Costs and Benefits of Vertical Divestiture (*)

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Abstract: This article discusses the tools economic theory provides for examining the implications of vertical separation in network industries. It argues that advocating vertical separation in all cases is too simplistic an answer. However, the economic profession has provided little guidance that would enable regulators to weigh the cost and benefits of different ownership and management structures in more sophisticated ways.
Key words: Vertical separation, vertical integration, economics of regulation, pipelines.

Ten years ago, in their now classical book *A Theory of Incentives in Procurement and Regulation*, Jean-Jacques LAFFONT & Jean TIROLE wrote:

> "An important question in regulatory theory is to identify the costs and benefits of breakups in a regulatory situation. Among these costs are those emphasized in the literature on incomplete contracts and ownership structure in unregulated industries: reduction of coordination, possible expropriation of specific investment […].
>
> Divestiture […] would reduce the incentives of the producer of the intermediate goods to favor one final good producer over the others. We feel that the integration of the literatures on market foreclosure and on regulation will help reframe the policy debate."

This integration has not been achieved. In this article, we would like to explain why this debate is important, discuss some of the tools that economics provides to shed light on this issue, and discuss some preliminary work which we are conducting on the topic.

We illustrate the problems faced in the railroad industry, where good data is available. It is easy to find other industries, where the regulator, or the antitrust authority, must grapple with these issues. For instance, in the telecommunications sector, the separation between the provision of local

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telephone access and long distance access has been discussed continuously since the beginning of the deregulation movement, and we consider very briefly these issues towards the end of the paper.

■ Railroads

The European Commission has been a fervent proponent of vertical separation for a long time. In many "network industries", the Commission has asked national governments to separate the management of the infrastructure from the provision of services which use this infrastructure. To introduce the issues involved, it may be useful to examine an industry which the readers of *COMMUNICATIONS & STRATEGIES* may contemplate with a somewhat unconcerned outlook: railroads (but we promise to speak about the Communications industries later). [1] We have chosen to use the railroads industry as one of our examples because the issues are very similar to those found in the telecommunications industries, and because there is better hard evidence on the cost of vertical separation.

The Council Directive 91/440/EEC of 29 July 1991 states:

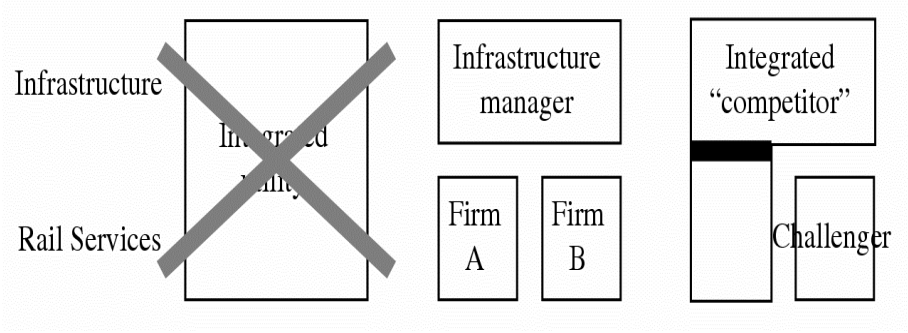
> "Whereas the future development and efficient operation of the railway system may be made easier if a distinction is made between the provision of transport services and the operation of infrastructure; whereas given this situation, it is necessary for these two activities to be separately managed and have separate accounts;
>
> The aim of this Directive is to facilitate the adoption of the Community railways to the needs of the single market and to increase their efficiency; [...]
>
> [...] by separating the management of railway operation and infrastructure from the provision of railway transport services, separation of accounts being compulsory and organizational or institutional separation being optional;
>
> […]
>
> 1. Member States shall take the measures necessary to ensure that the accounts for business relating to the provision of transport services and those for business relating to the management of railway infrastructure are kept separate. ...

[1] The material that follows is based on the research of our colleagues at the IDEI, especially Guido Friebel and Marc Ivaldi. All misinterpretations are our responsibility.

> 2. Member States may also provide that this separation shall require the organization of distinct divisions within a single undertaking or that the infrastructure shall be managed by a separate entity."

This Directive is worth quoting at some length, as it provides a description of the choices available to the national regulators, which are illustrated in Figure 1.

