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COMPETITION WITH LOCK-IN

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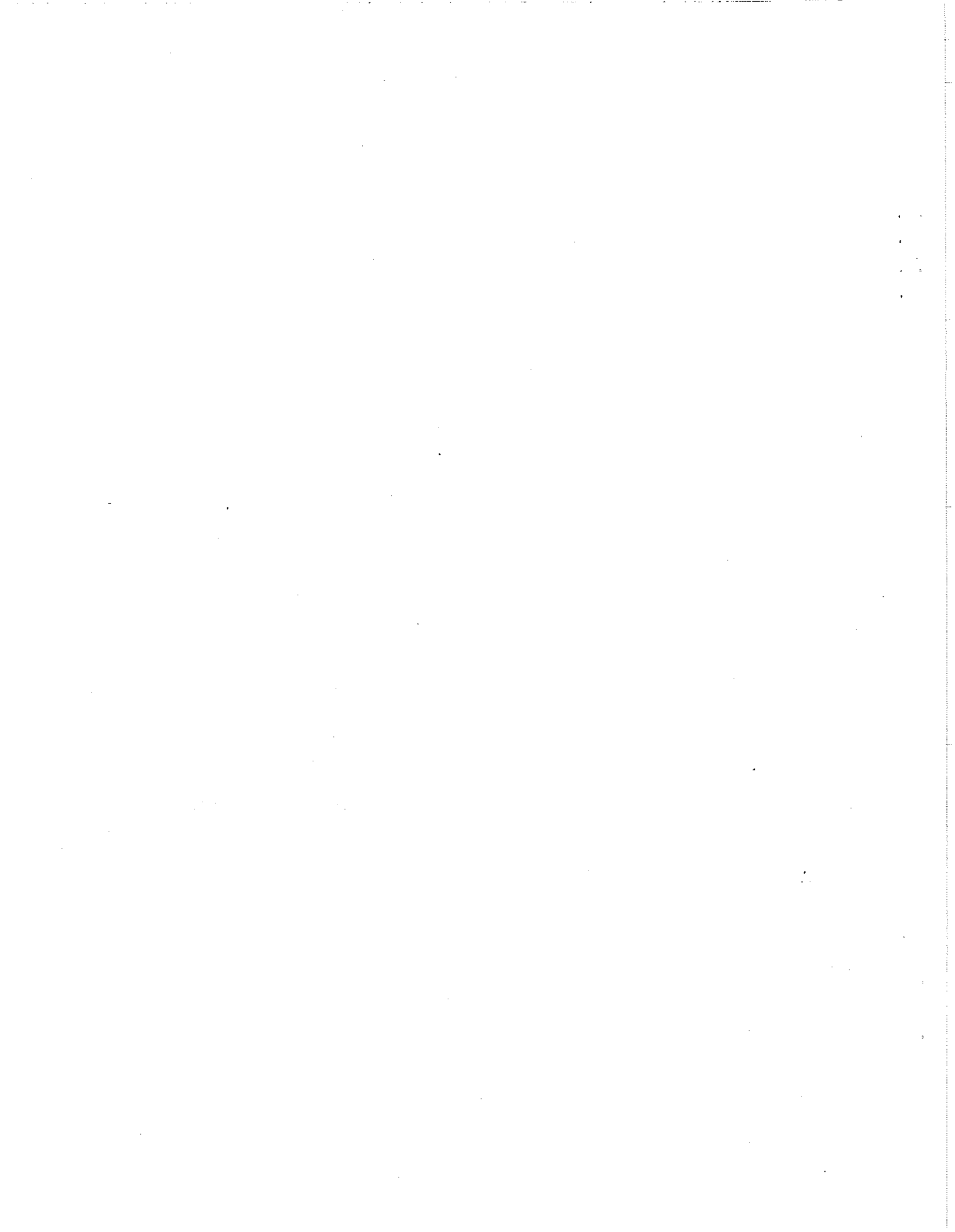
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Key words: Lock-in, loyalty, switching costs, regulation, contracts, procurement.

Abstract

We discuss the growing literature on, and some unresolved problems in, the economics of competition when buyers become locked-in to their suppliers.

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COMPETITION WITH LOCK-IN

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1. INTRODUCTION

Once a buyer begins to buy from a particular seller, he may become locked in: competing goods that were good substitutes before are now less good substitutes. There is less competition ex-post than there was ex-ante.

