Forthcoming Handbook of Industrial Organization

A Primer on Foreclosure*

Patrick Rey**

and

Jean Tirole***

February 21, 1997

* Financial support for this research was provided by a grant from BellSouth New Zealand. The authors are grateful to Lucy White for helpful comments on a previous draft.

* IDEI and CNRS EP40.

** IDEI and GREMAQ (CNRS UMR 5604), CERAS (CNRS URA 2036), and MIT.

Abstract

The paper provides an overview of the theory of access to an essential facility in an unregulated environment. It considers a wide array of contexts: possibility of bypass of the bottleneck facility, upstream vs downstream location of this facility, and diœerent exclusionary activities such as vertical integration and exclusive dealing. It identiøes a number of robust conclusions as to the social and private desirability of foreclosure. The common carrier policy of forcing the bottleneck to operate upstream is shown to lower consumer prices. In contrast, we show that nondiscrimination laws can be detrimental and that the imputation rule (ECPR) is often ineœective in a deregulated environment. Besides the normative analysis of foreclosure, the paper also develops insights for business strategy, as when it analyses the recent AT&T divestiture in terms of foreclosure theory.

Keywords: Essential facility, foreclosure, vertical integration, antitrust.

JEL numbers: D4, K21, L42.

1 Introduction

This paper provides a framework for the analysis of the rationale as well as the costs and benefits of market foreclosure. According to the received definition, foreclosure refers to any dominant firm's practice that denies proper access to an essential input it produces to some users of this input, with the intent of extending monopoly power from one segment of the market (the bottleneck segment) to the other (the potentially competitive segment). The excluded firms on the competitive segment are then said to be "squeezed" or to be suffering a secondary line injury. Essentiality means that the dominant firm's product cannot cheaply be duplicated by users who are denied access to it. Examples of essential facilities or bottlenecks to which competition law has been applied include a stadium, a railroad bridge or station, a harbor, a power transmission or a local telecommunications network, and a computer reservation system.[1] The foreclosure or essential facility doctrine states that the owner of such an essential facility has an incentive to monopolize complementary or downstream segments as well. This doctrine was first discussed in the US in Terminal Railroad Association v. U.S. (1912), in which a set of railroads formed a joint venture owning a key bridge across the Mississippi River and the approaches and terminal in Saint Louis and excluded nonmember competitors. The Supreme Court ruled that this practice was a violation of the Sherman Act. A version of the doctrine was invoked by the European Court of Justice in the celebrated United Brands (1978) decision, in which it held that United Brands Corporation enjoyed substantial market power in the banana market in Europe and engaged in exclusionary practices in related markets (distribution, ripening).[2]

Foreclosure can take several forms. It can be complete, as in the case of a refusal to deal or of an extravagant price for access to the essential facility ("constructive refusal"), or partial, as when the bottleneck owner favors some downstream firms (perhaps, its subsidiary) to the detriment of other competitors who still have (limited) access to the essential facility. It can also be performed in various ways:

- The bottleneck owner can integrate vertically with one or several firms in the complementary segment. For example, computer reservations systems were developed by major airlines. Before the Civil Aeronautics Board (CAB)'s 1984 famous decision, it was perceived that smaller airlines, especially those competing head to head with the inte-

[1] Extensive legal discussions of foreclosure can be found in Areeda (1981) and, especially, Hancher (1995).

[2] More recently still, the Queensland Wire case (which involved vertical integration and a vertical price squeeze) is perhaps the first such Australian case in 1989. The Clear case provides an example of application of the doctrine in New Zealand, in which Telecom's network is the essential facility.

grated ørms, had to pay a high price for access to the reservation systems and received poor display of their Æights on the travel agent's screen (a key competitive disadvantage given that most travel agents do not browse much through screen displays). The CAB attempted to impose equal access in price and quality to what are perceived to be essential facilities, namely computer reservation systems.[3] Note that the CAB did not call for the major airlines' divestiture of their computer reservation systems. In contrast, in the same year, US courts forced AT&T to divest its regional operating companies (known as the RBOCs). Other examples of forced vertical separation include the UK brewing industry, in which, following an investigation by the Monopoly and Mergers Commission in 1989, the ımajorsȷ were instructed to divest pubs, an essential facility,[4] and the British rail system, in which restructuring creates a separate provider of access, Railtrack.

The integrated ørm can refuse to deal with potential competitors. Relatedly, it may engage in tie-ins and refuse to unbundle, thereby denying access to the essential facility. For example, in Port of Genoa (1991), the European Court of Justice held that the harbor is an essential facility and that its use should not be reserved to the undertaking managing it.[5] A number of cases involve the requirement by a durable good manufacturer with market power that repairs, maintenance or spare parts be provided by the manufacturer.[6]

˘ In the presence of economies of scope or scale generated by the cooperation between ørms in the same market, a dominant group of ørms may put its competitors at a disadvantage by refusing to cooperate. Famous cases include Aspen Skying Co. v. Aspen Highlands Skying Co (1985), in which the common owners of three mountains on the site ørst oœered a low percentage and then discontinued the All-Aspen ski passes which enabled skiers to use these mountains as well a fourth one independently owned; and Associated Press v. United States (1945), in which members of the newspapers cooperative could block membership by competing newspapers. Such cases have obvious implications for network industries.[7]

---

[3]Similarly in 1988, the European Commission imposed a øne on Sabena for denying access to its computer reservation system to the price-cutting airline London European.

[4]Snyder (1994) performs an event study analysis of this industry and provides some evidence of noncompetitive behavior.

[5]A related case is the Sealink decision (1992), where the same company operated ferry services and controlled the harbor.

[6]See e.g. in Europe, Hugin v. Commission (1979), in which a manufacturer refused to supply spare parts for its cash machines and the Commission held that the manufacturer had a dominant position on its own spare parts. A recent and hotly debated case in the US is Kodak, who refused to sell replacement parts for photocopiers to owners unless the latter agreed not to use independent service organizations (see Borenstein et al (1995) and Shapiro (1995) for a discussion of this case).

[7]For example, Otter Tail Power Co v. United States (1973) established a (controversial) duty for a vertically integrated power company to supply other companies. In Aer Lingus (1992), the European Commission condemned Aer Lingus for refusing to interline (a technique enabling the marketing of single

˘ Short of integration, the bottleneck owner can grant exclusivity to a subset of ørms on the complementary segment, and thus de facto exclude their rivals. For example, the Court held that the exclusive rights granted to Avis and Hertz for the operation from the Auckland airport terminal building by Auckland Regional Authority violated sections 27 and 36 of the New Zealand Commerce Act. Similarly, the European Commission has investigated the 65 year contract between Eurotunnel on the one side, and British Rail and SNCF on the other side, allocating the entire capacity to the latter two companies.

˘ Another instrument in the ıforecloserȷ's toolbox is second-and third-degree price discrimination. Third-degree discrimination consists in charging diœerent (cost-adjusted) prices to diœerent customers. It generalizes exclusivity arrangements by favoring some customers over the others, but gives the bottleneck owner some Æexibility in serving discriminated-against customers. Even if outright third-degree price discrimination is prohibited, the bottleneck owner may be able to duplicate it in an apparently anonymous way, that is through second-degree price discrimination. For example, a loyalty program oœered to all or rebates based on the rate of growth of purchases may target speciøc customers even though they formally are available to all customers. Similarly, substantial price discounts may allow the survival of only a few customers; for instance, a large enough øxed (that is, consumption independent) fee transforms a potentially competitive downstream industry into a natural monopoly industry. Such considerations (besides many others) played a role in the process of enacting the Robinson-Patman Act in the US in 1936.[8] There was in particular a concern that independent wholesalers or retailers might not be able to compete with powerful chains buying their supplies at favorable prices.

For all its prominence in competition law, the notion of foreclosure until recently had poor intellectual foundations. Indeed, the intellectual impetus in the late seventies (reÆected in the American antitrust practice of the eighties) cast serious doubt about its validity. In particular, the Chicago School, led, in this instance, by Bork (1978) and Posner (1976), thought that the whole concept resulted from a confusion about the exercise of monopoly power. It argued that a bottleneck monopolist could earn monopoly proøt on the corresponding segment, but could not extend its market power to related segments; for example, in the absence of eŒciency gains, vertical integration could not increase the proøtability of the merging ørms. Relatedly, it questioned the rationale for excluding

tickets for combined Æights) with British Midland.

[8]Interestingly, in Hoœman La Roche, the European Court upheld the Commission's condemnation of purchasing agreements or loyalty rebates while asserting the company's right to oœer volume discounts as long as they are extended to all customers.

downstream customers, who could be the source of extra monopoly profits. The Chicago School view has had the beneficial effect of forcing industrial economists to reconsider the foreclosure argument and to put it, we believe, on firmer ground.

The objective of this paper is threefold. First, it summarizes recent developments in the analysis of foreclosure in the context of a unified framework. Second, it extends the existing literature by considering new modes of competition and by studying the impact of various forms of competition policy. In so doing, it develops a critical view of what, we feel, are misguided or insufficient policy interventions. Third, it builds a preliminary checklist of exclusionary complaints and bottleneck defenses, which may be useful for thinking about foreclosure.

We should also explain what we will not do. First, we will by and large ignore predatory behavior to focus on exclusionary practices. To some extent this choice is for convenience, but it also reflects, admittedly excessively, the fact that exclusionary practices are more common that predatory behaviors. It bears emphasizing, though, that an exclusionary practice aims at increasing the perpetrator's profit while predatory actions in contrast are profit-reducing behaviors that are intended to affect the competitors' profitability, with the ultimate goal of inducing their exit.[9]

Second, we abstract from the closely related access issues in regulated industries. In such industries, price controls and explicit or implicit earnings schemes often create incentives for regulated firms to engage in practices such as cross-subsidies and degradation of interconnection quality (or delays in interconnecting) that are arguably of lesser importance in an unregulated environment. Of course, to the extent that competition policy looks into the regulatory toolbox for possible remedies, some of the most salient issues in the regulatory context may gain prominence in the antitrust environment.

Third, we focus on the leverage (or rather, as we will see, the restoration) of market power. We will for example not discuss alternative theories of foreclosure based on bargaining power.[10] Other “nonleverage” theories of exclusion include price discrimination (where, say, the complementary and potentially competitive product is used as a counting device: see, e.g. Bowman (1957)), the avoidance of “multiprincipal externalities” (Bernheim-Whinston (1992), Martimort (1996)), the extraction of the entrants' rents (Aghion-Bolton (1987), Spier-Whinston (1995)), and favoritism (in which the bottleneck segment favors a subsidiary in the procurement of the complementary good, because it has superior information about the subsidiary or because it internalizes part of its rent).

[9]Note that, in Europe, a refusal to deal was assessed in Commercial Solvents (1974) from the point of view of the elimination of competitors, while, starting with United Brands (1978), the European Court of Justice no longer required that the refusal to deal may lead to the competitors' exit.

[10]On this, see Hart-Tirole (1990) and especially, Bolton-Whinston (1993).

We will also not cover Whinston (1990)'s theory of entry deterrence through tie-ins, that act as commitments for tough behavior in the competitive market; this theory is unrelated to the issue of access to a bottleneck and applies quite generally even if the goods are not complements.[11]

The paper is organized as follows: Section 2 briefly discusses several antitrust remedies. Section 3 provides an informal overview of the argument. Section 4 develops the conceptual framework and identifies the rationale for foreclosure. It also examines the impact of policies such as nondiscrimination laws and "common carrier" type policies. Section 5 and 6 apply the foreclosure argument to an analysis of vertical mergers and exclusive contracts, respectively. Section 7 shows that the logic of foreclosure may actually induce bottleneck owners not to integrate vertically. Section 8 studies possible defenses for exclusionary behaviors. And section 9 concludes.

