objectively "right" decision, 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 distributor may disagree, thinking that programming must be specifically tailored to a local market (Ghemawat 2001). Each party will find it costly to accommodate the other's approach, but if they don't agree on something, the market will be poorly served.

Under nonintegration, managers make their decisions separately, and this may lead to inefficient production. Integration solves this problem by bringing in an additional party, call it HQ, which is motivated by monetary compensation to maximize the enterprise's output.[3] HQ accomplishes this by enforcing a common standard. But delegating decision rights to HQ does not come for free, and generates two types of losses. First, as in Hart and Holmström (2002) this solution to the coordination problem may lead to high private costs for the initial managers. Second, using HQ to enforce coordination may have direct costs in terms of foregone output. For instance, HQ may not be specialized in all the tasks carried out by the suppliers, (e.g., Hart and Moore 1999), there may be additional communication and delay costs (e.g., Radner 1993, Bolton and Dewatripont 1994), or HQ may have its own moral hazard problems.

[2]The model is inspired by earlier work (Legros and Newman 1996, forthcoming) 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.

[3]Other models that take this view of integration include Alchian and Demsetz (1972), Hart and Holmström (2002), Mailath et al. (2002).

In our model, the ownership structures (integration versus nonintegration) are decided by managers when the firms form; this takes place in a competitive supplier market in which the two types of suppliers "match." The firms' output is sold in a competitive product market, wherein all firms and consumers are price-takers.

The decision whether to integrate will depend on the market price of output. If the value of output is high because the price is 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 the output price may induce a flurry of integration.

As this example illustrates, this "pecuniary" mechanism for organization choice provides a natural explanation for the tendency for organizational restructuring to be *widespread*. There is considerable evidence that firms integrate (or divest) in "waves" and that reorganizations of this sort are most pronounced at the industry level. Since product price is common to a whole industry, anything that changes it will not only have the classical price-theoretic quantity and consumer welfare effects, but will have organizational effects as well. And as we have suggested, these organizational effects will in turn feed back to quantity and welfare.

In particular, at low product prices, there will be too little integration. In this situation, revenue is small, and under nonintegration managers concede very little to producing high output; integration would raise output, but generate little extra revenue for the managers and entail a significant increase in private costs. Consumers would certainly benefit if firms integrated, since this would raise output and lower prices.

Shareholders of each firm would also would like integration, since in this competitive world, from their point of view there would be an increase in revenue (and they neglect the impact on price when all firms integrate). Thus, the model identifies situations in which firms are ripe for "hostile" takeover.

As prices rise, managers gain increased interest in revenue and recognize

that nonintegration will fall short in this dimension, since the only way to raise output under nonintegration is by a large and unbalanced allocation of private costs. At this point they will switch to integration, since the output gain is more cheaply accomplished this way: firms invite "friendly" takeovers. As prices rise further, nonintegration would actually generate higher output than integration, but only by imposing a large private cost on one of the managers, and both consumers and shareholders of individual firms would prefer divestiture. the managers, however, remain integrated, until prices become so high that the revenue advantages of nonintegration outweigh the bounded private costs. Thus there is a switch back to nonintegration at sufficiently high prices. In this range the competitive outcome is second-best efficient.

One feature of our model is that the derivation of equilibrium organizational choices and product prices reduces to a standard supply-and-demand analysis. In Section 3, we apply this framework to show how internal organization, as well as prices and quantities, respond to shocks such as changes in product demand, entry of additional suppliers, and increases in managers' free cash flow. We identify regimes where product prices *increase* and consumer welfare decreases following positive shocks, such as the entry of low-cost suppliers.

2 Model

There are two types of supplier, denoted A and B. Production of marketable output requires the coordinated input of exactly one A and one B provider, and we call their union a firm. Examples of A and B might include game consoles and game software, upstream and downstream enterprises, or manufacturing and customer support. For each provider, a decision is rendered indicating the way in which production is to be carried out. For instance software can be elegant or user friendly, or a product line and its associated marketing campaign can be mass- or niche-market oriented. Denote the decision in an A provider by $a \in [0, 1]$, and a B decision by $b \in [0, 1]$. Overseeing each provider is a manager, who bears a private cost of the decision

made in his unit. We assume that the A manager's preferences are increasing in a, while the B manager's preferences are decreasing in b: formally, $C_A(a) = \frac{1}{2}(1-a)^2$ for the manager A and $C_B(b) = \frac{1}{2}b^2$ for manager B.

It is important that decisions made in each part of the firm do not conflict, else there is loss of output. More precisely, the enterprise will succeed with a probability equal to $1-\frac{1}{2}(a-b)^2$, in which case it generates a unit of output; otherwise it fails, yielding 0. For instance, if A finds Macintosh aesthetically pleasing while B finds PCs practical, and each adopt large quantities of their preferred machines, the resulting incompatibilities will reduce expected output.

Decisions are not contractible, but *the right to make them* can be reassigned by contract. In addition, the output generated by the firm is contractible, which allows monetary incentives to be created. Managers bear the cost of decisions even if they don't make them because their primary function is to implement decisions and to convince their workforces to agree.

Managers can *integrate* by engaging the service of a headquarters (HQ). HQ can aid in coordinating decisions, but the cost of ceding control from the managerial point of view is a loss of " quiet life," that is to say, a higher private cost. From the consumer point of view, the benefit of integration is to improve coordination and therefore increase output and decrease prices; but since they don't choose organization, they may not enjoy these benefits.

The divergence between consumer and managerial interests is governed by the efficacy of HQ. Typically, employing an HQ comes at a cost in terms of foregone output that we model as reduction $\sigma \geq 0$ in the success probability. As discussed in the Introduction, HQ may reduce potential output through the direct costs of communication, additional management personnel, or losses from delegating decisions from A and B to staff who are not experts. In this case, HQ could take a share of the (reduced) revenue, leaving the residual for the managers to share.

Other costs could be linked to a moral hazard problem: since HQ has control over both suppliers resources, it also may have opportunities to divert those resources into other activities (including private benefits, other

divisions, or pet projects).[4]

To summarize, *expected output* is

$$Q(a,b) = \begin{cases} 1 - \frac{1}{2}(a-b)^2 & \text{if there is nonintegration} \\ [1 - \frac{1}{2}(a-b)^2](1-\sigma) & \text{if there is integration.}^5 \end{cases}$$

Managers are compensated via shares of the revenue. Denote by P their total compensation in case of success. The actual price in the product market is λP, where λ is the reciprocal of the managerial share. By a managerial firm, we simply mean one in which major decisions on behalf of the firm are made by individuals with low financial stakes in the enterprise. Thus we think of λ as being " large," on the order of 100 or so. The rest of the revenue accrues to " shareholders" who remain passive.