Examples of this are common. A customer who chooses a particular long-distance carrier in an equal-access exchange may face explicit charges as well as nonpecuniary costs in changing to another carrier. A large user who has hard-wired bypass of a local loop to a long-distance carrier will face costs of changing to another supplier. A firm that locates a manufacturing plant near a major supplier gives that supplier some power to raise price without inducing substitution, even though it had no advantage ex ante. A person who chooses a doctor will normally be somewhat reluctant to change, even if there is no evidence that the doctor is better than another. A buyer of cars, cameras or computers may be obliged to buy upgrades, spare parts or accessories from the maker of the original equipment. This phenomenon of "lock-in," "switching costs," or "inertia" has attracted some attention recently in the economics literature: see for instance Farrell (1986), Farrell and Gallini (1986), Farrell and Shapiro (1986), Green and Scotchmer (1986), Klemperer (1986), Scotchmer (1986), Summers (1985), Sutton (1980), and

von Weizsacker (1984). Generally, these treatments have focused on the effects of lock-in on firms' pricing policies. Klemperer and Summers emphasise artificially created switching costs (for instance, airlines' "frequent flyer" discounts). Porter (1985) makes "switching costs" an important part of his analysis of competitive advantage. For a discussion of customers' "conversion costs" in the computer industry, see Fisher, McGowan and Greenwood (1983).

These examples involve the formation of relationship-specific capital, using the term "capital" in its most general meaning of an asset that lasts in time. By saying that an asset is relationship-specific, we mean that its best use outside the relationship is strictly less valuable than its use within. Besides these examples of rational lock-in effects, we also observe brand loyalty, especially in consumer purchases, even when there is no apparent specific capital -- in other words, when there is no "objective" reason for inertia. From the seller's point of view it may matter little what is the source of the inertia.

Lock-in is important not only in markets with posted prices and many buyers, but also, for instance, in the procurement problem faced by the Defense Department, a city contracting for a cable-TV franchise, or any buyer of custom-designed goods. Once the initial contract is awarded to one supplier, that supplier may have considerable ex-post monopoly power, even though before the contract was awarded there were many equally qualified sellers clamoring to be selected.

Lock-in is important also for regulation. Once a provider of some service has become entrenched, competitive pressure may no longer do an adequate job of disciplining price, service quality, and so on -- even if ex ante there were many bidders for the "franchise". This is one of the problems with the "competitive franchising" alternative to administrative regulation suggested by Demsetz (1968). Demsetz proposed that sellers "bid" on "the price" at which they will serve demand. In a simple model, this effectively makes sellers reveal the true level of average costs, and promise to service demand at that price -- a result that would probably outperform practical administrative regulation. But since prices will have to change over time in response to cost changes, such a bid would have to be a complicated function of observable aspects of costs and demand data, if there is to be any chance of achieving efficiency. Such complex long-term contracts are notoriously hard to write and to enforce, and it might be that contract enforcement would come to much the same thing as administrative regulation. On the other hand, lock-in means that it would be hard to have re-franchising too often. Cable TV regulation (by cities) has encountered precisely these problems.

Three important problems arise in a market with lock-in that do not arise without. First and most obviously, the ex-post monopoly power may be exploited by the seller. In other words, a seller who has acquired some "locked-in" customers may raise prices (see Klemperer 1986, Farrell and Gallini, 1986), lower service quality (see Shepard 1986), cut back on research or other expenditures that make the product attractive, or the like. Second, even if the price-gouging problem were solved, there

is another supply problem: if sellers may go bankrupt (or leave the market for other reasons), buyers will have to try to predict the likelihood of that, and choose their supplier with that fear in mind, in a way that does not apply in a standard market in which there are no costs to leaving a sinking ship. Third, if different sellers may be more or less successful in tracking technological progress, then buyers will be concerned to predict whose products or services will be best in the future, not only whose are best now. In particular, if there are network externalities in consumption, then there is an advantage to buying from the seller who will have greatest market share in the future, even if his share now is low (see Katz and Shapiro (1986a), Farrell and Saloner (1986)).

In this paper, we discuss some economic problems generated by lock-in. In Section 2, we summarise existing work on price effects. In Section 3, we discuss the problems of bankruptcy and technological progress with lock-in, with particular reference to the microprocessor industry. Section 4 describes some active strategies with which buyers can sometimes mitigate the problems of lock-in. Section 5 concludes.