2 Envisioned remedies

Assuming that the intellectual argument underlying the rationale for and the detrimental impact of foreclosure is compelling, one must still design an informationally feasible policy that either reduces the incentive to exclude or impedes the impact of foreclosure, and verify that the cure has no strongly undesirable side-effect.

A number of remedies have been considered by competition law practitioners. While we clearly should not restrict ourselves to the existing set of policies and should attempt to design better ones, it is useful to review the most prominent ones. It is convenient to group existing policies into five categories:

- Structural policies. Structural policies such as divestitures and line of business restrictions are often considered in last resort, as they may involve substantial transaction costs of disentangling activities and may jeopardize the benefits of integration. Yet, in specific instances (as for the AT&T 1984 divestiture) policy makers may come to the conclusions that it is hard to design proper rules of access for the integrated bottleneck, and that other methods of foreclosure can be prevented under vertical separation.

Note that milder forms of vertical separation are sometimes considered; for instance, antitrust authorities may demand that the essential facility be commonly owned by all users, with the provision that new entrants be able to purchase shares and membership

[11]Other entry deterrence theories include Aghion-Bolton (1987) and Rasmussen-Ramseyer-Wiley (1991), which rely on scale economies and buyers' miscoordination, and Comanor-Rey (1995), which relies on the preservation of industry rents. See also Caillaud-Rey (1995) for a review of the strategic commitment effects of vertical arrangements.

into the network ıat a reasonable pricej (as in the Associated Press case mentioned above). The joint ownership of an essential facility by competitors must then be granted an exemption from certain antitrust provisions (as is done for example for certain types of R&D joint ventures).

˘ Access price control. In the tradition of fully distributed cost regulation of access in regulated industries, antitrust authorities sometimes compare the price of access with some measure of its cost. The principle of such a comparison was for example accepted by the European Court in United Brands (1978), although it did not apply it in the speciøc instance. As is well known, the measurement of marginal cost is a diŒcult empirical matter, while the allocation of common costs among product lines has weak theoretical underpinnings. Clearly, the antitrust authorities lack the expertise and the staœ to conduct extensive cost studies; at best can one put the onus of proving overpricing on the excluded competitors, who may well have better cost information that the authorities.

˘ Access quantity control. Instead of trying to deøne a ırightj access price, the authorities sometimes focus on the quantity of access. For example, following an investigation of the Eurotunnel exclusivity contract mentioned above, the European Commission asked that 25% of each operator (British Rail, SNCF)'s capacity be allocated to new entrants for passenger and freight services.

˘ Price linkages. Antitrust authorities often try to use other prices ˘ for access or retail goods ˘ as benchmarks for the access price.

A famous rule, variously called the EŒcient Component Pricing Rule (ECPR), the Baumol-Willig rule, the imputation rule, the parity principle, and (perhaps confusingly) the nondiscrimination rule, links the integrated monopolist's access and retail prices. Namely, the access price charged to competitors should not exceed the price charged by the integrated ørm on the competitive segment minus the incremental cost of that ørm on the competitive segment. For example, the ICC has expressed a preference for the use of ECPR in railroad disputes in the US.

There are also various forms of mandated linkages between access charges. The bottleneck ørm may be forced to oœer the same tariœs to all users, or even to charge a single per-unit price. Or, it may be required to charge a price of access not exceeding the price charged for ønal use of the bottleneck segment (for example, the access charge for the local telephone network may not be allowed to exceed the price of local calls for residential or business consumers).

Last, there may be mandated linkages between several ørms' access prices, as in the case of reciprocity in access charges for two competing telecommunications networks (each network being an essential facility for the other).

- "Common Carrier" policies. By this expression, we mean the policy of turning the vertical structure of the industry upside down. It might appear that in a complementary goods industry, labelling one segment the "upstream segment" and the other the "downstream segment" is purely semantic. The analysis of this paper shows that it is not, because the downstream firms not only purchase goods (inputs) from the complementary segment but also are the ones who interact with the final consumers. Later, we will ask whether, in presence of differential competitiveness of the two segments, it is desirable to locate the more competitive segment upstream or downstream. The relevance of this question is illustrated (in a regulatory context) by Order 436 which created a structure that allows US gas producers to directly sign contracts with the gas customers (and purchase access from the pipelines bottleneck) rather than staying mere suppliers of inputs to pipelines packaging a bundle of production and transport to final customers.

- Disclosure requirements. Another tool in the policymaker's box is the requirement that contracts for intermediate goods be made public, with the hope that more "transparency" in supply contracts will promote downstream competition. Note that transparency is not equivalent to the prohibition of access price discrimination among buyers. A disclosure requirement does not preclude different tariffs for different buyers.

3 Informal overview of the arguments and main insights

Consider the following quintessential bottleneck situation: An upstream monopolist, the bottleneck owner, produces a key input for downstream use. There is potential competition in the downstream segment, but it can develop only if competitors have proper access to the essential input. The foreclosure doctrine states that in this situation the bottleneck owner has an incentive to restrict or deny access to the intermediate product to some or most of its potential buyers, and thereby to favor a downstream independent firm or a downstream affiliate. This doctrine maintains that foreclosure aims at extending the bottleneck's monopoly power to the downstream segment. The thrust of the Chicago School critique of this doctrine is that there is only one final product market and therefore only one monopoly power to be exploited, and that it is not obvious how the upstream monopolist could further extend its monopoly power.

The reconciliation of the foreclosure doctrine and the Chicago School is based on the observation that an upstream monopolist in general cannot fully exert its monopoly power without engaging in exclusionary practices. This fact is little acknowledged except in the speciøc contexts of patent licensing and of franchising. A patentholder is the owner of an essential facility, namely a technology that can be used as an input in productive processes. The patentholder is unlikely to make much money if it cannot commit not to Æood the market with licenses; for, if everyone holds a license, intense downstream competition destroys the proøt created by the upstream monopoly position. Therefore, a patentholder would like to promise that the number of licenses is limited. There is however a commitment problem: Once the patentholder has granted n licenses, it is then tempted to sell further licenses. It thereby depreciates the value of the existing n licenses. Such expropriation is ex post proøtable for the licensor, but reduces its ex ante proøt. A similar point can be made for franchising. Franchisees are unlikely to pay much to franchisors if they do not have the guarantee that competitors will not set shop at their doorsteps.

A bottleneck owner faces a commitment problem similar to that of a durable-good monopolist: Once he has contracted with a downstream ørm for access to its essential facility, he has an incentive to provide access to other ørms as well, even though those ørms will compete with the ørst one and reduce its proøts. This opportunistic behavior ex ante reduces the bottleneck owner's proøt (in the example just given, the ørst ørm is willing to pay and buy less). There is thus a strong analogy with Coase's durable good analysis. As is well-known, a durable-good monopolist in general does not make the monopoly proøt because it ıcreates its own competitionȷ: By selling more of the durable good at some date, it depreciates the value of units sold at earlier dates; the prospect of further sales in turn makes early buyers wary of expropriation and makes them reluctant to purchase. The analogy with the durable-good model also extends to the means of restoring monopoly power: vertical integration, exclusive dealing, retail price Æoor, reputation of the monopolist not to expropriate, and so forth.

The licensing and franchising examples involve binary decisions for input transfer (grant or not a license or franchising agreement). But the commitment problem is very general and extends to situations in which downstream ørms purchase variable amounts of the essential input. It is then not surprising that the loss of monopoly power associated with the commitment problem is more severe, the more competitive the downstream segment.[12] This proposition has two facets. First, the upstream bottleneck's proøt is

[12]In a recent debate in France on producers-distributors relationships, some have advocated that the tough competition observed in the French retail market (which appears to be much tougher than in neighboring countries, and in part due to the presence of large chains of independent retailers) generates ıtoo muchȷ destructive competition among their suppliers.

smaller, the larger the number of downstream ørms. Second, for a given number of downstream ørms, the upstream proøt is smaller, the more substitutable are the downstream units.

Bottlenecks are rarely pure bottlenecks. They most often compete with inferior goods or services. In the presence of such bypass opportunities, an upstream bottleneck owner must face both the commitment problem and the threat of second sourcing by the downstream ørms. A couple of interesting insights result from this extension of the basic framework. First, a vertically integrated ørm controlling the bottleneck in general may want to supply a limited but positive amount of the essential input to the downstream aŒliate's competitors, who would otherwise purchase the inferior good. The prospect of productive ineŒciency creates scope for proøtable external sales by the bottleneck owner. Second, and relatedly, bypass possibilities create a distinction between two ways of restoring monopoly power, vertical integration and exclusive dealing. While exclusive dealing does not enable the bottleneck owner to supply several downstream ørms, vertical integration in contrast provides enough Æexibility to supply nonaŒliates and yet favor the aŒliate.

Our analysis has three broad policy implications. First, it does matter whether the more competitive of two complementary segments lies upstream or downstream. We show that prices are lower when the bottleneck owner lies upstream. This result is robust to the existence of bypass opportunities, and to the vertical structure of the industry (independent or vertically integrated bottleneck). Intuitively, an upstream bottleneck location has two beneøts from a social welfare point of view. First, it creates a commitment problem not encountered by a downstream monopolist and thus reduces monopoly power. Second, in the presence of bypass opportunities, an upstream location of the bottleneck prevents productive ineŒciency by creating a stage of competition that eliminates inferior substitutes. Our analysis thus supports common carrier policies.

The second policy implication is that nondiscrimination laws may have the perverse eœect of restoring the monopoly power that they are supposed to øght. When an upstream bottleneck practices foreclosure by discriminating among competitors, it is tempting to impose a requirement that all competitors be oœered the same commercial conditions. Nondiscrimination rules however beneøt the upstream bottleneck because, by forcing it to sell further units at the same high price as the initial ones, they help the bottleneck commit not to Æood the market. A nondiscrimination law is thus a misguided policy in this situation.

The third policy implication is that ECPR (which was designed for a regulated environment, but is also used in antitrust contexts) often has little bite in the unregulated environment. As pointed out by William Baumol in testimonies, ECPR only provides a link between access and ønal prices and is therefore only a partial rule. Moreover, the higher the ønal price, the higher the access price can be. In an unregulated environment, an integrated ørm with upstream market power can thus exercise its market power by setting a high price for the ønal good and, at the same time, set a high access charge to prevent other ørms in the competitive segment from becoming eœective competitors.

Our analysis has also implications for business strategy. Interestingly, while the desire to foreclose in general motivates vertical integration, it may alternatively call for divestiture. For example, we develop a rationale for the recent divestiture of AT&T manufacturing arm that is related to the oŒcial justiøcation of this divestiture. With the impending competition in telecommunications between AT&T and the RBOCs, the latter, who are major buyers of AT&T equipment, would have been concerned that the AT&T manufacturing arm would exclude them in order to favor its telecommunication aŒliate. The RBOCs might therefore have turned to alternative manufacturers. We provide necessary and suŒcient conditions under which this smaller-customer-base eœect dominates the foreclosure eœect, and thus divestiture is preferred to vertical integration.

Last, we conclude the paper with a review and a brief assessment of eŒciency defenses for foreclosure activities, and with a discussion of the research agenda.

4 The rationale for foreclosure

As discussed in the introduction, the motivation for foreclosure is the desire to extend or protect market power. We analyze this rationale using the simplest framework.

4.1 A simple framework

An upstream ørm, U, is a monopoly producer of an intermediate product. It supplies at marginal cost c two undiœerentiated downstream ørms, D_1 and D_2 (see Figure 1).