Figure 1



The Member States are not allowed to keep the former model of an integrated, and regulated, utility with no competition either upstream or downstream. The Commission would prefer total separation of the infrastructure's management from service providers, firms A and B in the figure. However, they are allowed to keep an integrated competitor, as long as a) it faces significant downstream competition and b) that there is a strong separation between its downstream unit and the manager of the infrastructure – this is represented by the heavy black line in the third panel in the picture. (Of course, very similar language can be found in the different documents which form the basis of the European framework for the Telecommunications Industry.)

The Commission pursues two objectives through these policies: the creation of a common market on the one hand and increased efficiency on the other hand. However, there is evidence that an integrated management of infrastructure and services is the optimal structure in some industries – railroad being one of them.

Since the early 80s, the US rail industry has reduced both its workforce and its track-mileage by 50 percent. At the same time the market share of rail in the freight market has increased, from 11.8% in 1993 to 12.2% in 2002. During this period, there has been a significant merger wave, which has increased the market power of railroads. However, it appears that the

potentially adverse effects of this concentration have been more then compensated by efficiency gains. As a result, the consumer surplus in U.S. rail freight markets has increased by about 30% between 1986 and 2001. Railroads in the US carry mostly freight, and all freight companies own their respective infrastructure. The superiority of an integrated structure in this industry is confirmed by IVALDI & McCULLOUGH (2004) who use US data to test for sub-additivity in the cost function for infrastructure and freight operations. They estimate that the total operational cost incurred by firms running each activity is 2.42% higher than that of a vertically integrated firm.

In Japan, where trains carry mainly passengers, the 6 regional passenger rail companies all operate on their own infrastructure. They are regulated by a nationwide regulator who compares their performance. MIZUTANI & SHOJI (2001) study the Kobe-Kosoku Railway and find that the costs of vertically separated firms are 5.6% higher than those of an integrated system. [2]

The efficiency gains from integrated management can seem evanescent and a bit abstract. Our colleagues Guido Friebel and Marc Ivaldi put flesh on these gains in a case study of wheels (see IVALDI, 2006). The wheels of railroad wagons and locomotives work best when they are round. However, as a wagon is operating, the wear and tear on the wheels is not symmetric and they become more irregular. This has negative consequences for the infrastructure: the wear-and-tear on the tracks is increased as is the risk of accidents. Of course, this implies that the suppliers of services create externalities towards the manager of the infrastructure; we would expect that integration would make them take into account these externalities in their choice of maintenance strategy. But there is more.

Recently, technologies have been developed that can help identify irregularities in the wheels through sensors in the tracks and transponders on the wagons and locomotives. These technologies generate precise data; they facilitate the identification of irregular wheels and help focus the maintenance efforts. The implementation of these technologies requires new investments both at the train and at the track levels, and also a

[2] Not all studies show gains of integrated management of infrastructure and services. For instance, SHIRES *et al.* (1999) compare the cost of the Swedish operator after a reform involving vertical separation, and find that operating costs had been reduced by 10%, although it is not clear whether this efficiency gain could not have been caused by other aspects of the reform.

standardization of the data. We will argue below that some degree of integration would, at least potentially facilitate such investments.

These studies suggest that we should at the very least ask ourselves whether important efficiency gains are foregone by insisting on strong vertical separation. To shed light on this issue, we review below the theoretical reasons why integrated firms might be more efficient than vertically separated firms.

Of course, against these potential efficiency gains from integration, we should weigh the risk that competition is biased when the infrastructure manager has incentives to favour one of the service providers. It is this fear that induced the Commission in a 2002 communication to ask for very strong independence of the infrastructure manager:

> "The independence of essential infrastructure management functions such as train path allocation from the business of railway undertakings constitutes a prerequisite for the beneficial effects of allowing authorised applicants on the rail freight market. ... The Commission will meanwhile monitor closely the effectiveness of the existing sectoral framework in facilitating fair and non-discriminatory access to infrastructure."

And indeed, there have been circumstances where European integrated operators have been accused of discriminating against the rivals of their own provider of services. [3]

■ Costs and benefits of vertical separation

Consider the two firms, U and D in figure 2, where U, the upstream firm, provides an input that D, the downstream uses to produce a final product. For the industries considered in this article, U would be the infrastructure manager and D the provider of services. The main question we ask is the following one. When are we better off if these two firms are managed together, as one integrated entity? Conversely, when are we better off if these two firms are owned by different entities?