Before production, B managers match with A managers in order to benefit from the synergies; at the time of matching, they sign contracts indicating

- the share s of managerial revenue P accruing to manager A, with $1-s$ going to B (in case of failure each receives zero); and
- the ownership structure of the relationship.

There are only two relevant structures to consider here: nonintegration (N), where each manager takes the decision on his activity, and integration (I), where the headquarters HQ takes decisions on each activity. Once a contract is given, managers (or HQ) make their decisions, output is realized and shares are distributed.

The demand side of the product market is modelled as a decreasing demand function $D(\lambda P)$, and the market price λP is taken as given by all firms when they make decisions.

[4]For instance, suppose that after output is realized, there is a probability σ that HQ has a chance to divert whatever output there is to an alternative use valued at ν times its market value, where $\sigma < \nu < 1$. If output is diverted, it doesn't reach the market, and the verifiable information is the same as if the firm had failed. Managers could prevent diversion by offering a share ν to HQ, leaving $(1-\nu)$ of the revenue to be shared between the managers, but since $\nu > \sigma$, it is actually better for them to give HQ a zero share of market revenue and let him divert when he is able, so that successfully produced output reaches consumers only $(1-\sigma)$ of the time.

In the supplier market, there is a continuum of both types of suppliers. The A's are on the long side of the market: their measure is $n > 1$, while the B's have unit measure. All unmatched A managers receive a payoff of zero (the outside option of B-managers will play little role here and can be taken to be 0). Except in Section 3.3, we assume there is no cost of production apart from the managers' private costs.

2.1 Integration

With integration, HQ receives an expected surplus proportional to $(1-\frac{1}{2}(a-b)^2)P$ and therefore makes decisions for both activities in order to maximize profits of the integrated firm, that is chooses $a = b$. When $a = b$, total managerial private cost $C_A(a)+C_B(a)$ is lowest when $a = 1/2$ and we assume that HQ will choose these decisions (indeed this is exactly what A and B would want her to do: since it maximizes the joint payoff, which is perfectly transferable via the sharing rule s, it Pareto dominates any other choice). The cost to each manager is then $\frac{1}{8}$, and the payoffs to the A and B managers are

$$\pi_A^I(s,P) = (1-\sigma)sP - \frac{1}{8}$$
$$\pi_B^I(s,P) = (1-\sigma)(1-s)P - \frac{1}{8}.$$

Total managerial welfare under integration is $W^I(P) = (1-\sigma)P - \frac{1}{4}$ and is fully transferable. With nonintegration things are a little more involved and we turn to this case now.

2.2 Nonintegration

Since each manager keeps control of his activity, A chooses $a \in [0,1]$, B chooses $b \in [0,1]$ in Cournot-Nash fashion. Using the expression for output

under nonintegration yields payoffs

$$\pi_A^N = (1 - \frac{1}{2}(a-b)^2)sP - \frac{1}{2}(1-a)^2$$
$$\pi_B^N = (1 - \frac{1}{2}(a-b)^2)(1-s)P - \frac{1}{2}b^2.$$

The best responses in the (unique) Nash equilibrium are:

$$a^N = \frac{1 + (1-s)P}{1+P}$$
$$b^N = \frac{(1-s)P}{1+P}.$$

Note that $a^N > b^N$ and that the coordination loss is

$$a^N - b^N = \frac{1}{1+P}, \tag{1}$$

which is *independent* of s. This loss 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.

The Nash equilibrium output is

$$Q^N = 1 - \frac{1}{2(1+P)^2} \tag{2}$$

and the equilibrium payoffs are

$$\pi_A^N(s,P) = Q^N(P)sP - \frac{1}{2}s^2(\frac{P}{1+P})^2 \tag{3}$$
$$\pi_B^N(s,P) = Q^N(P)(1-s)P - \frac{1}{2}(1-s)^2(\frac{P}{1+P})^2.$$

Varying s, one obtains the Pareto frontier in the case of nonintegration. We have $\partial\pi^A/\partial s = Q^N(P)P - s(\frac{P}{1+P})^2$, $\partial\pi^B/\partial s = -Q^N(P)P + (1-s)(\frac{P}{1+P})^2$ and simple computations show that the Pareto frontier is decreasing and concave.

Total welfare is

$$W^N(s,P) = Q^N(P)P - \frac{1}{2}(s^2 + (1-s)^2)(\frac{P}{1+P})^2 \tag{4}$$

The maximum surplus is obtained at $s = 1/2$ and the minimum surplus is obtained at $s = 0$ (or $s = 1$). Note that when $s = 0$, $a = 1$: the A manager makes no concession, and only the B bears a positive private cost.

2.3 Choice of Organizational Form

The frontier under integration is a straight line, while the frontier under nonintegration is concave. The relative positions of these frontiers depend on the price. Figure 1 below represents a situation where neither integration nor nonintegration dominates globally, but one form may dominate for some levels of payoffs. If the frontiers are as in the figure, the organization that managers choose depend on where they locate along the frontiers, i.e., on the terms of trade on the supplier market.

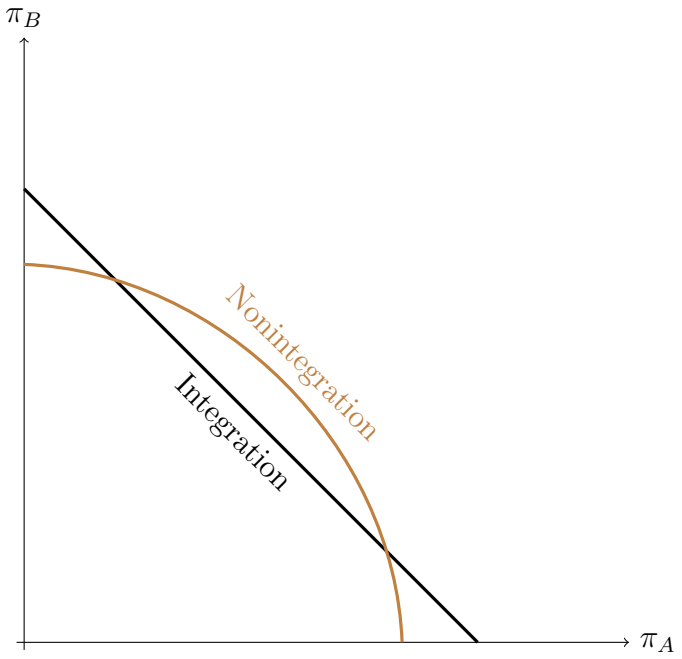

Figure 1: Frontiers

As the following proposition establishes, nonintegration may dominate integration when product price is low or high, but integration never dominates nonintegration. There is a range of prices where integration is preferred to nonintegration when B's share of surplus is large enough. Thus, organizational form is determined only in the full general equilibrium of the supplier and product markets.