2. PRICE COMPETITION

Lock-in has two competing effects on price. On the one hand, buyers who are locked in can be exploited by their supplier, if no contract prevents this. (We discuss contracts below.) This exploitation can potentially far exceed the simple degree of lock-in (switching costs),

for each seller can exploit his locked-in buyers by charging a price a little higher than do his competitors -- who are themselves doing likewise. As Klemperer (1986) has emphasised, this can lead to monopoly pricing, in much the same manner as in Diamond's (1971) search model. (Summers (1985) and Green and Scotchmer (1986) have related results.)

Clearly, locked-in customers are profitable. But this fact itself creates competition -- competition to capture buyers! When market share is valuable, as when buyers are locked in, a seller's marginal-revenue curve is shifted upwards, so that competition becomes fiercer. Thus, if new buyers can be effectively separated (charged different prices) from old, as in Klemperer's two-period models, we find ex-ante competition followed by ex-post monopoly. This competition may lower profits so much that firms prefer to reduce switching costs by making their products compatible -- see for instance Klemperer (1986) or Katz and Shapiro (1986b).

When new and old buyers must be charged the same price, however, then there is no clearcut "ex-ante" and "ex-post". Each seller must compromise between his desire to exploit his locked-in buyers and his wish to attract new buyers. The importance of going after new buyers depends on how profitable they will be -- how much they will be exploited -- in the future. At the same time, the extent to which he wishes to exploit the old buyers depends on the relative importance of attracting new buyers. This problem, therefore, cannot be properly tackled in a two-period model, but demands a many-period treatment. Unfortunately, such a treatment has (so far) proven mathematically

intractable. Von Weizsacker (1984) and Green and Scotchmer (1986) simplified the problem by using solution concepts that ignore some part of the strategic intertemporal interaction between sellers; they effectively assumed away competitors' price reactions to a seller's change in price. Farrell and Shapiro (1986) solved for perfect equilibrium (thus taking account of such reactions), but were able to do so only by drastically simplifying the structure of demand.

One conclusion of these models, emphasised especially by Farrell (1986) and Farrell and Shapiro (1986), is that firms with many locked-in buyers will be relatively less willing to cut prices so as to attract new buyers: their marginal-revenue curves are always lower than those of less well-endowed rivals, because any price cut must be given to locked-in buyers as well as to new buyers. This is a "fat-cat" result, in the sense of Fudenberg and Tirole (1984): the large firm is too "fat" to compete effectively for the new buyers. An interesting consequence of this is that buyers may not always wish to patronise the cheapest firm, even if all products are identical and if they are not yet locked-in. The reason is that, if all new buyers go to the cheapest firm, it may well become a large firm as a result, and will therefore be interested more in exploiting its locked-in buyers than in competing for new; thus its price is likely to be high. Therefore, buying from the cheap and much-patronised firm now may lock a buyer in to what will become an expensive firm soon. It may be wiser to "flee the crowd" and buy from a smaller, if slightly more expensive, seller. Whether we see such behavior in practice, however, is questionable.

3. OTHER PROBLEMS

Price gouging is by no means the only problem for buyers in a market with lock-in. Interruption of supply, or technological backwardness on the part of a supplier, may be equally or more damaging, and may be much harder to control contractually. What can we say about these problems?

In the microelectronics industry,¹ products such as personal computers are designed around a microchip that incorporates an "architecture" that is often proprietary to the microchip supplier. To change to a new architecture involves extensive redesign of the entire product, and this is a very substantial switching cost indeed. Because both buyer and seller of the chip are firms, and because this switching cost is large, it might seem appropriate to solve the problem of lock-in by vertical integration or by detailed contracting. Surprisingly, vertical integration is not widespread in the United States microelectronics industry. There is much more vertical integration in the Japanese industry. See Ferguson (1985) for an extended discussion of this, its historical causes, and its possible implications. Shepard (1986) also reports that, while long-term price contracts are common in this industry, they seldom specify such other important features of performance as delivery times.

¹ I am indebted to Charles Ferguson for conversations on the microelectronics industry. Any misunderstandings are mine.