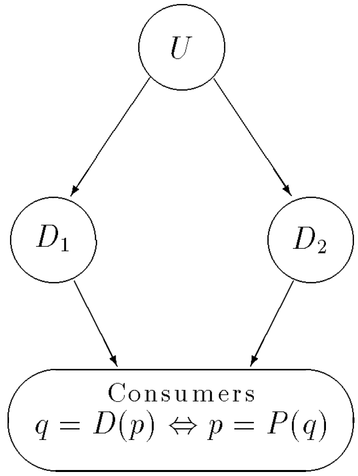

Figure 1

We will refer to the upstream segment as the "bottleneck segment" or the "essential facility" and to the downstream segment as the "competitive segment" (although it need not be perfectly competitive). The downstream firms transform the intermediate product into an homogenous final one, on a one-for-one basis and at zero marginal cost. They compete in the final goods market, characterized by a decreasing, concave, inverse demand function $p = P(q)$. Let Q^m, p^m, and π^m denote the whole vertical structure's or industry's monopoly output, price, and profit:

$$
\begin{aligned}
Q^m &= \arg\max_q \{(P(q) - c)q\}, \\
p^m &= P(Q^m), \\
\pi^m &= (p^m - c)Q^m.
\end{aligned}
$$

The interaction between the firms is modelled according to the following timing:

- Stage 1: U offers each D_i a tariff $T_i(.)$; D_i then orders a quantity of intermediate product, q_i and pays $T_i(q_i)$ accordingly.
- Stage 2: D_1 and D_2 transform the intermediate product into the final good, observe each other's output and set their prices for the final good.

This timing reflects a situation in which the supplier produces to order before the final consumers formulate their demand. The downstream firms are capacity constrained by their previous orders when they market the final product. Alternatively, the transformation activity is sufficiently time consuming that a downstream firm cannot quickly reorder more intermediate good and transform it if its final demand is unexpectedly high, or reduce its order if its final demand is disappointingly low. In the Appendix, we discuss the case in which ønal consumers are patient enough and the production cycle is fast enough that the downstream ørms produce to order. Technically, the diœerence between these two modes of production resembles the distinction beween Cournot and Bertrand competition.

We focus on perfect Bayesian equilibria. Given the quantities purchased in the ørst stage, the downstream ørms play in the second stage a standard Bertrand-Edgeworth game of price competition with capacity constraints. For simplicity, we assume that the marginal cost c is suŒciently large relative to the downstream marginal cost (zero) that if the downstream ørms have purchased quantities q_1 and q_2 in the viable range, they ønd it optimal to transform all units of intermediate product into ønal good and to set their price at $P(q_1+q_2)$.[13] The second stage can then be summarized by Cournot revenue functions $P(q_1+q_2)q_i$. As for the ørst stage, several cases can be distinguished, according to whether the tariœ oœered to one downstream ørm is observed by the other or not.

4.1.1 Commitment, observability and credibility

Let us ørst consider, as a benchmark, the case where both tariœs oœered by U are observed by both D_1 and D_2. In that case, U can fully exert its monopoly power and get the entire monopoly proøt (see for example Mathewson-Winter (1984) and Perry-Porter (1989)). For example, U can achieve this result by oœering $(q_i, T_i) = (Q^m/2, p^m Q^m/2)$:[14] both D_1 and D_2 accept this contract and together sell the monopoly quantity, Q^m, at the monopoly price p^m.[15] In this world, there is no rationale for foreclosure. The upstream monopolist can preserve its monopoly power without excluding one of the competitors.

Oœering those contracts may however not be credible if the contracts are secret or can be privately renegotiated. Suppose for example that U and D_2 have agreed to $q_2 = Q^m/2$; U and D_1 would then have an incentive to agree to the quantity, q_1, that maximizes their joint proøt, i.e.:

$$\begin{aligned} q_1 &= \arg\max_q \{[P(Q^m/2+q) \Leftrightarrow c]q\} \\ &= R^C(Q^m/2) \\ &> Q^m/2, \end{aligned}$$

[13] See Tirole (1988, chap. 5) for more detail.

[14] Since U has perfect information on D_1 and D_2 it can actually dictate their quantity choices -subject to their participation constraint- via adequately designed tariœs of the form ı(q_i, T_i)ȷ: $T(q) = T_i$ if $q = q_i$ and $+\infty$ otherwise. Since U moreover makes take-it-or-leave-it oœers, it can set T_i so as to extract D_i's entire proøt.

[15] Although downstream ørms are symmetric, an asymmetric allocation of the monopoly output between them would do as well.

where R^C denotes the standard Cournot reaction function, and the last inequality comes from $-1 < (R^C)' < 0$ (whenever quantities are positive).[16] Hence, U has an incentive to convince D_1 secretly to buy more than $Q^m/2$. Anticipating this, firm D_2 would turn down the monopolist's offer.

4.1.2 Secret contracts

From now on, we consider the game where in the first stage, U offers secret contracts (that is, D_i observes the contract it is offered, but not the contract offered to D_j). In the game so defined, U is subject to the temptation just described and thus faces a credibility problem. The contracts actually offered by U in equilibrium, as well as the responses from D_1 and D_2, will depend on the nature of each downstream firm's conjectures about the contract offered to its rival. Since there is considerable leeway in specifying those beliefs, there are actually many perfect Bayesian equilibria, but, as we will see, one equilibrium stands out as the only plausible one and we will therefore focus on this equilibrium.

To illustrate the role of conjectures, suppose that D_1 and D_2 assume that U makes the same offer (even unexpected ones) to both of them. Then it is credible for U to offer $(q_1, T_1) = (q_2, T_2) = (Q^m/2, p^m Q^m/2)$: Expecting that any offer it receives is also made to its rival, D_i refuses to pay more than $P(2q)q$ for any quantity q; U thus maximizes $(P(2q) - c)2q$ and chooses $q = Q^m/2$. Hence, under such a symmetry assumption on the firms' conjectures, U does not suffer from any loss of credibility.

This symmetry assumption, which concerns unexpected offers (i.e., out-of-equilibrium ones) as well as expected ones, is not however very appealing. It is more plausible to assume that, when a firm receives an unexpected offer it does not revise its beliefs about the offer made to its rival. Secrecy together with upstream production on order implies that, from the point of view of the upstream monopolist, D_1 and D_2 form two completely separate markets (of course, D_1 and D_2 themselves perceive a strong interdependency). Thus the monopolist has no incentive to change his offer to D_j when it alters D_i's contract. Such conjectures are called passive or market-by-market-bargaining conjectures.[17]

[16] $\hat{q} = R^C(q)$ is defined by: $P(\hat{q}+q)-c+\hat{q}P'(\hat{q}+q) = 0$, and thus $R^{C\prime}(q) = -(P' + qP'')/(2P' + qP'') \in (-1, 0)$ since $P(.)$ is assumed to be decreasing and concave. Hence: $q^m - R(q^m/2) = R(0) - R(q^m/2) < q^m/2$, implying $R(q^m/2) > q^m/2$. Note also that the assumption of a concave demand function is made only for convenience. Even if it does not hold, a revealed preference argument shows that variations in reactions are strictly lower than variations in outputs.

[17] Conjectures can be passive only if the downstream units have perfect information about the bottleneck's marginal cost; for, assume that the bottleneck has private information about this marginal cost. The tariff offered to D_1, say, then signals information about the marginal cost; for example, a two-part tariff with a low marginal price may reveal a low marginal cost and therefore signal that D_2 is also offered a tariff with a low marginal cost and will produce a high quantity. Thus, when the bottleneck has private information about its marginal cost, the downstream firms' conjectures can no longer be "passive". But

Under passive conjectures, D_i, regardless of the contract offer it receives from U, expects D_j to produce the candidate equilibrium quantity, q_j, and is thus willing to pay up to $P(q+q_j)q$ for any given quantity q. U, who extracts all of D_i's expected profit by making a take-it-or-leave-it offer, offers to supply q_i so as to maximize the joint profit in their bilateral relationship, namely:

$$\begin{aligned} q_i &= \arg\max_q \{(P(q+q_j) - c)q\} \\ &\equiv R^C(q_j). \end{aligned}$$

Hence, under passive conjectures the equilibrium is unique and characterized by the Cournot quantities, price and profits:

$$\begin{aligned} q_1 &= q_2 = q^C \quad \text{where} \quad q^C = R^C(q^C) > Q^m/2, \\ p_1 &= p_2 = p^C = P(2q^C) < p^m, \\ \pi_U &= (p^C - c)2q^C = 2\pi^C < \pi^m. \end{aligned}$$

This result, due to Hart and Tirole (1990), and further analyzed by McAfee and Schwartz (1994) highlights the commitment problem faced by the supplier. Even though it is in a monopoly position, its inability to credibly commit itself gives room for opportunistic behavior and prevents it from achieving the monopoly outcome.

As already mentioned, this outcome is closely related to the phenomenon underlying the Coasian conjecture on the pricing policy of a durable good monopolist.[18] If the monopolist can commit to future prices, it can obtain the monopoly profit by committing itself to never set its price below the monopoly level. However, once all sales have taken place (in the first period), it has an incentive to lower its price and exploit the residual demand. If the monopolist cannot commit itself on its future pricing policy, the buyers then delay their purchase in order to benefit from lower future prices, and the profit is reduced.

Suppose more generally that there are n identical downstream competitors. Then, by the same argument, the passive conjectures equilibrium is symmetric and satisfies

$$q = R^C((n-1)q),$$

they may still reflect the fact that the bottleneck bargains "market-by-market", that is attempts to maximize its profit in any given intermediate market (where an "intermediate market" corresponds to a D_i) without internalizing the impact of the contract on the other market, since its profits in the two markets are unrelated. A lack of transparency of the bottleneck's cost may nevertheless improve the bottleneck's commitment ability. [We are grateful to Lucy White for this point.]

[18]See Coase (1972), as well as Tirole (1988, chapter 1) for an overview.

where q is the output per downstream firm. Thus, the commitment problem becomes more severe, the larger the number of downstream firms. Indeed, the retail price on the competitive segment tends to marginal cost c and the industry profit tends to zero as the number of firms tends to infinity. Thus, we would expect bottleneck owners to be keener to foreclose access to the essential facility, the more competitive the downstream industry. The analogy with the durable good model again is obvious. There, the monopolist's commitment problem increases with the number of periods of sales. Indeed, and this is Coase's famous conjecture, the monopolist's profit vanishes as opportunities to revise prices become more and more frequent.

Adding downstream firms is one way of increasing the intensity of downstream competition. Another relevant impact of competition on the extent of the commitment problem is obtained by varying the degree of dowsntream product differentiation. Let us, for the sake of this exercise only, depart from the perfect substitutes assumption and allow the two downstream firms to produce differentiated products. Under our assumptions Bertrand-Edgeworth competition with capacities q_1 and q_2 yields retail prices $p_1 = P_1(q_1, q_2)$ and $p_2 = P_2(q_2, q_1)$. The equilibrium of the overall game is still the Cournot equilibrium of the simpler game in which the downstream firms face marginal cost c. If, as we would normally expect, the ratio of Cournot industry profit over monopoly profit increases with the degree of differentiation, the incentive to restore monopoly power is stronger, the more substitutable the downstream products.

• Restoring monopoly power. In contrast with conventional wisdom, foreclosure here aims at reestablishing rather than extending market power: In order to exert its market power the upstream monopolist has an incentive to alter the structure of the downstream market. For example, excluding all downstream firms but one eliminates the "Coasian pricing" problem and restores U's ability to sustain the monopoly price; exclusive dealing thus is a straightforward way to extend U's monopoly position to the downstream market.