Contrary to managers, consumers are indifferent between all values of s *if the organization is given*. Hence, conditions in the supplier market affect consumers only insofar as they affect the choice of organizations.

Proposition 1 *When σ is positive, managerial welfare with integration (i) is smaller than the minimum total welfare with non integration if and only if P does not belong to the interval $\left[\underline{P}(\sigma), \overline{P}(\sigma)\right]$, where $\underline{P}(\sigma)$ and $\overline{P}(\sigma)$ are the two solutions of the equation $\sigma = \frac{P-1}{4P(1+P)}$.*
(ii) is smaller than the maximum welfare with non integration.

Proof. (i) Managerial welfare under integration is smaller than the minimum managerial welfare under nonintegration when

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

$$\iff \sigma > \frac{P-1}{4P(1+P)} \tag{5}$$

$$\iff 4\sigma P^2 + (4\sigma - 1)P + 1 > 0, \tag{6}$$

which holds whenever P is outside the interval $\left[\underline{P}(\sigma), \overline{P}(\sigma)\right]$, where $\underline{P}(\sigma)$ and $\overline{P}(\sigma)$ are the two solutions of the equation $\sigma = \frac{P-1}{4P(1+P)}$.
(ii) Managerial welfare under integration is always smaller than the maximum nonintegration welfare. From (4), maximum welfare under nonintegration is obtained at $s = 1/2$, and welfare with integration is smaller than this maximum welfare when

$$(1-\sigma)P - \frac{1}{4} < (1 - \frac{1}{2(1+P)^2})P - \frac{1}{4}(\frac{P}{1+P})^2$$

which simplifies to

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

which is true for all nonnegative σ. ■

It is straigthforward to see that $\left[\underline{P}(\sigma), \overline{P}(\sigma)\right]$ is nonempty when

$$\sigma \leq \bar{\sigma} \equiv 3/4 - \sqrt{2}/2,$$

and that $\underline{P}(\sigma)$ is increasing and $\overline{P}(\sigma)$ is decreasing in σ. Note that $\underline{P}(0) = 1$, while $\overline{P}(0)$ is unbounded.

2.4 Industry Equilibrium and the "Organizationally Augmented" Supply Curve

Industry equilibrium comprises a general equilibrium of the supplier market and product market. In the supplier market, an equilibrium consists of " matches" of one upstream firm and one downstream firm, along with a surplus allocation among all the managers. Such an allocation must be stable in the sense that no (A,B) pair can form an enterprise that generates surpluses that exceed their equilibrium levels. In the product market, the large number of firms implies that the industry supply is almost surely equal to its expected value of output given the product price; equilibrium requires that the the price adjust so that the demand equal the supply.

Since the A agents are in excess supply and would earn zero if unmatched, their competitive payoff must be equal to zero. Then if frontiers are as in Figure 1, integration would be chosen since it maximizes B's payoff given that A gets zero. At other product prices, the maximum payoff to B may be generated through nonintegration. The maximum payoff to B under integration is equal to the total welfare $(1-\sigma)P - \frac{1}{4}$ and the maximum payoff to B under nonintegration obtains when $s = 0$ in (4), that is $(1 - \frac{1}{2(1+P)^2})P - \frac{1}{2}(\frac{P}{1+P})^2$.

From Proposition 1, there are three cases of interest, depending on the size of σ. When $\sigma = 0$, managers (strictly) prefer nonintegration if and only if $P < \underline{P}(0) = 1$. When $\sigma \in (0, \bar{\sigma})$, managers prefer nonintegration if and only if $P \notin \left[\underline{P}(\sigma), \overline{P}(\sigma)\right]$. And when $\sigma > \bar{\sigma}$, managers never integrate. Integration

will be chosen by managers in equilibrium only when $P \in \left[\underline{P}(\sigma), \overline{P}(\sigma)\right]$.

We note that output supplied to the product market under integration $(1-\sigma)$ is smaller than output under nonintegration $(1-\frac{1}{2(1+P)^2})$ if and only if

$$\sigma > \frac{1}{2(1+P)^2} \tag{7}$$

that is when

$$P > P^*(\sigma) = \sqrt{\frac{1}{2\sigma}} - 1. \tag{8}$$

It is straightforward to see that $P^*(\sigma) \in (\underline{P}(\sigma), \overline{P}(\sigma))$ whenever $\sigma < \overline{\sigma}$.

The reason nonintegration generates higher output as price increases is straightforward enough: the higher is P, the more revenue figures in managers' payoffs. This leads one to " concede" to the other's decision in order to reduce output losses.

The nonmonotonicity of managers' organizational preference in price when $\sigma \in (0, \bar{\sigma})$ is more subtle. At low prices, despite integration's better output performance, revenue is still small enough that the managers (in particular the manager of B) are more concerned with their private benefits, i.e., they like the quiet life. At high prices, nonintegration performs well enough in the output dimension that they do not want to incur the cost σ of HQ. Only for intermediate prices do managers prefer integration. In this range, the B manager knows that revenue is large enough that he will be induced to bear a large private cost to match the perfectly self indulgent A manager, who generates little income from the firm ($s = 0$) and therefore chooses $a = 1$. B prefers the relatively high output and moderate private cost that he incurs under integration.[6]

As discussed above, the demand side of the product market is represetned by the demand function $D(\lambda P)$. To derive industry supply, suppose that a fraction α of firms are integrated and a fraction $1-\alpha$ are nonintegrated. Total supply at price λP is then

[6]For this outcome, it is crucial that the supplier market be unbalanced, i.e. that A or B be accruing the preponderence of the surplus. For as we already noted, the total surplus under nonintegration when it is equally shared ($s = \frac{1}{2}$) always exceeds that generated by integration. Thus if surplus is (nearly) equally shared by A and B,(for instance, if there is a large enough fixed production cost), they never integrate.

$$S(\lambda P, \alpha) = \alpha(1-\sigma) + (1-\alpha)\left(1 - \frac{1}{2}\left(\frac{1}{1+P}\right)^2\right). \tag{9}$$

For $\sigma < \bar{\sigma}$, when $P < \underline{P}(\sigma)$, $\alpha = 0$ and total supply is just the output when all firms choose nonintegration. At $P = \underline{P}(\sigma)$, α can vary between 0 and 1 since managers are indifferent between the two forms of organization; however because $\underline{P}(\sigma) < P^*(\sigma)$, output is greater with integration and as α increases total supply increases. When $\alpha = 1$ output is $1 - \sigma$ and stays at this level for all $P \in (\underline{P}(\sigma), \overline{P}(\sigma))$. At $P = \overline{P}(\sigma)$, managers are again indifferent between the two ownership structures and α can decrease from 1 to 0 continuously; because $P^*(\sigma) < \overline{P}(\sigma)$, output is greater the smaller is α. Finally for $P > \overline{P}(\sigma)$ all firms remain nonintegrated and output increases with P.