These architectures are not the same as the chips. Rather, as technical progress winds its rapid way along, the chips are updated (typically every two or three years) by each chip manufacturer within its own architecture. For instance, at the time of writing, Intel has recently introduced the 80386 chip, which is compatible with but an advance on its 80286 and 8086 chips. Therefore, in choosing a chip manufacturer, one is choosing to trust a firm to keep up with (or preferably lead) technical change.² Moreover, if a chip maker goes bankrupt³ then it is by no means guaranteed that someone else will take over and develop that architecture. So the choice of an architecture also involves trusting a firm to stay in business.

² Zilog's Z8000 chip, for instance, was initially very attractive, but Zilog failed to update the chip for many years, with the result that it is now nearly obsolete (Ferguson, 1985, p. 47).

³ For instance, MOS Technologies, the supplier of the 8-bit 6502 chip used in the Apple IIe, went bankrupt. Although there is now a successor corporation (Western Design Center) that has recently announced a successor chip within the MOS architecture, there has been much more of a lag (ten years) in updating the MOS chip than would have been likely had MOS not gone bankrupt. (Ferguson, 1985, p. 47.) It is difficult to take over the architecture of a bankrupt concern (even if it is very valuable) because much of the essential knowledge is in people's heads. Thus it is not simply an asset that will be transferred on bankruptcy.

These problems may be more important than even quite large price differences. For instance, if performance in the industry as a whole is improving at 20% per year, and if an unwise choice of architecture means that the improvement in the product one is locked into is only half that, then performance will be about 30% behind the industry after only four years. This could well prove a fatal problem for the product. Moreover, if the architecture is not developing quickly enough, then it will be attracting few if any new buyers, and this could lead either to bankruptcy of the supplier or to incentives to raise prices: given that the seller is attracting few if any new buyers in any case, he may be tempted to raise price and exploit his locked-in buyers.

How does a buyer choose a seller that he can trust to keep up with the industry's progress? Reputation may come in here, giving an advantage to those firms that have been long established (though not of course to those that have performed poorly in the past). Size (in the market) is another major advantage, for three reasons. First, size will support generous research and development budgets. Second, size makes bankruptcy relatively unlikely. Third, in the event of bankruptcy, it is likely that size will make others pick up the architecture. Moreover, there may be standardization advantages to "going with the crowd".

These advantages of size have a "positive-feedback" effect on competition for market share. At any stage, the largest seller has an advantage due to size. This effect is analytically akin to the presence of economies of scale, learning by doing, or network externalities.

Especially if the effects are dynamic (if scale in one period gives an advantage in subsequent periods, as well as contemporaneously), entry may be made relatively difficult, and early leaders may achieve a lasting benefit. Of course, if the industry is competitive from the beginning, that merely shifts the locus of competition to the early stages, in much the same way as lock-in itself does so with competition for market share.

To the extent that buyers look for signs of continuity of supply, there are advantages to being perceived as relatively unlikely to suffer strikes, go bankrupt, or become capacity-constrained. Again, all these things are important contemporaneously in any market; but when lock-in is important, buyers' predictions of future values become essential also.

4. STRATEGIES FOR STRATEGICALLY ACTIVE BUYERS

In the models discussed above, buyers have no strategic power. That is, each new buyer selects the seller that offers him the best available deal, but buyers cannot affect the set of options offered. This is often a reasonable assumption, for instance in most consumer markets, but there are many important markets in which it is not the case. Examples include government procurement, regulation, and the microelectronics market discussed above. More generally, it includes cases of bilateral monopoly power, such as the case where a major user of fuel is considering a choice of supplier. See Joskow (1985). But

market power is not necessary on either side for there to be active negotiation of contract terms. Rather, what is required is presumably some combination of absolute size of transaction and relative importance for both parties; and although size tends loosely to go with market power, there is no necessary connection. In this section, we ask what strategies a buyer might usefully follow in order to mitigate the problems discussed above.

We focus on three main strategies: long-term contracts, vertical integration, and second-sourcing.

4.1 Long-Term Contracts

Perhaps the most obvious protection against the kind of opportunism that lock-in may produce is to sign long-term contracts. When buyers are strategically active, such contracts are sometimes used. For instance, Joskow (1985) describes long-term contracts between power producers and their suppliers of coal. Such contracts are obviously useful weapons against price gouging. However, when there is uncertainty about future costs, demand, value for the product, etcetera, and when important features of behavior (intensity of research and development effort, good-faith efforts to reduce delivery lags, etc.) are difficult to observe or to contract on, long term contracts are far from a full solution. Shepard (1986) reports, for instance, that although prices are often determined by such contracts in the microelectronics industry, delivery times seldom are.