Alternatively, U may want to integrate downwards with one of the downstream firms, in order to eliminate the temptation of opportunism and credibly commit itself to reduce supplies to downstream firms. For, suppose that the upstream firm internalizes the profit of its downstream affiliate, and that it supplies the monopoly quantity Q^m to this affiliate and denies access to the bottleneck good to nonintegrated downstream firms. The integrated firm then receives the monopoly profit π^m. Any deviation to supply nonintegrated producers can only result in a lower industry profit, and therefore in a lower profit for the integrated firm.[19]

[19]Again, there is an analogy with Coase's durable good model. A standard way for a durable-good

The bottleneck monopolist may conceive still other ways of preserving the monopoly proøt. For instance, a market-wide resale price maintenance (RPM), in the form of a price Æoor, together with a return option[20] would obviously solve the commitment problem. [As we will see, price ceilings can also help solve this problem in some instances.] Alternatively, allowing tariœs to be contingent on both ørms' outputs is another such instrument: A contract of the form ı$q_i = Q^m/2$, $T_i = p^m Q^m/2$, together with a hefty penalty paid by the supplier to the buyer if the buyer's competitor is delivered a higher quantity, and thus produces a higher quantity" solves the opportunism problem. The tariœ $T_i(q_i, q_j) = P(q_i+q_j)q_i$ is another possibility: By capturing all realized downstream proøts, this tariœ ˘ which in eœect mimicks vertical integration ˘ internalizes all externalities and prevents opportunism.[21] Similarly, D_i's contract could be based on D_i's revenue, if observable, rather than D_i's input: A contract of the form ıgive back (almost) all of your revenueȷ also eliminates the risk of opportunistic behavior: When dealing with D_j, U then takes into account the impact of his oœer on D_i's revenue, and thus is no longer tempted to ıexpropriateȷ this revenue.

Recalling the various ways in which a durable-good monopolist can restore his commitment power[22] suggests several other commitment policies for the bottleneck owner. In an oft repeated relationship, the bottleneck owner may build a reputation with D_1, say, for practicing ıimplicit exclusive dealingȷ. That is, the bottleneck owner may sacriøce short-term proøt by not supplying D_2 in order to build a reputation and extract high payments from D_1 in the future, in the same way a durable-good monopolist may gain by refraining from Æooding the market. In another analogy with the durable-good model, the bottleneck owner gains from facing a (publicly observed) tight capacity constraint (or more generally from producing under decreasing returns to scale). The downstream ørms are then somewhat protected against expropriation by the capacity constraint.[23] Some of these analogies with the durable-good model are listed in Table 1.

---

monopolist of restoring commitment power is to refrain from selling. A durable-good monopolist who leases the good assumes ownership of existing units and thus is not tempted to expropriate the owners of previous production by Æooding the market (it would expropriate itself), in the same way the integrated bottleneck owner is not tempted to expropriate its aŒliate by supplying other downstream ørms.

[20]The possibility for downstream units to return the wares at the marginal wholesale price is in general needed for obtaining the monopoly solution. Suppose that $c = 0$, and that when both sellers charge the same price but supply more than the demand at this price, the rationing follows a proportional rule (so, sellers sell an amount proportional to what they bring to the market). Let the upstream ørm supply $q^m/2$ to each downstream ørm and impose price Æoor p^m. Then the upstream ørm can supply some more units at a low incremental price to one of the sellers, thus expropriating the other seller.

[21]The contract may oœer a small discount for the particular choice $q_i = Q^m/2$, in order to help downstream ørms to coordinate on the desired outcome.

[22]On this, see Tirole (1988, p84˘86).

[23]Obviously, it may also help the upstream ørm if the downstream ørms face a capacity constraint.

EXCLUSIONARY BEHAVIOR	ANALOGUE FOR THE DURABLE-GOOD MONOPOLIST
Exclusive dealing	Destruction of production unit
Proøt sharing / vertical integration	Leasing
Retail price Æoor	Most favored nation clause
Reputation for implicit exclusive dealing	Reputation for not Æooding the market
Limitation of productive capacity	Limitation of productive capacity

Table 1

4.2 Policy implications

The previous subsection has presented the basic motivation for foreclosure and stressed the strong analogy with the Coasian pricing problem. We now derive some policy implications.

4.2.1 Upstream versus downstream bottlenecks

The ıCoasian pricing problemȷ is more likely to arise when bottlenecks are at more upstream levels, that is, when they have to supply (competing) intermediaries to reach ønal consumers. To see this, consider the more general framework, where two complementary goods, 1 and 2, must be combined together to form the ønal good (on a one-to-one basis: one unit of good 1 plus one unit of good 2 produces one unit of ønal good), good 1 being produced by a monopolist M (at constant marginal cost c) whereas good 2 is produced by two competing ørms C_1 and C_2 (at no cost). In the case of telecommunications, for example, good 1 can correspond to the local wired segment and good 2 to the mobile segment. To stick to the previous framework, we denote by $p = P(q)$ the inverse demand for the ønal good.

The case where M is ıupstreamȷ (Figure 2a) is formally equivalent to the one analyzed above: M sells good 1 to C_1 and C_2, who combine it with good 2 to provide consumers with the ønal good. If M can make secret oœers to both C_1 and C_2, then opportunism prevents M from fully exerting its monopoly power. The upstream monopolist obtains the Cournot proøt.

If instead M is ıdownstreamȷ (that is, C_1 and C_2 supply M, who then deals directly with consumers, as in Figure 2b), the situation is completely diœerent: Being at the interface with consumers, M is naturally inclined to ıinternalizeȷ any negative externality between C_1 and C_2, and is thus induced to maintain monopoly prices. Assuming M can still make take-it-or-leave-it oœers to both C_1 and C_2, M can now at the same time extract all proøts from them and charge the monopoly price to ønal consumers.[24] Hence, from either the consumers' or total welfare perspective, it is preferable to put the more competitive segment downstream. For example, in the above mentioned telecommunications example, it is preferable to let consumers deal directly with the competing mobile operators who then buy access from the øxed link operator. This idea may provide a rationale for the U.S. gas reform (order 436)[25] and the ıcommon carrierȷ concept, although some caution must be exerted in view of the regulatory constraints in those industries.

---

[24] Does this result depend on the assumption that the monopolist has all the bargaining power? Consider for example the opposite extreme: The upstream competitors make take-it-or-leave-it contract oœers $T_i(q_i)$ to the downstream monopolist. This situation has been analyzed in depth by the literature on ısupply functions equilibriaȷ (e.g., Back-Zender (1993), Bernheim-Whinston (1986, 1992), Green-Newbery (1992), and Klemperer-Meyer (1989)). As is well-known, supply function games have multiple equilibria (see e.g. Back-Zender (1993) and Bernheim-Whinston (1992)). On the other hand, it is possible to select among diœerentiable equilibria by introducing enough uncertainty (Klemperer-Meyer (1989)). This selection yields the same Bertrand competition outcome ($T_i(q_i) = 0$ for all q_i) as for the polar distribution of bargaining powers.

[25] Before the reform, pipelines (the bottleneck) sold gas to customers (distribution companies, large industrial customers) and purchased their gas internally or from independent producers who had no direct access to customers. Since the reform, producers can purchase access from pipelines and intereact directly with customers.

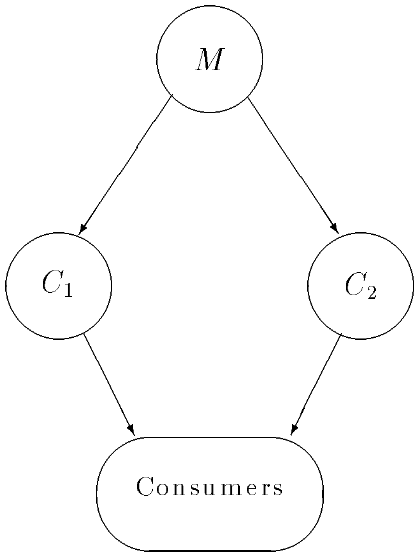

Figure 2a

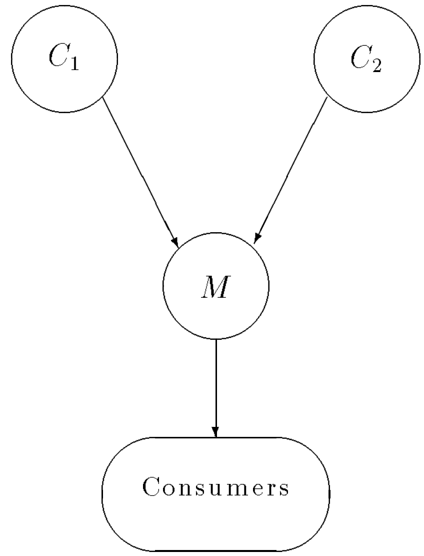

Figure 2b

4.2.2 Non-discrimination laws

Non-discrimination laws are often motivated by the protection of final consumers against abuses of dominant positions. It is well-known that in other contexts such non-discrimination laws may have ambiguous effects, since they may favor some consumers to the detriment of others. But it should be stressed that, in the context described above, such laws have a very perverse effect, adversely affecting all consumers and total welfare. They eliminate opportunistic behavior and allow the bottleneck owner to fully exercise its monopoly power!

To see this, consider the basic (Cournot) framework presented above, and assume that U is restricted to offer the same tariff to both D_1 and D_2:

- Stage 1: U offers the same tariff $T(\cdot)$ to both D_1 and D_2; D_i then orders a quantity of intermediate product, q_i and pays $T(q_i)$ accordingly.

- Stage 2: D_1 and D_2 transform the intermediate product into final good, observe each other's output and set their prices for the final good.

Note that this game is played under complete information at each point of time. Thus there is no scope for opportunistic behavior from U. Formally, the situation is the same as with secret offers but "symmetric" beliefs, and in equilibrium U gets the entire monopoly proøt. An example of optimal tariœ is $T(q) = F + wq$, with F and w such that:

$$
\begin{aligned}
q^C(w) &= Q^m/2 \\
F &= (p^m \Leftrightarrow w)Q^m/2,
\end{aligned}
$$

where $q^C(w)$ denotes the Cournot equilibrium quantity (per ørm) when ørms' unit cost is w :

$$q^C(w) = \hat{q} \quad \text{such that} \quad \hat{q} = \arg\max_q \{(P(q + \hat{q}) \Leftrightarrow w)q\}.$$

In other words, the marginal transfer price w is set so as to lead to the desired monopoly price and quantities, and F is used to extract D_i's proøt. Hence, if the upstream ørm cannot discriminate between the two downstream ørms (but can still oœer a non-linear tariœ, or at least require a ˘uniform˘ franchise fee), it can fully exert its market power and maintain the monopoly price: Non-discrimination laws thus reduce consumer surplus and total welfare by enabling the monopolist to commit.

To obtain the monopoly proøt, the upstream monopoly can alternatively oœer the following nondiscriminatory two-part tariœ:

$$T(q_i) = \pi^m + cq_i.$$

That is, the wholesale price is equal to marginal cost and the øxed fee equal to the monopoly proøt. It is then an equilibrium for D_1 to sign an agreement and for D_2 to turn it down.[26] The competitive sector then makes no proøt, and the upstream monopolist obtains the monopoly proøt by monopolizing the downstream sector. Note that the øxed fee de facto transforms a potentially competitive downstream industry into a natural monopoly (increasing returns to scale) industry. Price discounts, an instance of second-degree price discrimination, are here a perfect substitute for the prohibited third-degree price discrimination. It is also interesting to note that such foreclosure ideas partly underlied the rationale for the 1936 Robinson-Patman Act in the US, although considerations such as diœerential access to backward integration (not to mention intense lobbying) were relevant as well.