When $\sigma \geq \bar{\sigma}$, managers always choose nonintegration and $\alpha = 0$ for all prices.

We therefore write $S(P, \alpha(P))$ to represent the supply correspondence, where $\alpha(P)$ is described in the previous paragraph. The supply curve for the case $\sigma \in (0, \bar{\sigma})$ is represented in Figure 2. The dotted curve corresponds to the industry supply when no firms are integrated.

An equilibrium in the product market is a price and a quantity that equate supply and demand: $D(\lambda P) \in S(P, \alpha(P))$. There are three distinct types of industry equilibria, depending on where along the supply curve the equilibrium price occurs: 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 product market supply embodies organization choices by managers. The model suggests that industries in which product prices are high or low will be predominately composed of nonintegrated firms, while those with intermediate prices will tend to be integrated. The model is also useful for illuminating sources of *changes* in organization.

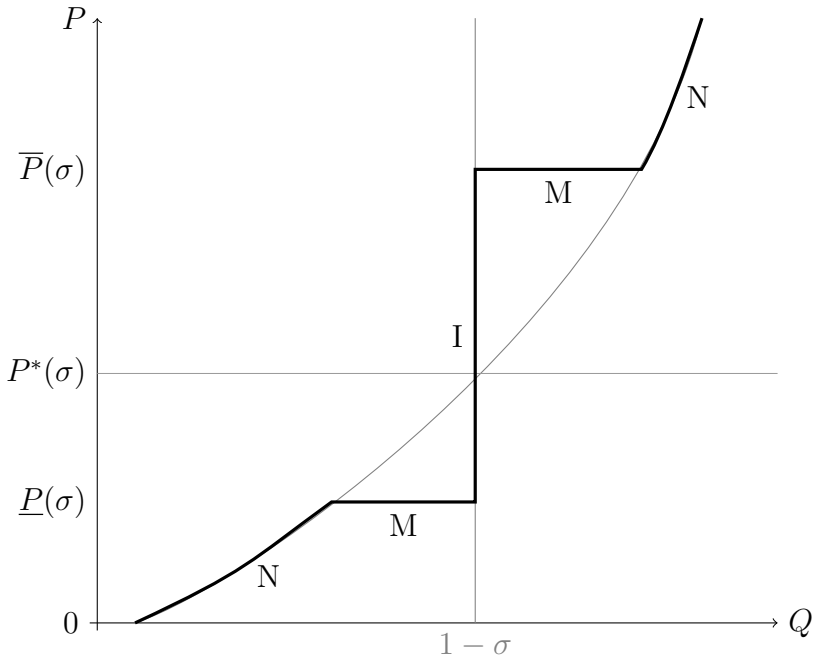

Figure 2: Organizationally Augmented Supply Curve

3 Comparative Statics

The fact that all firms face the same price means that anything that affects that price – a demand shift or foreign competition – can lead to widespread and simultaneous reorganization, e.g., a merger wave or mass divestiture. An additional channel of coordinated reorganization is the supplier market: changes in the relative scarcities of the two sides, or to outside opportunities on one side, will change the way surplus is divided between managers, and this too will lead to reorganization.[7] In some cases these changes in the supplier market terms of trade will have surprising effects on product market outcomes.

[7]See Legros and Newman (forthcoming) for a detailed analysis if this mechanism.

3.1 Balanced Supply Shock

Assume that both sides of the supplier market expand so as to keep the ratio of A's to B's the same, or alternatively assume that the measure of B firms increases while remaining less than that of A firms. This increase in the number of A and B firms could come for opening of international trade barriers, for instance. The sequence of events can be gleaned from Figure 3. If demand is high, 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. Hence, globalization can be a force for the generation of merger activity without further assumption about changes to technology or regulation. If demand is low however, the opposite is true and globablization can be a force for divestitures and arm-length type of contracting.

Notice that in both cases, the reorganizations are *inefficient*: though prices fall following entry, they do not fall as far as they might if somehow the managers were prevented from integrating when demand is high or forced to stay integrated when demand is low.

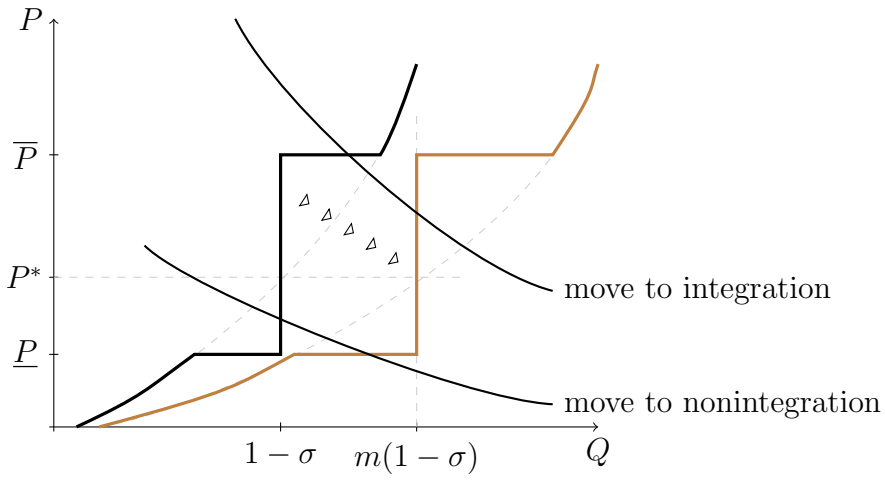

Figure 3: Positive Supply Shock

3.2 Demand Shocks

Consider demand shocks that are multiplicative, that is the demand schedule becomes $\beta D(\lambda P)$, where $\beta < 1$ represents shrinking demand, say due to entry of substitute products, while $\beta > 1$ corresponds to growing demand, say over the industry life cycle.