[3] For instance, in The Netherlands: there have been accusations that lack of cooperation by the tasks organizations prevented, in the mid-1990s, the entrant Lovers Rail to compete with the incumbent on the core network.

Figure 2

The economic literature has tackled the problem following two different approaches. The first approach concentrates on market power. If both firms are independently owned, and if they fix their prices independently of each other, neither will internalize the reduction in sales of the other one when it increases its own price. This "double marginalization" phenomenon implies that the final price will be higher with two different firms than with a single integrated supplier, and that profits will be lower. Both the firms and the consumers benefit from integration. In other words profits and welfare go hand in hand and are enhanced by integration. It should be noticed that these results are mitigated when firms use more sophisticated pricing mechanisms than simply announcing a price per unit.

Similar inefficiencies arise when, as is often the case, the downstream firm provides services that increase the value of the goods to consumers and/or the profit of the upstream firm: advice, sales effort, financial arrangements, ... These services create positive externalities towards U, as they increase the value of the goods for the consumers and therefore the level of demand. As it is generally impossible to write the first-best contract specifying the optimal level of these services, they tend to be undersupplied.

■ Efficiency benefits of vertical integration

More important for our purposes is the branch of literature that has examined the efficiency implications of vertical integration, and its mirror image, vertical separation. Forgetting the exercise of market power, under which circumstances are the combined costs of firms U and D reduced when they are jointly owned?

The difficulty of this problem is illustrated by the following two "paradoxes". Williamson proposed the paradox of selective intervention, which shows that it is always optimal to merge firms U and D. This is

because, it would always be possible, or so it seems, to instruct the managers of what has become two divisions of the new merged firm, to act exactly as if the firms had not merged. In this case, there would be no benefit, but also no cost to the merger. In general, it will be possible to extract small gains from the merger by "selective intervention" in minor decisions: sharing a parking lot, benefiting from better prices because of bulk purchases, etc. Either way, this seems to prove that a well managed merger can never be detrimental to efficiency.

The second paradox goes exactly in the opposite direction. It implies that there is never any efficiency gain from merging. If such efficiency gains existed and could be identified, the parties could capture them by staying independent and signing a contract that commits them to acting exactly as if they had merged. [4]

Of course, in reality vertical integration and vertical separation are not equivalent – these paradoxes are just meant to illustrate the difficulty of pinpointing the benefits of one or the other. In practice, it seems that merging firms overestimate the benefits and underestimate the costs of vertical integration. One may wonder whether regulators, as well as competition authorities, do not underestimate (or, maybe, do not want to take into account) the efficiency benefits of integration.

■ The basic trade-off

In the economic literature on vertical integration vs. vertical separation, a consensus seems to exist [5] around the following basic trade-off. Vertical integration decreases the costs of coordination between the two entities. In particular, since the publication of GROSSMAN & HART (1986)'s very influential paper, the literature has stressed the fact that vertical integration provides better incentives to invest in "specific"' capital, that is capital which is only (or at least, much more) useful within the framework of the relationship between U and D. On the other hand, vertical integration

[4] This is essentially the argument that COASE (1960) makes regarding private negotiations to solve the externalities problems.

[5] Although there is a general consensus about the costs and benefits of these two structures, there are very different theories as to why this trade-off exists.

decreases the "power" of incentives, as the managers of U and D are less responsible for the results of their own actions.

It may be useful to work through an example to better grasp the trade-offs which are involved. Consider a company which owns an oil field and a refinery. For the purposes of this example, we assume that the oil can only be processed in this specific refinery. We compare the two situations represented graphically as follows:

OIL FIELD ⟹ **PIPELINE** ⟹ **REFINERY**

OIL FIELD ⟹ **BOAT** ⟹ **REFINERY**

In the first case, the oil must be carried from the oil field to the refinery through a pipeline. In the second, the oil field and the refinery are both close to a harbour, and the transportation is done by boat. It seems intuitive that in the first case, one would choose to have common ownership of the field, the pipeline and the refinery, whereas in the second vertical separation would be optimal.