An ideal long-term contract is equivalent to an ideal scheme of regulation. In either case, the goal is to formulate rules under which efficient decisions result from a process in which the interests of the better-informed party do not coincide with those of the other party. In the economics literature, this is studied under the heading of the "principal-agent problem". The basic lesson is clear enough: the informational asymmetry causes problems. The problems of regulation are not simply a matter of government intervention in the market: rather, the private market also suffers from them in a closely related form. For example, an ex-ante efficient long-term contract will normally offer some protection to the seller against cost increases -- it will not specify prices independently of costs. To that extent, the incentives to keep costs down are diluted. Likewise, if the seller is also selling to other buyers, and there are joint costs, then the problem of how to allocate the joint costs between the contractual output and other output is the same problem in essence as the regulatory problem of how to allocate joint costs between regulated and unregulated activities.

4.2 Vertical Integration

If a contract does not work, one alternative is vertical integration: put a top executive in charge of both buyer and seller, charge her to maximize joint profits, and the problems go away. So at least it would seem in theory. What then prevents firms from integrating almost universally? -- after all, any intelligent industrial organization economist can think of several kinds of problem that might arise between two firms in any particular industry. Clearly, our "theory" of vertical

integration has its problems: there are costs to integration. Some can be seen in the context of lock-in.

For instance, if there are economies of scale in the upstream industry, or benefits from making a product a de facto industry standard, and if downstream firms are unwilling to buy from a vertical partner of a downstream rival, then vertical integration may involve the sacrifice of these economies of scale.

A more systematic flaw in vertical integration is that the "upstream" division may come to depend on its internal customer for viability, creating political pressure on the downstream user to buy internally. While the problems of price gouging presumably can be prevented by our senior executive, other problems such as "laziness" are harder to police.

4.3 Second Sourcing

One way to achieve ex-post competition is to insist on product standardization or compatibility among suppliers, so that switching costs become very much smaller (perhaps negligible). Then the seller individually has no power to behave opportunistically. This strategy has been followed by the Department of Defense, and is often used in industry also. For example, Intel has made second-sourcing arrangements with various competitors, and Xerox has openly licenced its Ethernet local-area-network technology. In AM stereo, Motorola has also followed a low-price licensing strategy. Evidently the strategy is attractive to

buyers; it is perhaps less obvious that it may be attractive to sellers also, but the seller must attract new buyers at some stage, and must either convince them that he will not exploit them once locked in, or else accept a lower level of demand than he could have had. Farrell and Gallini (1986) analyze the incentives for a monopoly innovator of a product with lock-in voluntarily to allow entry (or to licence its product free of royalties) after an initial period, and show that, if the lock-in is severe enough, it often pays to do so, in order to attract new buyers. On this strategy, see also Shepard (1986).

What are the social costs of second-sourcing? We identify two here: one related to costs, and the other to the process of standardization that is often accelerated by second-sourcing agreements.

In the absence of sunk costs of production, compulsory licensing of product design is sufficient to produce ex-post competition. But when there are sunk costs, for instance if there is a learning curve, then it is necessary in general to do more: the knowledge in principle of how to produce a product may not be enough to make one an active competitor. Thus, free entry and public knowledge of the technology may not suffice to deregulate local telephone service without generating monopoly problems. Maintaining an active competitor may be costly, since it involves splitting the orders so as not to let one seller go too much further down the learning curve than the other.

From a policy point of view, there are pitfalls in imposing or accelerating standardization. It is often difficult to change a

standard once it is in place (see David, 1985; Farrell and Saloner, 1985, 1986), and the buyer concerned with mitigating lock-in problems may be more interested in the short-run competitive effects than in the implications for long-term social benefits from the standard that gets adopted. This raises the possibility that second-sourcing, in encouraging early standardization, may sometimes be harmful.

5. CONCLUSION

We have identified an important problem in the theory of competition that has until recently received little attention from economists. Whether rationally or not, buyers are often "loyal" to suppliers. As a result, no static formulation of the degree of competition is adequate: there may be intense competition to "capture" new buyers, while at the same time monopolistic practices may prevail in the price and other treatment of "old" customers.