Figure 4 illustrates how shrinking demand may lead the industry from a nonintegrated equilibrium (point x) to an integrated one (point y). Moreover, when demand is high and firms are nonintegrated, negative demand shocks can lead to inefficient integration in the industry. Further decreases will eventually lead to a move away from integration (point z.)

The reverse process gives some indication of how organization should be expected to evolve over the industry life cycle. When demand is initially low and the product begins to mature, firms will begin to integrate (move from z to y) and the synergies will first benefit all stakeholders (managers, shareholders and consumers). As demand continues to grow, integration becomes detrimental to consumers, and later in the 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 x).

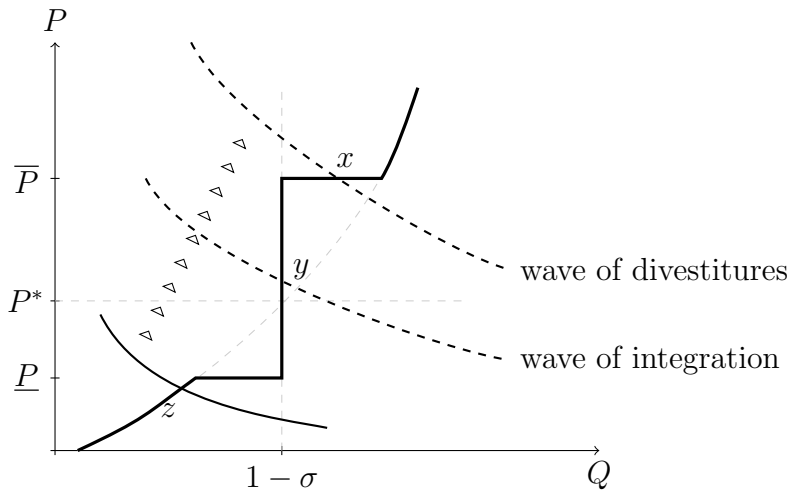

Figure 4: Demand Shocks

A number of authors have emphasized the empirical regularities surrounding " clustering" of takeovers and divestitures. For instance, Mitchell and Mulherin (1996) argue that for the US at least, merger waves are best explained empirically by the joint effects of macroeconomic and industry-level variables. In particular, Powell and Yawson (forthcoming), looking at data from the UK, emphasize growth in sales and foreign competition as important explainors of takeovers, while divestitiures are associated with negative demand shocks.

3.3 Hetereogeneity and Unbalanced Supply Shocks

Many market-induced reorganizations, such as outsourcing due to the opening of international factor markets, are thought to be motivated by the search for lower costs of production. Here we modify the basic model to take account of this possibility. Suppose that it costs the A a fixed amount ω to participate in joint production with B, who continues to have zero costs.

It turns out that the effect of entry by lower cost A's (e.g. assume at least a unit measure of A with low costs become available to match with the B's) depends crucially on whether the cost ω has to be paid lump sum or can be paid contingently on the firm's output.

Examples of the first kind would be a wage bill that must be paid upfront or " greenfield" investment in relation specific new factory. Examples of the second kind would be an outside option of the A or a " brownfield" investment.

3.3.1 Brownfield Investments

Think of contracting with an A manager with a plant that could fetch a profit of ω in some other use. The contracting problem is very similar to what we have done before with the caveat that A must now be assured of an expected payoff of ω.

As is apparent from figure 1, as the minimum payoff to A decreases, it becomes indeed possible (and optimal for the B) to choose integration. Formally, fix the price P and suppose that the maximum payoff to B when

A's cost is ω is obtained for a sharing rule s , and therefore that the indirect payoffs are

$$\pi_A^N(s,P) = \omega, \pi_B^N(s,P) = W^N(s,P) - \omega.$$

Consider now a lower value $\omega' < \omega$. We know that $W^N(s,P)$ and that $\pi_A^N(s,P)$ are decreasing in s for $s < 1/2$.. Hence, for $s' < s$ such that $\pi_A^N(s',P) = \omega'$, we have $W^N(s',P) < W^N(s,\omega)$. Supposing that B is indifferent between nonintegration and integration under ω, we have $W^N(s,P) = (1-\sigma)P - 1/4$, implying that

$$\begin{aligned} W^N(s',P) - \omega' &< W^N(s,P) - \omega' \\ &= W^I(P) - \omega' \end{aligned}$$

and B strictly prefers integration to nonintegration. Hence, whenever P is such that integration is preferred under ω, it will be also under ω'; because the preference is strict with ω' when there is indifference with ω, there are more prices for which integration is preferred under ω'.

Hence, *for brownfield investments, reduced costs are a force toward integration.* This is represented in the figure 5.

It is then immediate that if the industry demand is high, offshoring brownfield investments will lead to a *lower* quantity and *higher* price with ω' than with ω. When demand is low, though, entry of low-cost A's yields the the usual comparative static of lower prices and higher quantities.

Note that the payoff of A is adjusted by using the sharing rule only. Even if the two managers are liquidity constrained, it is possible for them to borrow ω, transfer ω to A in order to meet the cost of participation and then commit to repay a debt when output is high. It can be shown, however, that the payoffs obtained under such debt contracts are Pareto dominated by contracts without debt, and will therefore never be used for brownfield investments. (Legros and Newman 2006.)

For greenfield investments however, liquidity constrained managers are forced to borrow ω, since ω must be paid before production takes place. What is perhaps surprising is that conditional on debt in order to finance the cost ω, the comparative statics of a lowering of this cost are opposite to the

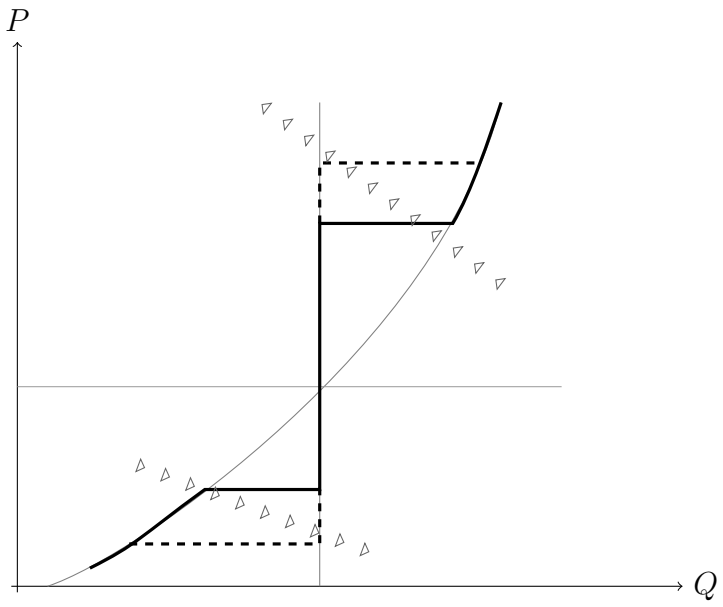

Figure 5: Entry of lower cost suppliers: Brownfield investments

case of brownfield investment: lower costs are a force toward nonintegration.