The fundamental reason for this different treatment of essentially identical activity (transportation of oil) lies in the characteristics of the capital that is used. In the first case, the capital is specific: the investments in the oil field, the pipeline and the refinery have no value except in the relationship between these three entities. In these cases, vertical integration decreases the need for elaborate contracts specifying for instance the type and quantity of maintenance that each of the parties has to incur. Furthermore, one can assume that the contracts can never be fool-proof. The consequences of underinvestment in the reliability of any of the three facilities would be borne in part by the owners of the other parts. Consequently, vertical separation would create opportunities and incentives for free-riding. Summing up, when there is specific capital, vertical integration tends to decrease the cost of production.

When boat transportation is available, the capital required to transport the oil is not specific. It is possible to use the boat for other purposes, and it is possible to hire other boats. Vertical separation makes it easier to provide incentives for the managers of the boat: if they do not perform well enough, there is little cost to switch to another supplier.

We examine in the next pages the way in which this trade-off plays in the case of regulated industries.

■ Regulatory issues

Before turning to a theoretical description of the tradeoffs faced by regulators, it may be useful to examine an example of the type of discrimination that regulators fear.

REIFFEN & WARD (2002) note [6]:

> "Indeed, given these features of the cellular industry, it is not surprising that there is evidence of discriminatory behavior by local telephone companies [...].
>
> [...] Specifically, during Bell Atlantic's 271 hearing regarding service in New York state, complaints were voiced about Bell Atlantic's provision of interconnection services to rival wireless carriers. Omnipoint, ... noted that `Bell Atlantic missed between 34% and 65% of `Firm Commitment Order' dates (installation dates agreed to in advance) for connecting new antennae in the New York Metropolitan area.'
>
> In its Comment, Omnipoint also claimed that Bell Atlantic discriminatorily provided lower-quality interconnection than it provided Bell Atlantic's own customers [...].
>
> These complaints have focused on the provision of interconnection to new antennae. It is plausible that discrimination against rival wireless companies could take this form, both because such discrimination is difficult for regulators to detect, and because it is potentially significant to wireless carriers."

It is important to realize that there would be no debate if the regulator had very good regulatory instruments. It would announce a maximum delay and would punish Bell Atlantic for missing the deadlines. But if Bell Atlantic knew that it would be punished for lateness, it would simply announce longer delays and continue to discriminate against its competitors. The regulator needs to have some idea of the reasonable delays in order to regulate this relationship. [7]

As far as the quality of interconnection is concerned, not only does the regulator ignore what the cost of improving it is; he also finds it very difficult to measure it. To the adverse selection problem is added a moral hazard

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[6] Disclaimer: for the sake of discussion, we will take these facts as given. We have no independent evidence about the specific situation, and our statements should not be viewed as attributing guilt to one party or the other.

[7] Of course, the cost of lowering the delay is private information of Bell Atlantic. An optimal regulation would provide incentives to announce shorter delay. In order to reduce the informational rents of Bell Atlantic, the regulator should have a reasonable idea of what these costs are.

problem, which is made even worse by the fact that quality differences may not be the consequence of a deliberate policy choice - they could be the consequences of many local decisions within the firm that favour internal clients.

■ Separation of accounts or divestiture?

There are different ways in which regulators impose separation between the activities of the infrastructure manager and of any supplier of services that it owns. One method is to impose or to encourage vertical separation or divestiture. The second method is to require that the two activities be managed separately. A third approach is to impose separation of accounts.

Separation of accounts by itself does not impose any behaviour; it is important for its side effects. In particular it gives the regulator instruments to verify whether the firm obeys non-discrimination rules. On the other hand, the differences between organizational separation and institutional separation are more subtle and deserve some comments. [8] If organizational separation implies that the regulator has enough instruments to force the integrated firm to run its two units in a totally independent manner, there is no difference.

The following simplified description of the consequences of the two different types of separation may be useful. It is reasonable to assume that the regulator has more control over short-run decisions made by firms than over long-run investment decisions. Even if the regulator were able to limit discrimination in the short run, he would not be able to prevent the technological investments of the infrastructure manager from being biased in favour of the supplier of services owned by the infrastructure operator. [9] Furthermore, it seems reasonable to assume that, when there is only organizational separation, both the infrastructure manager and the service

[8] The French terminology on this topic is useful. It distinguishes “séparation juridique” and “séparation de propriété”. This emphasizes the fact that in one case the two entities are managed in ways which are totally independent, and in the other that they have distinct ownership. It still leaves open the reason why this makes a difference and, more importantly, what differences it makes.