When buyers have strategic power, they can mitigate the effects of switching costs. We have briefly discussed three potentially useful strategies: long-term contracts, vertical integration, and second-sourcing requirements. In general, none of these strategies is ideal, however, so we can expect to see (as we do see) problems of lock-in persisting despite buyers' strategic actions. Furthermore, buyers' attempts to predict features of sellers' behavior and performance in the future may lead to biases towards (for example) large sellers, which may affect the efficiency of competition. If buyers

attempt to influence the course of events through long-term contracts or through second-sourcing requirements, these actions may themselves have efficiency effects comparable to those of regulation.

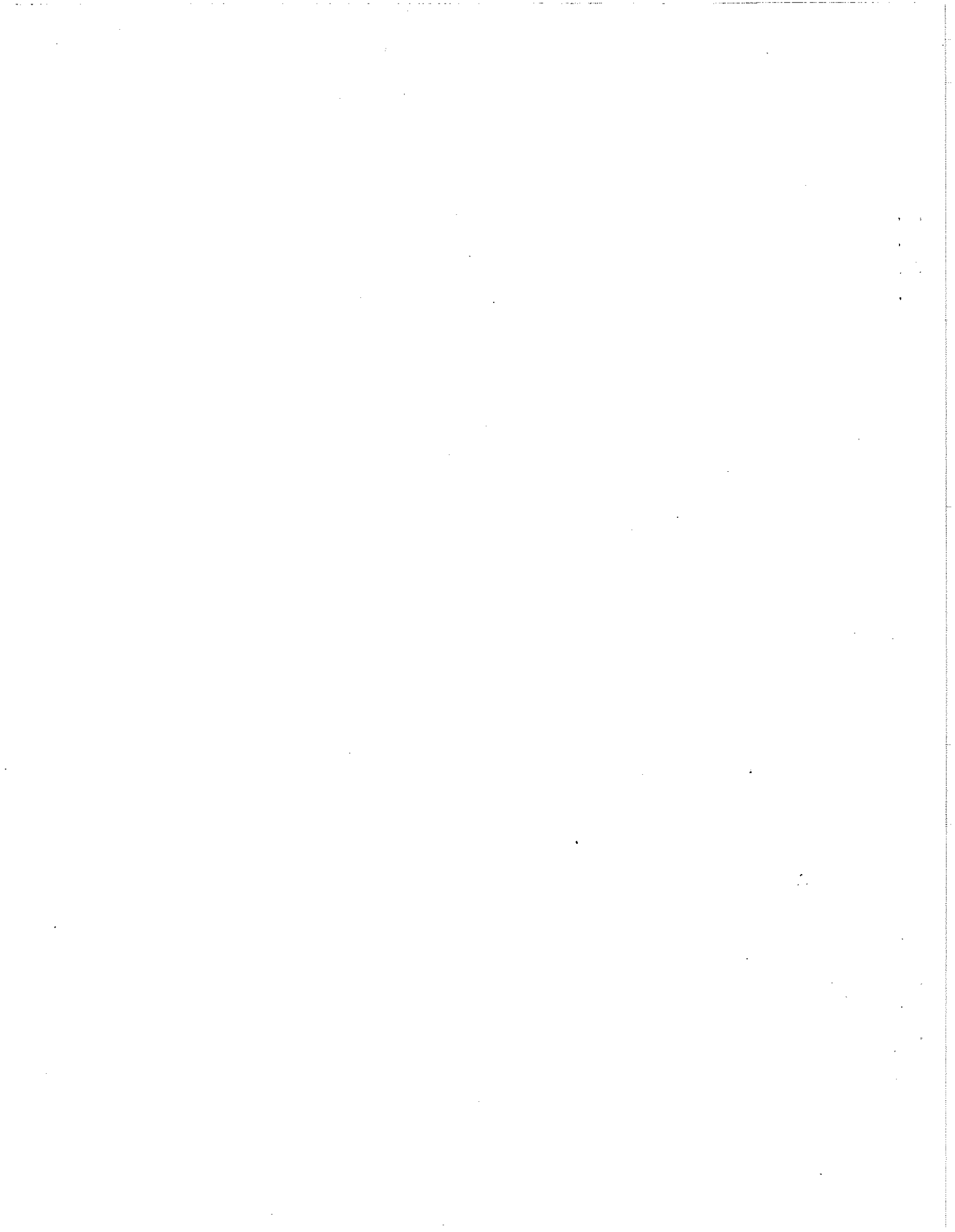
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