3.3.2 Greenfield Investments

If ω must be paid up front, and if the firm has not enough liquidity for this, the firm will need to borrow ω from the financial market in exchange for a state contingent debt repayment D in case of success and 0 in case of failure. The market for loan is competitive. Under integration, the level of price does not affect the probability of success and the probability of repayment is one; the surplus to the B manager is therefore $\pi_B^I(P,\omega) = (1-\sigma)P - 1/4 - \omega$, as in the brownfield case.

Under nonintegration, A gets an ex-ante payment of ω and the two managers commit to pay D if there is success. The payoffs to the two managers given a sharing rule s are then,

$$\pi_A^N(s,P,D) = s(P-D)(1-(a-b)^2) - \frac{1}{2}(1-a)^2 + \omega$$
$$\pi_B^N(s,P,D) = (1-s)(P-D)(1-(a-b)^2) - \frac{1}{2}b^2.$$

Note that the debt has the effect of lowering the price perceived by the managers. For this reason it may be tempting to view the effect of debt as that of a tax: for a given price P and a level of debt D the organizational choice should be the same under price $P - D$ and no debt. This reasoning would imply that both the lower bound $\underline{P}$ and the upper bound $\overline{P}$ increase.

However, this intuition is partial and incorrect. Indeed, the probability of success must be sufficiently large for the creditor to have an expected repayment equal to ω. The larger the value of ω, the larger the level of debt and therefore the more depressed incentives for the managers to concede. This implies that as ω decreases, incentives are improved and because integration is not affected, nonintegration will be more often preferred.

Formally, from (2), the equilibrium under nonintegration is $Q^{no} = 1 - 1/(2(1 + P - D)^2)$. Since the creditor makes zero profits when $QD = \omega$, the level of debt $D(\omega)$ when the cost is ω is obtained by solving the equation

$$\frac{\omega}{D} = 1 - \frac{1}{2(1 + P - D)^2}. \tag{10}$$

There can be multiple solutions but the lowest repayment is also the preferred equilibrium by the managers and is increasing in ω.

Since $u_A = \omega$, we can choose $s = 0$ and $\pi_A^N(0, P - D(\omega)) = 0$ and $\pi_B = W^N(0, P - D(\omega))$. If B is indifferent between integration and nonintegration, we have

$$W^N(0, P - D(\omega)) = W^I(P) - \omega \tag{11}$$

Observe that

$$W^N(0, P - D(\omega)) + \omega = PQ^N(P - D(\omega)) - C(P - D(\omega))$$

where $C(P) = \frac{1}{2}P^2/(1 + P)^2$. For $P' < P$, the function $PQ^N(P')) - C(P')$

is increasing in P'.[8] Hence, for $\omega' < \omega$, $P - D(\omega') > P - D(\omega)$, and

$$\begin{aligned} W^N(0, P - D(\omega')) + \omega' &> W^N(0, P - D(\omega)) + \omega \\ &= W^I(P) \end{aligned}$$

Thus B manager strictly prefers nonintegration to integration when the cost is ω'.[9]

With greenfield investments, *a lower cost faced by the A managers is a force towards nonintegration.* Alternatively the interval $[\underline{P}(\sigma), \overline{P}(\sigma)]$ over wich integration is preferred to nonintegration is decreasing in ω (that is the lower bound increases and the upper bound decreases). This leads to a shift of the industry supply as in Figure 6.

As is apparent, it is now in *low demand* regimes that offshoring of greenfield investments may decrease output and increase price, while decreased prices and increased quantities occur in high demand regimes.

3.4 Free Cash Flow

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 integration (that is one more unit of surplus given to B costs one unit of surplus to A), this is no longer true with nonintegration. This explains why the organizational choice will not necessarily coincide with that maximizes the total managerial welfare. This is no longer true if the managers have access to liquidity, or other free cash flow,[10] that can be

[8] Derivation with respect to P' yields the expression $(P-P')((1+P')^3)$ which is positive because $P' < P$.

[9] The same reasoning holds for any initial share $s \in (0, 1/2)$. Because $u_A(s, \omega', P) = \pi_A^N(s, P - D(\omega')) + \omega'$ and π_A^N is increasing in $P - D(\omega)$, we have $u_A(s, \omega', P) > \omega'$. The optimal value of s under ω' will therefore be $s' < s$, which will further increase the payoff to B under nonintegration while the payoff under integration is the same.

[10] Jensen (1986) showed how free cash flow can lead managers to choose projects with a low rate of return, in particular how they will value firm growth beyond the "optimal" size. Interestingly, here we point out a distorsion in the other direction, that managers are willing to use their cash to *avoid* growth, and how this is detrimental to shareholders when price is low. Legros and Newman (1996) and (forthcoming) discuss the role of liquidity in equilibrium models of organizations.