[9] For simplicity and concreteness, we speak as if the firm which manages the infrastructure owned the service supplier. Our discussion is independent of the actual structure of ownership and we would reach the same conclusions if the service supplier owned the manager of infrastructure or if they were both owned by a third entity.

supplier choose their investments to maximize joint profits. Of course, in reality, the regulator does not have enough power to fully enforce non-discrimination in the short run, and could prevent some investments that are too biased. However, we believe that this hypothesis, which needs further validation, provides a fair starting point.

■ The benefits of accounting separation

The costs of accounting separation, compared to separation of ownership are clear: it leaves scope for unfair competition, both because the regulator will have only imperfect tools to prevent discrimination in the short run, and because it can lead to biased investments.

On the other hand, allowing integrated ownership might encourage investment, for several reasons. First, both components of the integrated firm will take into account the interests of the other component in their investment decisions and the free-riding which we discussed above will be limited. In particular, the components will be less fearful of finding themselves at the mercy of their partner in any future negotiation. The benefits of integration for investment in specific capital that we discussed above continue to hold under accounting separation. Second, coordination between the types of investments will be easier to obtain – for instance the decision on interconnection standards will be facilitated. Third, information on long-run plans will flow more freely and this will improve the choice of investments.

It is certainly the case that this may lead to a situation where the investments would be biased in favour of the service supplier with a link to the infrastructure manager. However, even if the regulator cannot provide a reasonable defence against discrimination, an investment that is primarily intended to serve the integrated service supplier can nevertheless also be useful for downstream competitors. For instance, if there is more investment in infrastructure because its manager wants to ensure enough capacity for one specific service supplier, other service suppliers will benefit. Similarly, although the decision on interconnection standards can be biased, in some circumstances the bias will be less important that the fact that it is made with the interest of both upstream and downstream components in mind. Finally, the information which the infrastructure manager receives can foster the choice of the right equipment for all service suppliers.

It may be worthwhile examining how this optimistic scenario will play in the "round wheels" case study discussed above. Recall that a coordinated investment decision by upstream and downstream operators is needed to implement the new detection technologies. Because the track manager and its integrated operator of trains both take into account the long run interests of the whole firm, they are able to coordinate on their respective share of the investments. The track manager is assured to have at least one partner who is interested in using the technology. Because the rail network is equipped, it also becomes worthwhile for other users to invest in monitoring equipment. Of course, under vertical separation, it may have been possible to reach this outcome through contractual arrangements. However, such arrangements are likely to be more difficult to reach than agreements between two units of the same firm.

More pessimistic scenarios are of course also possible. It could be the case that the regulator has very little control over discriminatory behaviour both in the short and long run, and that the investments which are induced by vertical integration are of little use to downstream competitors. Our guess would be that both types of situations may arise. In Europe at least, the regulator has been very focused on one side of the ledger, and our main point is that one should look at the other side as well.

The same type of tradeoffs would arise if the regulator tried to ensure non-discrimination in the installation of, say, antennas through divestiture. In particular, the fact that the regulator has difficulties enforcing unbiased investment in quality stems from the fact that the type of investments which are made is not easily observable. This would also make it more difficult to ensure that there is enough investment after vertical separation.

■ Summary of a model

In a recent article, (CREMER *et al*., 2006) we have built a model that illustrates some of these issues. While a formal exposition of this model would go beyond the scope of this paper, a summary of the main ideas may help understanding the main policy issues.

This paper studies the impact of "legal unbundling" *vs* "ownership unbundling" on the incentives of a network operator to invest and maintain its assets. "Ownership unbundling" is the term used by the European Commission for full vertical separation. "Legal unbundling" means that the

downstream firm continues to be owned by the upstream firm but that management is completely separated. This is stronger than the accounting separation discussed above. The results we find have implications for all intermediate types of separation.