Note, last, that if U is restricted to use linear prices, then the outcome is even worse for consumers and economic welfare, as well as for the monopolist, who still can commit but cannot prevent double marginalization. When the above game is modiøed by restricting the tariœ $T(\cdot)$ to be of the form $T(q) = wq$, the unique equilibrium yields $w > (q^C)^{-1}(Q^m/2)$ and $p > p^m, Q < Q^m$. [27]

[26] To be certain, there is a coordination problem here. But this problem is readily solved if U contacts one of the downstream ørms ørst.

[27] Formally, w is set so as to maximize $(P(2q^C(w)) - w)2q^C(w) \equiv (P(Q) - w(Q))Q$, where $w(Q) \equiv$

5 The restoration of monopoly power: vertical integration

As we observed, vertical integration helps the upstream monopolist U to circumvent its commitment problem and to (credibly) maintain monopoly prices (Hart-Tirole (1990)). Suppose that U integrate with D_1 as in Figure 3b the upstream monopolist, if it receives D_1's profit, internalizes the impact of sales to D_2 on the profitability of units supplied to its subsidiary. Consequently, the “expropriation” problem disappears and U restricts supplies to D_2 as is consistent with the exercise of market power. We first analyze in detail the foreclosure effect of vertical integration under the possibility of bypass and then derive some policy implications.

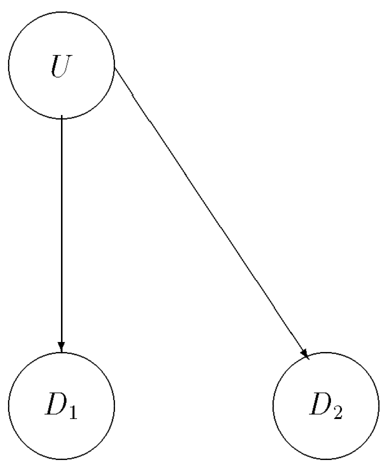

Figure 3a

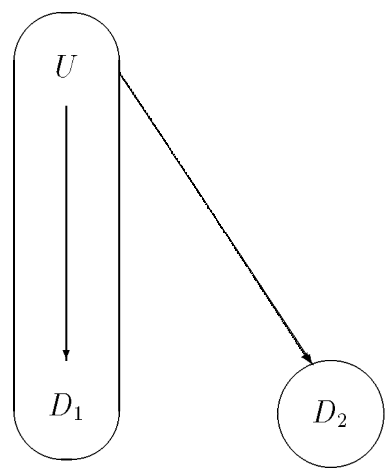

Figure 3b

5.1 Vertical integration and bypass of the bottleneck segment

In the simple framework above, vertical integration leads to the complete exclusion of the nonintegrated downstream firm. This is clearly an extreme consequence, relying in particular on the absence of alternative potential supplier for D_2. We show however that the same logic holds, even when there exists a (less efficient) second source for D_2. The new feature is then that the vertically integrated firm may supply its competitor on the donwstream segment, a sometimes realistic outcome.

$(q^C)^{-1}(Q/2)$ is decreasing in Q, which results in a total quantity $Q < Q^m$: An increase in Q is less profitable for the upstream monopolist than in the monopoly case, because the monopolist's margin, $P(Q)-w(Q)$, corresponds to a fictitious demand function with slope $P'-w' > P'$. That is, the endogenous wholesale price makes the demand function less elastic and leads to a price above the monopoly price. To put it yet another way, the upstream monopolist does not take into account the fact that a decrease of output affects the downstream profits as well as its own (variable) profit.

We generalize the model by introducing a second supplier, $\hat{U}$, with higher unit cost[28] $\hat{c} > c$. The timing is now as follows:

- Stage 1: U and $\hat{U}$ both secretly offer each D_i a tariff, $T_i(\cdot)$ and $\hat{T}_i(\cdot)$; each D_i then orders a quantity of intermediate product to each supplier, q_i and $\hat{q}_i$, and pays $T_i(q_i)$, $\hat{T}_i(\hat{q}_i)$, accordingly.

- Stage 2: D_1 and D_2 transform the intermediate product into final good, observe each other's output and set their prices for the final good.

In the absence of integration (Figure 4a), U, being more efficient, ends up supplying both D_1 and D_2, although at a lower price than before due to the potential competition from $\hat{U}$. More precisely (see Hart-Tirole (1990) for a formal proof), U supplies as before q^C to both downstream firms, but for a payment equal to $\pi^C - \max_q\{(P(q+q^C) - \hat{c})q\}$, since each downstream firm can alternatively buy from $\hat{U}$, who is willing to supply them at any price $\hat{p} \geq \hat{c}$. That is, the introduction of the alternative supplier does not affect final prices and quantities or the organization of production, but it alters the split of the profit between U and the downstream firms.

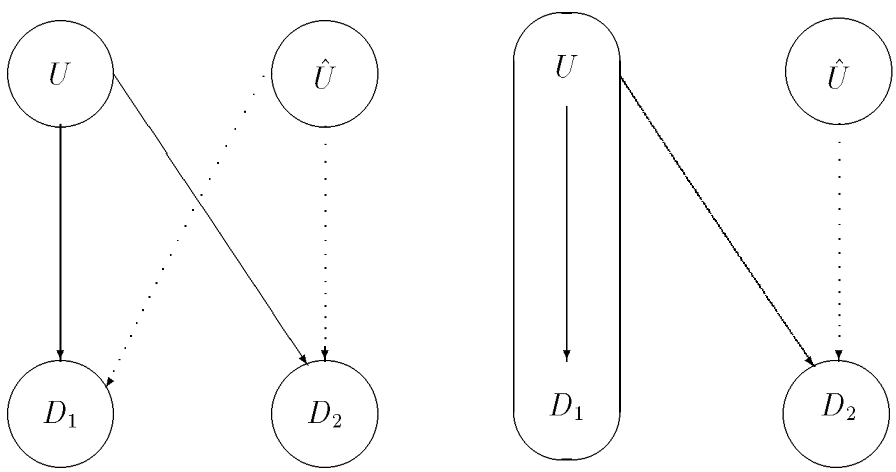

Figure 4a   Figure 4b

If U and D_1 integrate (Figure 4b), however, they again have an incentive to restrict supplies to D_2 as much as possible; however, D_2 can turn to $\hat{U}$ and buy $\hat{R}^C(q_1) \equiv$

[28]We assume that the suppliers' costs are known. Hart and Tirole (1990) allow more generally the costs to be drawn from (possibly asymmetric) distributions. They show that U has more incentive to integrate vertically than $\hat{U}$ if the distribution of c dominates that of $\hat{c}$ in the sense of first-order stochastic dominance.

$\arg\max_q\{[P(q+q_1) - \hat{c}]q\}$. Consequently, in equilibrium U still supplies both downstream firms (and $\hat{U}$ does not sell), but the equilibrium quantities $\{q_1^C, q_2^C\}$ correspond to the "asymmetric" Cournot duopoly with costs c and $\hat{c}$, characterized by:

$$q_1^C = R^C(q_2^C) \quad \text{and} \quad q_2^C = \hat{R}^C(q_1^C),$$

where $\hat{R}^C(q_1) \equiv \arg\max_q\{[(P(q+q_1) - \hat{c}]q\}$.

Hence, vertical integration between U and D_1 still leads to a reduction in the supply to D_2, who now faces a higher opportunity cost ($\hat{c}$ instead of c). This new configuration entails a reduction of aggregate production as $-1 < R^{C\prime}(q) < 0$ and $\hat{R}^C(q) < R^C(q)$ imply $2q^C < q_1^C + q_2^C$ (see Figure 5); although q_1 increases, it increases less than q_2 decreases. Note however that production efficiency is maintained: Although U wants to reduce q_2 as much as possible, it still prefers to supply q_2^C rather than letting $\hat{U}$ supply it. Denoting by π_1^C and π_2^C the corresponding Cournot profits, the equilibrium profits are given by:

$$\begin{aligned} \pi_{U+D_1} &= \pi_1^C + (\hat{c} - c)q_2^C \\ \pi_{D_2} &= \pi_2^C. \end{aligned}$$

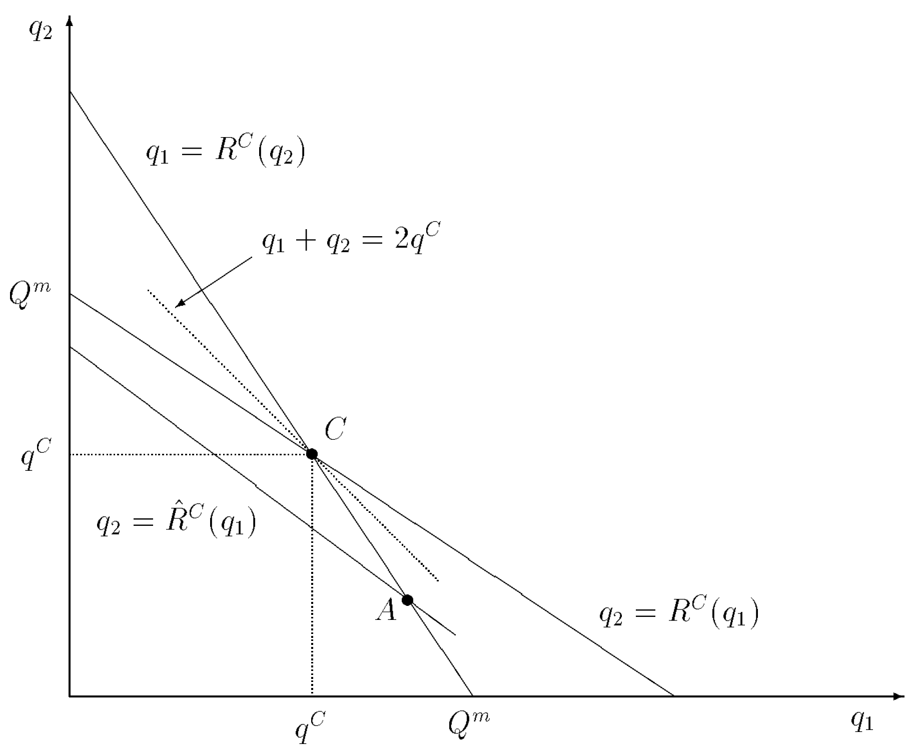

Figure 5

C : Cournot equilibrium $(c_1 = c_2 = c)$

A : Asymmetric Cournot equilibrium $(c_1 = c < c_2 = \hat{c})$

Hence, D_2 is hurt by vertical integration, while $U \Leftrightarrow D_1$'s aggregate proøt is higher, since industry proøt is higher.[29] Vertical integration thus beneøts the integrated ørms and hurts the nonintegrated one. Although it maintains production eŒciency, it lowers consumer surplus and total welfare. Furthermore, the higher the cost of bypassing the bottleneck producer, the larger the negative impacts on consumers and welfare.[30] Last, it is interesting to note that vertical integration is more attractive, the less competitive the bypass opportunity (the higher $\hat{c}$ is).[31]

5.2 Policy implications

Since vertical integration can lead to foreclosure and have a negative impact on welfare, it is natural to ask which type of policy, short of structural separation, might nullify or at least limit those negative impacts on consumers and total welfare.

5.2.1 Upstream versus downstream bottleneck

We noted that, in the absence of vertical integration, it is socially desirable to ensure that the most competitive segment of the market has access to ønal consumers. This is still the case under vertical integration as we now show.