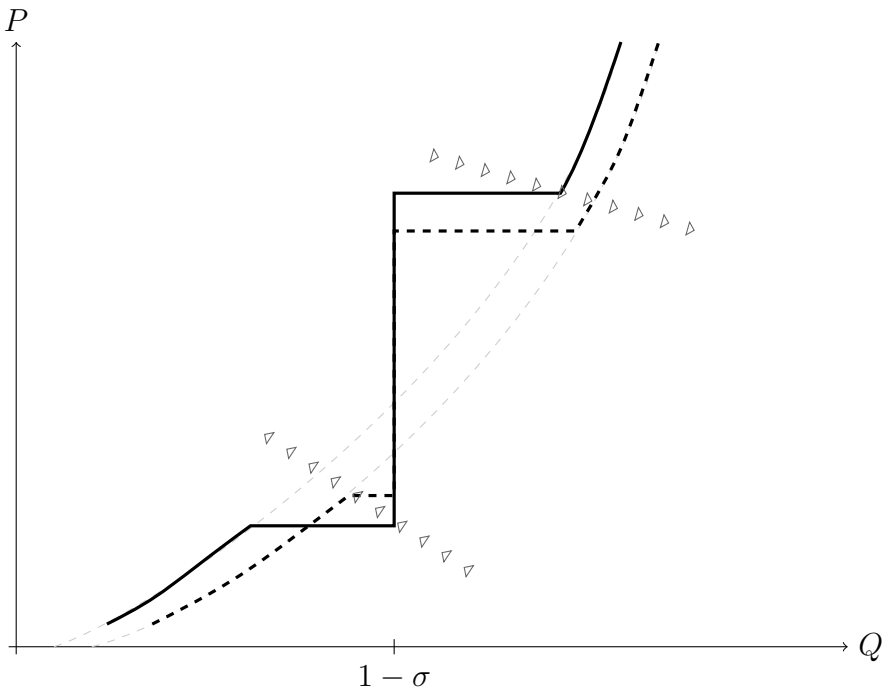

Figure 6: Entry of lower cost suppliers: Greenfield investments

transferred without loss to the B manager before production takes place.

Liquidity is a more efficient instrument for surplus allocation than the sharing rule s only when firms do not integrate. Indeed, under nonintegration, a change of s affects total costs. By contrast, when firms are integrated, a change in s has no effect on output or on costs and therefore surplus is perfectly transferable by using s. Hence, the introduction of liquidity favors nonintegration and we should observe in equilibrium a smaller number of firms that are integrated.

Consider a distribution of liquidity $F(l)$ among the A managers, where $\int dF(l) = n > 1$, and let l_F be the *marginal liquidity*, that is there is a measure n of A managers with liquidity greater than l_F

$$F(l_F) = n - 1.$$

There is no loss of generality in assuming that only A firms with liquidity

greater than l_F will be active on the matching market.

Since there is a measure $n-1$ of A units that will not be matched, A managers will try to offer the maximum payoff consistent with being matched with a B unit while getting a nonnegative payoff. Fix the product price at P. The maximum surplus that a B manager can obtain via integration is $(1-\sigma)P - 1/4$. The maximum he can obtain when the sharing rule is s is $W^N(s,P)$; however this can be achieved only if the A manager has liquidity at least equal to $\pi_A^N(s,P)$ that can be transfered ex ante to B.

We have three regimes. First, when $P \leq \underline{P}$, or when $P \geq \overline{P}$, integration is dominated by non integration (Lemma 1) 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 1, there exists a sharing rule s_0 for which

$$W^N(s_0(P), P) = W^I(P).$$

Then, assuming that the A managers have a zero outside option, manager B is indifferent between using integration with a share of $s = 0$ to A or using nonintegration with a share $s_0(P)$ to A and getting an ex ante transfer of

$$L(P) = \pi_A^N(s_0(P), P).$$

If $l < L(P)$, the maximum payoff to a B manager is less with nonintegration and an ex ante transfer of l than with integration. Hence, all A firms with $l \leq L(P)$ will still offer integration contracts in order to be matched; however, firms with $l > L$ will offer nonintegration contracts.

The measure of firms that integrate is the measure of A managers with liquidity greater than $L(P)$. Hence, there is a measure $F(L(P)) - F(l_F) = F(L(P)) - n + 1$ of firms that integrate and a measure of $n - F(L(P))$ of firms that do not integrate. With liquidity there is a smaller measure of firms that integrate, and because the output with integration is larger than with non integration when $P < P^*$ we conclude that the supply curve rotates at P^*, as illustrated in Figure 7 and the next proposition

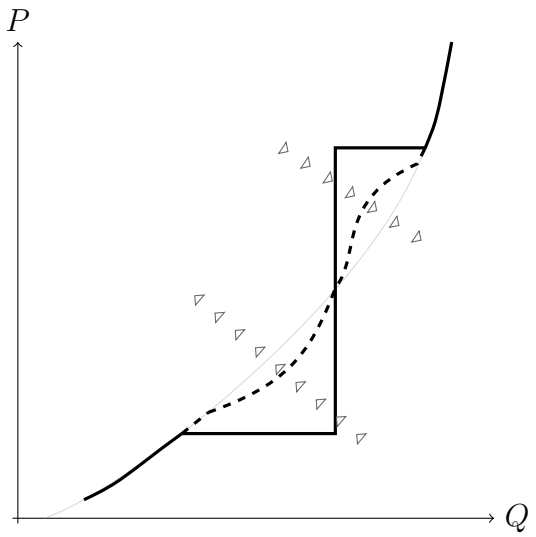

Figure 7: The effect of liquidity

Proposition 2 *With liquidity, the supply curve coincides with the no liquidity case when* $P \notin (\underline{P}, \overline{P})$. *When* $P \in (\underline{P}, P^*)$ *the supply curve is shifting in and when* $P \in (P^*, \overline{P})$ *the supply curve is shifting up.*

Going back to the characterization of the conflict between managers and the other stakeholders 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 seems new to the literature.

4 Welfare

Since managers give weight to their private costs in making decisions about which organization to adopt, either form of organization can be inefficient from an output point of view. In general the degree of ineffciency will depend on the market price.

4.1 Inefficient Nonintegration

As we saw, $B's$ surplus is maximum when $s = 0$. Since A has no stake in the revenue of the firm, he will always set $a = 1$, and therefore B bears the cost of coordination. When P is small, B does not concede much under nonintegration and incurs only a small private cost. From his point of view, integration has neither an advantage in terms of generating output (since at low price, this is not worth much), nor in guaranteeing B a small cost. Thus, when P is small, B will choose nonintegration even if integration would yield a larger output. As we saw, when $\sigma < \bar{\sigma}$, this happens as long as P is lower than $\underline{P}(\sigma)$, and when $\sigma > \bar{\sigma}$ when P is smaller than $P^*(\sigma)$. We represent this situation when $\sigma = 0$ and $\underline{P}(0) = 1$, that is inefficient nonintegration is chosen when the market price is less than λ.