It is useful to think of the industry as composed of four types of agents. The consumers will play a rather passive role as they simply choose to buy from one firm or the other, but regulation takes into account their interest. The regulator has only one decision to make: whether or not to impose vertical separation. Under vertical separation, there are three firms: an upstream firm (the infrastructure manager in our previous discussion) and two downstream firms (the service suppliers). With legal unbundling, which is a restricted form of vertical integration, the upstream firm and one of the downstream firms (or possibly even both firms) will be owned (but not managed) by a single entity.

For simplicity, the upstream firm has only one decision to make: it chooses the size of the network. This network is an essential facility which the service suppliers must use to produce any service at all. We allow the upstream firm to choose investments biased in favour of the downstream firm to which it is linked.

The regulator is able to enforce non-discrimination perfectly. Hence, once the upstream firm has chosen its investment, it puts the resulting equipment for rent, and the downstream firms compete both for access to the infrastructure and in a downstream market. [10]

Our main results are in line with the points made in the previous sections. Because the investment in the network is not protected, at the time at which it is made, by a contract, the (fully separated) upstream firm will not take into account the interests of its clients when choosing its size. This effect can be mitigated by allowing it to *own* part of the downstream industry (even if it does not control its management). In other words, ownership separation is more detrimental to welfare than legal unbundling. The model is admittedly biased: the best structure is always to have the upstream firm own both downstream firms, as we are assuming that the regulator has enough power to force them to compete. However, we believe that it is of some importance that we can show that it is better to have the upstream firm own one downstream firm rather than none, even when investment is biased towards

[10] The reader can think of this competition as Bertrand competition with perfect substitutes.

the firm it owns (i.e., when one unit of investment is more productive for the integrated service supplier than for its competitor).

■ Telecommunications and Information Services

The aim of this article was to present a brief summary of the main conceptual issues involved in the choice of vertical divestiture. Maybe somewhat cowardly, we have chosen to use the railways industry as the main illustration, as it provides a less confusing set of issues than telecommunications, where the problems are more multiform. In particular, the list of products, services and activities that can be bundled or unbundled in telecoms is daunting.

For instance, the United States went through a radical phase of ownership separation between long distance and local phone services in the 1980s, after the break-up of AT&T. This facilitated the emergence of strong competition in the long-distance communications market. The companies in charge of local phone services have since become important providers of long distance communications, and strong non discrimination rules are in effect to provide a level playing field. We see therefore, in terms of our framework, that the US regulatory framework has moved back and forth between different models.

The review of the 2003 "New Regulatory Framework" which is currently being conducted by the Commission will, among other topics, examine the issue of vertical separation, with a view of encouraging effective competition. Clearly, the issue of discrimination is foremost in the mind of the Commission, as Viviane Reding stated in REDING (2007)

> "Many of the countries that are behind in broadband coverage and take-up have endemic problems of discriminatory behaviour by the incumbent: favouring its service providers over competitors. Therefore, I believe that, as an exceptional measure, an independent regulator should have the power to force an organisational separation of the management of the infrastructure from the management of service provision. This will create clear and separate incentives for the firm offering access to do so in a way that treats all competitors evenly."

If our analysis is correct, regulators should weigh the trade-off between minimising discrimination and lowering incentives for efficiency. This analysis can only be done case by case. It is also very difficult, and there are

many cases where the regulator, or the competition authorities, overestimated the potential for discrimination, while industry overestimated the efficiency gains.

■ Conclusions

Regulators tend to believe that the infrastructure managers whose firm is integrated downstream discriminate in ways which are detrimental to social efficiency. At least in Europe, they have been favouring strong vertical separation. However, one should keep in mind that solving regulatory issues through total divestiture may have efficiency costs, which will depend on the quality of regulatory controls that can be set in place, and in particular on the tools for preventing discrimination. Divestiture may have negative consequences on investments.

We believe that the answers that have been given up to now have been somewhat simplistic, since there has been scant examination of the trade-offs involved. Regulators are certainly not the only ones who should be blamed for this situation; the academic community certainly has, at least, an equivalent responsibility. This problem has been known to exist for over a decade now; the theoretical tools for tackling it are available; it is surprising that more work has not been done on these issues.

Building a methodology that allows for a quantitative assessment of the benefits and costs of different structures in concrete situations may be a difficult (or even unfeasible) task. However, it should be possible to rank industries by the likeliness that total divestiture is optimal, and to provide regulators with advice explaining the critical factors in making decisions about the structure of the industry.

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