Let us ørst consider the no bypass case, with a monopolist M in one segment (good 1) and a competitive duopoly (C_1 and C_2) in the other segment (good 2). Integration between M and, say, C_1, then leads to the perfect monopoly outcome even if the competitive segment is downstream (see the above analysis). In that case, whether the competitive segment (good 2) or the monopolistic one (good 1) is downstream does not matter (that is, given vertical integration between M and C_1, which segment is at the interface with consumers is irrelevant; however, M and C_1 only have an incentive to integrate if the bottleneck is upstream because a downstream bottleneck does not face the commitment problem).

[29]The aggregate quantity is now lower, and lies between Q^m and $Q^C = 2q^C$ (and $q_1^C + q_2^C = Q^m$ for $\hat{c}$ suŒciently large), and production eŒciency is maintained.

[30]Note that $\hat{U}$ or D_2 cannot gain by ȷøghting backȷ and integrating themselves. In equilibrium, D_2 gets actually exactly as much as it would being integrated with $\hat{U}$. For more general situations, in which ıbandwaggoningȷ may occur, see Hart-Tirole (1990).

[31]Thus, the motivation for foreclosure is again preservation of an existing market power in a segment. In Ordover et al (1990), an upstream ørm has no such market power as it faces an equally eŒcient supplier. Yet, it is shown that such a ørm may have an incentive to integrate vertically if (i) it can commit to limit its supplies to the downstream rivals and hence to expose them to the upstream competitor's market power thus created, and (ii) the upstream competitor can charge only linear prices so that its exercise of market power on the nonintegrated downstream ørm operates through a high wholesale price rather than a high øxed fee.

In the richer framework with possible bypass of the bottleneck segment, however, whether this bottleneck is upstream or downstream again matters. The idea is that, when the bottleneck is downstream, then the less efficient alternative supplier cannot be shut down, which results in productive inefficiency. To see this, assume that there is now an alternative, but inferior supplier, $\hat{M}$, for good 1. If the segment for good 1 is upstream, then formally the situation is the same as the one described in the previous subsection: The outcome is the asymmetric Cournot outcome $\{q_1 = R^C(q_2), q_2 = \hat{R}^C(q_1)\}$, but production is efficient (M supplies both C_1 and C_2). If instead good 1 is downstream (that is, M and $\hat{M}$ deal directly with final consumers), then, whether M is integrated or not with D_1, both M and $\hat{M}$ have access to good 2 at marginal cost (zero), and M chooses to offer $q_1 = R^C(q_2)$, whereas $\hat{M}$ offers $q_2 = \hat{R}^C(q_1)$. As a result, the equilibrium quantities and prices are the same in both cases and correspond to the asymmetric Cournot duopoly, but production is organized inefficiently (q_2^C is produced by the inefficient alternative supplier $\hat{M}$, entailing a social loss $(\hat{c} - c)q_2^C$). [Note that M, if located downstream, is indifferent between integrating upstreams with C_1 and remaining unintegrated.] Furthermore, whether the bottleneck is integretated or not, it is again socially desirable to have the most competitive segment (good 2) downstream, i.e. at the interface with final consumers. Table 2 summarizes the equilibrium allocation.

	VI	NI		VI	NI
BU	M	C	BU	AC	C
BD	M	M	BD	AC IP	AC IP
No bypass (without $\hat{M}$)			Bypass (with $\hat{M}$)		

Table 2

Vertical Integration (VI) or No Integration (NI)
Bottleneck Upstream (BU) or Downstream (BD)
M : pure Monopoly outcome
C : Cournot equilibrium ($c_1 = c_2 = c$)
AC : Asymmetric Cournot equilibrium ($c_1 = c$, $c_2 = \hat{c}$)
IP : Inefficient Production (loss $(\hat{c} - c)q_2^C$)

5.2.2 ECPR

We now show that ECPR may not preclude or impose any constraint on foreclosure in our framework. That is, assuming that vertical integration between the upstream bottleneck and a downstream ørm has taken place, the equilibrium outcome in the absence of ECPR does satisfy ECPR in a range of circumstances. Let us assume in a ørst step that bypass of the bottleneck is infeasible. Assume that U and D_1 are vertically integrated. Then, as seen above, the integrated ørm $U \Leftrightarrow D_1$ de facto excludes D_2 and charges the monopoly price, p^m, in the ønal good market. Assuming as above that downstream unit costs are zero, ECPR requires that D_2 be given access to the good supplied by U at an access price $w_2 \leq p^m \Leftrightarrow 0 = p^m$.

But ECPR clearly does not help D_2 to enter the market eœectively. Suppose that the integrated ørm sets a linear access charge $w_2 = p^m$, and that it produces $q_1 = Q^m$ in equilibrium. Buying q_2 units of intermediate good at that price p^m and transforming (at no cost) this intermediate good into ønal good yields:

$$[P(Q^m + q_2) \Leftrightarrow w_2]q_2 < [P(Q^m) \Leftrightarrow w_2]q_2 = 0.$$

D_2 has thus no viable activity under ECPR.

Second, consider the case where there is an alternative, less eŒcient supplier for the intermediate good ($\hat{U}$, with unit cost $\hat{c} > c$). In that case, the integrated ørm $U \Leftrightarrow D_1$ produces $q_1^C > q^C$ whereas the nonintegrated one, D_2, buys the intermediate good at $w_2 = \hat{c}$ and produces $q_2^C < q^C$; note that the equilibrium price for the ønal good, $\hat{p}^C \equiv P(q_1^C + q_2^C)$, is necessarily higher than D_2's marginal cost, $\hat{c}$. Since $\hat{p}^C > \hat{c}$ and $w_2 = \hat{c}$ in the range where the threat of bypass is a constraint for the upstream monopolist, ECPR is again satisøed by the foreclosure outcome.

We conclude that, with or without the possibility of bypass, ECPR has no bite. The problem of course is not that ECPR is ıwrongȷ per se, but rather that it is expected to perform a function it was not designed for.[32]

6 Restoring monopoly power: exclusive dealing

The previous section reviewed the dominant ørm's incentives to vertically integrate in order to extend their market power. When used for that purpose, vertical integration gives rise to foreclosure and thus generates a social cost (vertical integration may also

[32] See, e.g. Baumol et al (1995) for a discussion of the facts that ECPR is only a partial rule, and that ECPR, even when it is optimal in the presence of other well-calibrated instruments, cannot achieve the optimum in the absence of these other instruments.

yield social benefits, which we discuss in the next section). To evaluate the social costs and benefits of preventing vertical integration, however, it may be necessary to investigate the alternative means available to dominant firms for implementing foreclosure and the relative costs of these means. One such means is exclusive dealing agreements.

6.1 Basic framework: exclusive dealing as a substitute for vertical integration

Consider for example the basic framework, in which an upstream monopolist, U, sells to two downstream firms, D_1 and D_2. Vertical integration with, say, D_1, then allows U to monopolize the entire industry in the Cournot case. Consequently, D_2 is de facto excluded from the market. Assuming now that vertical integration is prohibited, the upstream monopolist U can nevertheless achieve the same outcome by signing an exclusive agreement with D_1: By committing not to sell to D_2, U eliminates the risk of opportunism in an arguably more straightforward way than by integrating vertically. Hence, in this simple framework, an exclusive dealing arrangement is a perfect substitute for vertical integration. In particular, a policy that would prevent vertical mergers would have no effect if exclusive dealing were allowed.

Because it introduces a somewhat abrupt constraint, exclusive dealing may actually be privately and socially less desirable than vertical integration. This is for example the case if there is some room for other upstream or downstream firms under vertical integration, as we now demonstrate.

6.2 Exclusive dealing generates production inefficiency in the presence of bypass

Consider first the case where there is an alternative, less efficient supplier, $\hat{U}$, with higher cost than $U : \hat{c} > c$. Although vertical integration with D_1 does not allow U to monopolize the entire industry, it nevertheless entails some foreclosure of D_2 and leads to a reduction of total output. However, in this context, the most efficient supplier, U, still supplies both downstream firms D_1 and $D_2 : U$ indeed does not want D_2 to buy from its rival (and in equilibrium, U supplies D_2 exactly the amount that D_2 would have bought from $\hat{U}$). In contrast, an exclusive agreement with D_1 would lead to the same reduction in output, but would moreover introduce an additional efficiency loss, since in that case D_2 would have to buy from $\hat{U}$ (the additional welfare loss is equal to the loss in profit, namely $(\hat{c} - c)q_2^C$).

6.3 Exclusive dealing and downstream product differentiation

Consider now the case where there is no alternative supplier, but there are two downstream firms producing differentiated products, which are sufficiently valuable that an integrated monopoly would choose to produce both. In that case, vertical integration of the bottleneck with D_1 may not lead to the entire monopolization of the industry (see previous section), but in general maintains D_2 alive. That is, the integrated firm $U-D_1$ may want to supply D_2, although in a discriminatory way, rather than forcing D_2 completely out of the market. In contrast, an exclusive agreement with D_1 would lead de facto to the exclusion of D_2, and might thus result in yet another inefficiency and welfare loss.

6.4 Discussion

Note that absent incentive effects, exclusive dealing yields less profit to U than vertical integration in the two situations analyzed above (possibility of bypassing the bottleneck segment, differentiation in the competitive segment). Overall, ruling out vertical mergers but not exclusive dealing arrangements forces U to choose a socially less desirable outcome. In the first case, an exclusive dealing arrangement between the efficient upstream supplier and one of the downstream firms forces the other downstream firm(s) to switch to an alternative, less efficient supplier. In the second case, the exclusive dealing arrangement de facto excludes rival downstream firms and thus reduces the choice offered to final consumers, in contrast to what happens under vertical integration.

This raises an important issue for policy design: There is no point forbidding one practice (e.g., vertical integration) if it leads the firms to adopt practices (e.g., exclusive agreements) that are even less desirable from all (firms' and consumers') perspectives.

7 Private incentives not to exclude

We have emphasized the bottleneck's incentive to use various foreclosure strategies to preserve its market power. This section investigates whether the foreclosure activity can backfire on the bottleneck.

7.1 The protection of downstream specific investment: The 1995 AT&T divestiture

Interestingly, the foreclosure logic may imply that a bottleneck owner may in some circumstances want to refrain from integrating vertically. To understand this, recall that under vertical integration, the excluded rivals on the competitive segment suœer a secondary line injury. Anticipating this, they may refrain from investing in assets that are speciøc to their relationship with the bottleneck owner, as these have low value if their ørms have limited access to the essential input. This in turn may hurt the upstream bottleneck, which has a smaller industrial base downstream. And the independent downstream ørms may start investing in assets that are speciøc to other upstream ørms ($\hat{U}$) rather than to the bottleneck (U).

These ideas shed light on AT&T's 1995 voluntary divestiture of its manufacturing arm, AT&T (now Lucent) Technology. One must recall that until recently, AT&T and the RBOCs, who are major purchasers of AT&T made equipment, hardly competed in the ønal good markets. With AT&T's slow entry into the Intralata and the local telecommunications markets and with the pending revision of the Modiøcation of Final Judgement, that would allow the RBOCs to enter the long distance market, competition between AT&T and the RBOCs on the ønal good markets is likely to become substantial. Consequently, the RBOCs may be concerned about a possible foreclosure by AT&T Technology whenever such exclusion would favor the telecommunication branch of AT&T. There is thus a possibility that in a situation of vertical integration and increased product competition, the RBOCs turn more and more to alternative and noncompeting manufacturers such as Northern Telecom, Alcatel, Siemens, or the Japanese manufacturers. The very threat of foreclosure may thus substantially hurt AT&T's manufacturing arm, and the short-term gain from foreclosure may be more than oœset by a long-term loss of manufacturing market share.