In a second-best allocation, in which the noncontractibility of decisions is taken for granted but organizational choice might be imposed by a planner, if the organization was chosen in order to maximize output, it should be integration. Letting $\phi = D^{-1}$ be the inverse demand, the change in consumer surplus is

$$\Delta CS = Q^N \phi(Q^N) - \phi(1) + \int_{Q^N}^{1} \phi(Q) dQ.$$

The change in revenues going to the firm (shareholders and managers) is

$$\Delta R = \phi(1) - Q^N \phi(Q^N). \tag{12}$$

Hence, total welfare increases by

$$\Delta CS + \Delta R = \int_{Q^N}^{1} \phi(Q) dQ. \tag{13}$$

The increase in managerial private costs is $\frac{1}{4} - C_B$, where $C_B = \frac{1}{2}b^2$ with b solving $Q^N = 1 - \frac{1}{2}(1-b)^2$. For λ large, this cost difference is small relative to ΔR. Hence for λ large (13) is a good approximation of the welfare loss from insufficient integration.

Consumers would value a change in organization, in particular would value hostile takeovers that would put a HQ in place and integrate, contrary to the wishes of their managers. The model identifies an incentive for shareholders of *an individual firm* to favor integration. Indeed, an individual firm shareholders would take the price as given and would value the increase in output that results from integration. However, as (12) suggests, if *all* firms in the industry choose integration – e.g., after a wave of takeovers – the total revenue going to these firms may in fact decrease if $\phi(1) < Q^N\phi(Q^N)$. If somehow these hostile takeovers happen, we would have a simple explanation for the frequent observation that there can be overbidding in takeovers: overbidding is a natural consequence of competition and downward sloping demand.[11]

4.2 Inefficient Integration

When the price is high enough, since A chooses $a = 1$ under nonintegration, B's high revenue stake will induce him to follow along, leading him to bear a high private cost. He would just as soon cede control to HQ and enjoy the benefits of coordinated production and a moderate private cost. Eventually, for P sufficiently large, B prefers again nonintegration, since as long as $\sigma > 0$ nonintegration becomes asymptotically output efficient, and the extra revenue swamps the (bounded) private costs.

As we saw in Section 2.4, there is inefficient integration when $\sigma \in (0, \bar{\sigma})$ and $P \in (P^*(\sigma), \bar{P}(\sigma))$. Changes in welfare for consumers and shareholders can be computed as we did in the case of inefficient nonintegration. Here, consumers and shareholders would value a move to nonintegration, which could be achieved by forcing the firm to divest.

[11] Usual explanations for overbidding focus on the takeover of a single firm. For instance the literature has highlighted the incentives of a bidder with an existing stake in the firm to bid more than his valuation. See Burkart and Panunzi (2006) for a recent review.

Finally, the results in Section 3.3 indicate that the availability of low cost suppliers does not necessarily benefit consumers in the presence of the distortions entailed by organizational design. In the brownfield case, for instance, the shift in surplus division toward the short side of the supplier market is acccomplished by integrating more, and when prices are already high enough, this may lead to a reduction in the quantitiy supplied and an increase in price, hurting consumers. The effects on consumer welfare of offshoring to low-cost suppliers in the various cases is summarized in the matrix below.

type \ demand	high	low
Greenfield	+	−
Brownfield	−	+

5 Conclusion

In many models of organization, managers trade off pecuniary benefits derived from firm revenue against private costs of implementing managerial decisions. In our model, two key variables affect the terms of this trade-off: product prices, over which managers have no control, and the choice whether to integrate, over which they do. In particular, nonintegration performs well from the managerial point of view under both high and low prices, while integration is chosen at middling prices.

At the same time, organizational choices also affect production: nonintegration produces relatively little output compared to integration at low prices, as managers prefer a "quiet life"; at certain higher prices, integration can be less productive than nonintegration, despite being preferred by managers. Thus, organizational decisions rendered by managers acting in their own interests can lead to lower output levels and higher prices than would occur if they were forced to act in consumers' interests. This result is obtained even with a competitive product market, i.e., firms or managers do not take into account the effect of reorganization or vertical integration on product prices.

We believe that these effects can be identified in practice. For instance,

the model can identify conditions under which "waves" of integration are likely to occur – e.g., growing demand in an initially nonintegrated industry – or when opening borders to low cost suppliers might lead to increased product prices. More generally, as prices, quantities, and integration decisions are easily measured, we are hopeful that models such as the present one will encourage empirical investigations that will quantify the real-world significance of the effects of prices on organization and vice versa.

Our analysis raises the issue of what policy remedies might be indicated to improve consumer welfare. It is likely that these policies may be unconventional. For instance, in the case of inefficient integration (where output would be higher under nonintegration), standard merger policy implemented by an antitrust authority that blocks a potentially harmful merger may be effective in increasing output and lowering market prices. But the policy is surely unconventional, in the sense that it does nothing to enhance competition, which by assumption is perfect both before and after a proposed merger – thus it is unlikely that the antitrust authority would be called upon to act. In the range of prices in which managers inefficiently opt not to integrate, conventional merger policy is rather ineffective – there is no merger to prevent.

Instead, the model suggests a novel benefit of corporate governance regulation: in competitive markets, strengthening shareholders' ability to force appropriate integration decisions may improve consumer welfare as well as shareholder interests. In our competitive world, shareholder and consumer interests are (nearly) aligned.[12] Shareholders take the product price as given and favor organizations that increase revenue, hence output, leading to lower industry prices. Similarly, consumers favor industry equilibria with low product prices, hence organizational choices that increase output.

Notice in particular that governance matters at *low* prices (and profitability levels) in this model, when there is inefficiently little integration, as well as at medium-high ones. This is in contrast to much literature on corpo-

[12]There is a small caveat: if they can imperfectly control organizational choice through control of managerial shares, their interests will typically diverge somewhat from those of consumers, particulalry at higher product prices, where they will tend to favor integration more than consumers would. Details to be added in a future draft.

rate governance, which emphasizes high profit regimes as most conducive to managerial cheating. Presumably, this is because high profit regimes are most conducive to "profit taking", diversion of revenues to private managerial benefits or investments in pet projects. Our analysis underscores that governance also matters for "profit making": proper organizational design affects managers' production decisions, and is particularly important when low profitability provides weak incentives for them to invest in an profit or output maximizing way.

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.[13]

Moreover, the impact 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.[14] These points warrant further investigation.

[13]Obviously, commitments to limit competition could take other forms, e.g. product bundling, or capacity investments. Nevertheless, there are appealing reasons for policymaker to take an interest in mergers as commitment devices: first, mergers are easy to identify and, second, they are easy to prevent, which is not the case with other forms of (explicit or implicit) commitments.

[14]Indeed, one can show that in the monopoly case, the welfare loss due to inefficient organization – a "Leibenstein trapezoid," as described in Section 4 – can dwarf the usual "Harberger triangle" welfare loss (Legros and Newman 2006). In this case, strengthening shareholder control may be counterproductive.

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