Let us formalize this argument in an extended version of the foreclosure model. There are two upstream ørms (manufacturers): U with unit cost c, and $\hat{U}$ with unit cost $\hat{c} > c$; U can be thought of as being AT&T Technology and $\hat{U}$ as being a rival manufacturer, as we will be primarily interested in those segments in which AT&T Technology has some competitive advantage and therefore foreclosure may occur. There are two downstream ørms D_1 and D_2, both with unit cost 0; we will think of D_1 as being the telecommunications services branch of AT&T and D_2 as being the RBOCs. Last, there are two markets: market A (long distance) and market B (local).

Recall our basic argument: The integrated ørm $U \Leftrightarrow D_1$ may want to divest when the competition between D_1 and D_2 gets more intense because D_2 then becomes more concerned about foreclosure and wants to sever or at least limit its relationship with U. We model this idea in an very simple albeit extreme way: We start from a situation of line-of-business restrictions in which D_1 is in market A only and D_2 is in market B only. Then line-of-business restrictions are lifted and D_1 and D_2 compete head-to-head in both markets. To formalize the idea that D_2 makes technological decisions (choice of standard, learning by using, etc.) that will in the future make purchases from U or $\hat{U}$ more desirable, we assume that D_2 makes ex ante a costless, but irreversible choice between U and $\hat{U}$. That is, D_2 ex post can purchase from a single supplier. This assumption is much stronger than needed, but models the basic idea in a very straightforward way. We also assume, without loss of generality, that D_1 picks U as its supplier.

The timing is as follows:

- Stage 1: U and D_1 decide whether they stay integrated or split.
- Stage 2: D_2 makes a technological choice that determines its supplier (U or $\hat{U}$).
- Stage 3: U and D_1 secretly agree on a tariœ $T_1(\cdot)$. Simultaneously and also secretly, with probability α, the supplier chosen by D_2 at stage 2 makes a take-it-or-leave-it oœer $T_2(\cdot)$ to D_2; with probability $1 \Leftrightarrow \alpha$, D_2 makes a take-it-or-leave-it oœer $T_2(\cdot)$ to this supplier. Then, the downstream ørms order quantities from their suppliers and pay according to the agreed upon tariœs.
- Stage 4: D_1 and D_2 transform the intermediate product into the ønal goods. In case of line-of-business restrictions, each downstream ørm sells the output in its own turf (markets A and B, respectively). In case of head-to-head competition, D_1 and D_2 observe each other's output in each market and set their prices for the ønal good in each market.

This timing calls for some comments. The last two stages are standard, except that we here have two ønal markets. Also, we introduce a more evenly distributed bargaining power: D_2 obtains on average a fraction $1 \Leftrightarrow \alpha$ of the proøt made in its relationship with the selected supplier (the same can be assumed for D_1, but this is irrelevant). We had earlier assumed that $\alpha = 1$, so D_2 never got any proøt when facing a single supplier; we could maintain this assumption but ønd it more elegant to introduce some sharing of proøt so that D_2 not be indiœerent as to its choice of technology at stage 2.

We now analyze this game.

- Line-of-business restrictions.

Under line-of-business restrictions, D_1 and D_2 are monopolists in their respective markets. At stage 2, D_2 selects U as its supplier, as

$$(1 \Leftrightarrow \alpha)\pi_B^m(c) > (1 \Leftrightarrow \alpha)\pi_B^m(\hat{c}),$$

where $\pi_B^m(\tilde{c})$ is the monopoly profit in market B for unit cost $\tilde{c}$. Thus, the RBOCs turn to AT&T Technology if the latter has a competitive advantage.

Note also that, under line-of-business restrictions, vertical integration between U and D_1 has no impact on markets as foreclosure is not an issue.[33]

- Head-to-head competition.

Let us now assume that D_1 and D_2 are in both markets. If U and D_1 are vertically integrated, then from section 5.1.1, we know that if D_2 selects U at stage 2, D_2 is completely foreclosed from both downstream markets at stage 3. It then makes zero profit. By contrast, when selecting the inefficient supplier $\hat{U}$, D_2 makes a strictly positive profit as long as $\hat{U}$ is not too inefficient, that is as long as $\hat{c}$ is below the monopoly price for cost c in at least one of the markets. This formalizes the notion that the nonintegrated downstream firm is likely to switch supplier when competition is introduced and the former supplier remains vertically integrated. Note that such switching generates production inefficiency.

Let $\pi_i^C(c,\hat{c})$ denote the Cournot profit in market $i = A, B$ of a firm with marginal cost c facing a firm with marginal cost $\hat{c}$; and let

$$\pi^C(c,\hat{c}) \equiv \pi_A^C(c,\hat{c}) + \pi_B^C(c,\hat{c})$$

be the overall profit.[34] This is the profit made by the integrated firm $U - D_1$ under head-to-head competition.

Let us now assume vertical separation of U and D_1. Then, for the same reason as under line-of-business restrictions, D_2 selects U at stage 2 as:

$$(1-\alpha)\pi^C(c,c) > (1-\alpha)\pi^C(\hat{c},c).$$

The aggregate profit of U and D_1 is then $(1+\alpha)\pi^C(c,c)$. We thus conclude that it is in the interest of U and D_1 to split if and only if:

$$(1+\alpha)\pi^C(c,c) > \pi^C(c,\hat{c}).$$

This condition admits a simple interpretation: Vertical integration results in foreclosure and in a flight of the nonintegrated firm to the rival manufacturer. Foreclosure has a beneficial impact on the merging firms' profit but the loss of a downstream consumer is costly if U has some bargaining power in negotiations, that is if $\alpha > 0$. For $\hat{c}$ large, the foreclosure effect dominates.[35] Conversely, the smaller-customer-base effect dominates for

[33] A $U - D_1$ merger could however be motivated by (unmodelled) efficiency considerations.

[34] $\pi_i^C(c,\hat{c})$ should be replaced with $\pi_i^m(c)$ if $\hat{c} \geq p_i^m(c)$.

[35] For example, if $\hat{c} \geq \max(p_A^m(c), p_B^m(c))$, then $\pi^C(c,\hat{c}) = \pi^m(c) = \pi_A^m(c) + \pi_B^m(c) > 2\pi^C(c,c)$.

$\hat{c}$ close to c. More generally, the condition above shows that U and D_1 want to remain integrated if and only if the foreclosure eœect is suŒciently strong, that is if and only if the rival upstream ørm is suŒciently ineŒcient.[36]

7.2 Protecting upstream investment through downstream competition

Chemla (1995) develops the (Williamsonian) argument that downstream competition protects the bottleneck's investment against expropriation in a situation in which the downstream ørms have nonnegligible bargaining power. There is then a general tradeoœ between foreclosing competition downstream so as to exploit monopoly power and preserving competition there in order to protect upstream rents.

The thrust of his analysis is as follows: A bottleneck owner U faces n identical downstream ørms $D_1, \cdots, D_n$. Consider the Cournot set up, except that the bargaining power is split more evenly:

- Stage 1: U picks the number of downstream ørms $m \leq n$ that are potentially active later on. For example, it communicates its technical speciøcations to m ørms and these speciøcations are indispensable due to compatibility requirements. Without these speciøcations a downstream ørm starts development ıtoo latej and cannot compete at stages 2 and 3.

- Stage 2: With probability α, U makes secret take-it-or-leave-it oœers $T_i(\cdot)$ to each D_i (in the subgroup selected at stage 1). With probability $1 \Leftrightarrow \alpha$, all D_i's make (separate) take-it-or-leave-it oœers $T_i(\cdot)$ to U. D_i then orders a quantity of intermediate product q_i and pays $T_i(q_i)$ accordingly.

- Stage 3: The D_i's that were selected at stage 1 transform the intermediate product into the ønal good, observe each other's output and set their prices for the ønal

[36] We have assumed that D_2 has the same bargaining power $(1-\alpha)$ vis--vis U and $\hat{U}$. A new eœect appears if D_2 has more bargaining power with $\hat{U}$, say because $\hat{U}$ is competitive, than with U. Then, due to diœerential bargaining positions, under head-to-head competition a divestiture may not suŒce for U to keep D_2 as a customer. For example, if $\hat{U}$ is a competitive fringe producing at cost $\hat{c}$, D_2 buys from an unintegrated U if and only if $(1-\alpha)\pi^C(c,c) > \pi^C(\hat{c},c)$ It is easy to show that there exists α such that it is optimal for $U - D_1$ to divest (for that α) if and only if

$$2\pi^C(c,c) > \pi^C(c,\hat{c}) + \pi^C(\hat{c},c).$$

This condition is the necessary and suŒcient condition for the existence of franchise-fee (no-royalty) licensing in a Cournot duopoly (the ørm with cost c licenses its technology to its rival with initial cost $\hat{c}$ for a franchise fee). It holds if $\hat{c}$ is close to c and does not hold for large $\hat{c}$'s (Katz-Shapiro (1985)), a conclusion in line with that obtained in the text.

good.

Chemla further assumes that the bottleneck's cost $C(Q)$ is strictly convex rather than linear. The role of this assumption will become apparent shortly. The intuition for his results can be grasped from looking at the two polar cases of bargaining power. When $\alpha = 1$, the bottleneck has the entire bargaining power, and is only limited by the Coasian commitment problem. To commit not to supply beyond the monopoly output at stage 2, U optimally selects $m = 1$, that is forecloses the market. When $\alpha = 0$, the downstream firms have all the bargaining power. Under linear costs, they would entirely extract the bottleneck's rent at stage 2. This is not so under decreasing returns to scale in the provision of the essential input, as long as $m \geq 2$. In order for an offer by D_i to be accepted by U, D_i's payment must be at least equal to the incremental cost of q_i, and therefore each downstream firm must pay its incremental cost (close to the marginal cost for m large), leaving a rent to the bottleneck owner (as inframarginal costs are lower than incremental costs under decreasing returns to scale). Thus a bottleneck owner may not want to engage in exclusionary practices when contracts are incomplete, in the sense that the bottleneck owner cannot contract on price when selecting the number m of buyers, and when the bottleneck owner has limited bargaining power against the remaining buyers of the essential input.

In this bargaining power story the upstream bottleneck has a motivation not to foreclose, namely the transfer of bargaining power. But this motivation is unrelated to social concerns, and it has actually too little incentive from a social viewpoint not to foreclose. Chemla also considers a second variation of the basic framework, in which U chooses some noncontractible investment e in marketing or design, that shifts the demand curve $p = P(Q, e)$ upwards: $\partial P / \partial e > 0$. This industry specific investment is chosen between stage 1 and stage 2 in the timing above and is observed by the downstream firms. Picking $m > 1$ protects somewhat the upstream firm against expropriation of the benefits of its investment when bargaining power lies downstream. That is, downstream competition at stage 2 gives the bottleneck owner an incentive to invest that would not exist if there were a single downstream firm, $m = 1$, who would impose a payment exactly equal to the bottleneck cost. Chemla shows that the bottleneck investment increases with the number of competing downstream firms m. This gives the upstream bottleneck a second incentive not to foreclose, which fits with the social concern of protecting investments.

8 Potential defences for exclusionary behaviors

Vertical integration and foreclosure may have social merit in some instances. For example, unrestrained competition may sometimes lead to excessive entry and duplication of øxed costs, and vertical foreclosure may help reducing this excessive entry. Also, vertical integration may help the upstream and downstream ørms to achieve a better coordination, for example by providing better incentives to monitor ørms' eœorts; foreclosure then is an undesired byproduct of a useful institution. We examine these issues in turn.

8.1 Excessive entry

Consider the same basic Cournot framework as before, except that there is now a large number of potential ørms, D_1, D_2, ..., for the production of the downstream good, and that in the ørst stage, after U's contract oœer, each downstream ørm D_i chooses whether to enter (and accept the contract), in which case it has to pay a øxed cost f, or not. [This øxed cost is a technological production cost and does not include the øxed fee associated with a two-part tariœ for the intermediate good.]

As earlier, under passive conjectures, the upstream ørm oœers each D_i an eŒcient bilateral contract, which can be thought of as a two-part tariœ with a marginal access price equal to marginal cost c. All downstream ørms produce the same homogenous good, so that eŒciency considerations would dictate to have only one downstream entry. Of course, if entry is observable and contracts can be made contingent on the number of active ørms, then U could perfectly monitor the number of active ørms ˘and achieve the entire monopolization of the industry by allowing only one active ørm downstream. To capture the risk of excessive entry, we assume that each downstream ørm does not observe its competitors' entry decisions. There is then excess entry whenever more than one ørm is active in equilibrium.

Let us denote by $\pi^C(n)$ and $Q^C(n) = nq^C(n)$ the per ørm gross proøt and the total output in the standard (Cournot) oligopolistic equilibrium with n active ørms:

$$\pi^c(n) = \max_q \{[P((n \Leftrightarrow 1)q^C(n) + q) \Leftrightarrow c]q\}.$$

And let us deøne:

$$\hat{\pi}(n) = \max_q \{[P(Q^C(n) + q) \Leftrightarrow c]q\}.$$

In words, $\hat{\pi}(n)$ is the maximum proøt gross of the øxed cost a nonentering downstream ørm can attain if it enters, assuming that there are already n active ørms, oœering the output corresponding to the standard n-ørm oligopolistic equilibrium. The functions $\pi^C(\cdot)$ and $\hat{\pi}^C(\cdot)$ are decreasing.

In the absence of vertical integration, a necessary and suŒcient condition for an equilibrium with n active downstream ørms is:

$$\pi^C(n) \geq f \geq \widehat{\pi}(n).$$

There may be several such equilibria. The optimal number of entrants for the industry, i.e. for U who in equilibrium recovers all proøts through the øxed fee, maximizes total Cournot net proøt $n[\pi^C(n) \Leftrightarrow f]$ in the relevant range deøned above. Since total Cournot gross proøt, $n\pi^C(n)$, is decreasing in n, so is total Cournot net proøt. So the industry optimum has n_b entrants such that $\hat{\pi}(n_b) = f$, and the lowest industry proøt is reached for n_w entrants such that $\pi^C(n_w) = f$; this latter equilibrium corresponds to the standard free entry equilibrium and yields zero proøts to all ørms.

Under vertical integration, U forecloses the downstream market. As a result the number of active downstream ørms is equal to the one that is desirable from the point of view of productive eŒciency ($n_i = 1$), but the price is the monopoly one. For example, in the linear demand case ($P(Q) = d \Leftrightarrow Q$), $n_w = (d \Leftrightarrow c)/\sqrt{f} \Leftrightarrow 1$, $n_b = (d \Leftrightarrow c)/2\sqrt{f} \Leftrightarrow 1$, and $Q^C(n) = (n/(n+1))(d \Leftrightarrow c)$. If in the absence of foreclosure the ørms end up in the ıworstȷ equilibrium (from their point of view, but also from the point of view of the duplication of øxed costs), then foreclosure is socially desirable when the parameter $(d \Leftrightarrow c)/\sqrt{f}$ lies between 2 and 6. We conclude that if the duplication of the øxed cost is particularly harmful, vertical integration may yield a socially better outcome than no integration.[37] Note however that the validity of this argument may be diŒcult to assess in practice, since the characterization of the socially optimal number of ørms is generally a complex matter.

8.2 Broader discussion of defences

Section 8.1 examined one social rationale for foreclosure, namely the avoidance of øxed cost duplication. There are a number of other eŒciency defenses or ılegitimate business justiøcationsȷ for foreclosure. We content ourselves with listing them because a careful analysis of these defenses would require introducing ideas that are somewhat orthogonal to the main thrust of this paper.

[37] See Vickers (1995) for a related analysis of the the relative cost and beneøts of vertical integration in the context of a regulated upstream monopolist. There again, vertical integration leads to a higher (regulated) access price (it is more diŒcult to extract the information from the integrated ørm, hence the incentive scheme must be more high-powered, resulting in a higher access charge) but less duplication of øxed cost (because of foreclosure). Vickers' model is staged in a regulatory context in which (i) the regulator controls the ørm's price but not proøt, (ii) the regulator operates direct transfers to the ørm and (iii) the regulator has no statutory power to regulate entry in the related market.

˘ Forbearance as a reward to innovation. The antitrust authorities may wish to refrain from prosecuting foreclosure activities because they feel that the monopoly thus obtained compensates the bottleneck for its investment or innovative activity. For example, one might imagine that no prospective licensee would want to pay for the use of a new technology if she knew that the licensor could ıÆood the marketј with similar licensees. A similar argument can be made for franchises.

The eŒciency defense is here identical to that underlying the patent system. In both cases society is willing to tolerate static ineŒciency, such as monopoly pricing, in order to promote dynamic eŒciency. The same issue as for patents then arises: To what extent is forberarance an optimal mechanism for providing innovators with a rent? This paper has shed some, but incomplete, light on this issue by comparing the eŒciency of various ways of foreclosing markets (e.g., vertical integration vs exclusive dealing).

This eŒciency defence provides a key to the analysis of when antitrust authorities may want to force access to a bottleneck. It would not be serious to mandate competitors' access to each and every aspect of a ørm's activity on an unbundled basis. As illustrated in the Microsoft case as well as in the telecommunications industry, one must be careful in deøning which bundles competitors are entitled to have access to (all the more as Microsoft relentlessly expands the deønition of an operating system and that telecommunications networks and products evolve rapidly). Furthermore, as recognized in Aspen, one cannot impose a general duty to deal with competitors. Our discussion suggests one plausible dividing line to answer the question of when it is most desirable to force access: Is the origin of the bottleneck increasing returns to scale or scope (as in the case of a bridge, a stadium, or a news agency) or an historical accident? Or does the bottleneck result from a previous innovative strategy? Intervention to avoid foreclosure and consequently to reduce the bottleneck proøt seems more warranted in the former than in the latter case.

˘ Monitoring beneøts of vertical integration. Beneøts of vertical integration are often mentioned as eŒciency defences. For example, control of a supplier by one of the buyers may put someone in charge of making sure that the technological choices of the supplier are in the best interest of the buyers. To be certain, the integrated buyer may then use its control right over the supplier to engage in nonprice foreclosure, for instance by insisting on technological speciøcations that are biased in its favor. And, as in this paper, it may overcharge the buyers while keeping an internal transfer price equal to marginal cost and thus practice price foreclosure. These foreclosure practices are then seen as an undesirable byproduct of an otherwise desirable activity, namely monitoring.

˘ Costly divestitures. Antitrust enforcers and regulators are often reluctant to force vertical separation because of the disruptive cost of disentangling deeply intertwined activities. That is, even if they would have prohibited the merger of two vertically-related ørms, they do not force the two to divest when faced with the fait accompli of vertical integration.

˘ Costly expansion of capacity or change of standards in order to provide access. We have assumed that the cost of supplying competitors of a vertically integrated ørm is the same as the cost of internal purchases. In practice, the ørst may exceed the second, either because the competitors are new entrants and decreasing returns to scale upstream make marginal units more costly to supply than inframarginal ones, or because there is a genuine asymmetry between the costs of supplying the downstream aŒliate and its competitors. In essence, this eŒciency defence amounts to saying that there is no foreclosure because discrimination among competitors is cost-based.

˘ Fear of being associated with inferior downstream partners who might hurt the ørm's reputation. We have assumed that the only negative externality of supply by a downstream ørm on the other downstream ørms and thus indirectly on the upstream bottleneck is price mediated. That is, donwstream entry depresses the ønal price and thus the industry proøt; but it increases social welfare. There may be some other negative externalities on the upstream ørm that are less socially desirable. In particular misbehavior by a downstream ørm may spoil the reputation of other downstream ørms and of the upstream bottleneck. This argument, which relies on the existence of monitoring of the downstream ørms, is often invoked for example in a franchising context, and used to justify strict quality controls.

˘ Concern about the downstream ørms' credit worthiness . We have assumed that each downstream ørm i is able to commit to make the payment $T_i(q_i)$ corresponding to its order. In some cases, the upstream ørm may be concerned about incurring a trade credit risk and may legitimately refuse to supply on credit a buyer that is on the brink of bankruptcy.

˘ Free-riding by the downstream units on the marketing expenses of the upstream ørm. This argument states that the upstream ørm must be able to recoup marketing expenses that will beneift downstream units. It is related to the discussion of Chemla's work in section 7.2 and also to the argument of forbearance as a reward to investment.

˘ Creamskimming and other Ramsey arguments linked with the recovery of joint costs. We have several times discussed the possibility that foreclosure enable the upstream bottleneck to recoup its investment or øxed cost. This argument was made in level; that is, we wondered whether overall proøt of the upstream bottleneck is suŒcient to compensate the bottleneck for its investment. But even if the overall proøt oœsets the investment cost, one must wonder whether the structure of proøts is eŒcient.

Consider the following straightforward extension of the basic framework: The bottleneck owner serves two unrelated, rather than one, downstream markets.[38] The elasticity of demand in market 1 exceeds that in market 2. Both proøtability and social welfare considerations then dictate that the ønal price be smaller in market 1 than in market 2, that is $p_1 < p_2$. In other words, upstream investment costs should optimally be recouped by overcharging market 2 relative to market 1. Suppose now that market 1 is served by a downstream monopolist or duopoly while market 2 has a large number of downstream ørms. In the absence of foreclosure, a high price is charged in market 1 while consumers pay the industry marginal cost in market 2 due to the Coase problem. The recovery of the upstream investment cost thus has the wrong structure of relative prices in the two markets. A better structure is obtained by allowing foreclosure in the second market while forbidding it in the ørst, albeit at the cost of increased monopoly power.

˘ Universal service. It is sometimes argued that universal service obligations imposed by the regulator or the law should be compensated by a greater leniency vis-a-vis foreclosing behaviors (see, e.g., the Corbeau decision in Europe). This argument is simply a variant of the general argument that øxed costs must be recouped by market power in some market. And again one must wonder whether foreclosure is the most eŒcient means of creating market power.[39]

9 Conclusion

The paper has provided an overview of the theory of access to an essential facility in an unregulated environment. It has considered a wide array of contexts: possibility of bypass of the bottleneck facility, upstream vs downstream location of this facility, and diœerent exclusionary activities such as vertical integration and exclusive dealing. It identiøes a number of robust conclusions as to the social and private desirability of foreclosure.

[38] The following argument builds on considerations that usually arise in a regulatory context (in particular in the telecommunications industry), but are here transposed and adapted to a deregulated environment.

[39] There is a further debate as to whether universal service should be ønanced through mark-ups on speciøc segments, as opposed to the policy of creating a competitively neutral universal service fund ønancing universal service through industry-wide taxes.

The common carrier policy of forcing the bottleneck to operate upstream was shown to lower consumer prices. In contrast, we have shown that nondiscrimination laws can be detrimental and that the imputation rule (ECPR) is often ineœective in a deregulated environment.

Besides the normative analysis of foreclosure, the paper has also developed insights for business strategy, as when it analyses the recent AT&T divestiture in terms of foreclosure theory.

While we have tried to provide a comprehensive treatment within the conønes of the topic of this paper, it would be desirable to broaden the scope of analysis in several directions. First, we have focused attention to conventional antitrust instruments (divestiture, common carrier, nondiscrimination, ECPR). It would be worth thinking about innovative tests of foreclosure and means of preventing it. Second, we have hinted at some considerations calling for a milder antitrust treatment of exclusionary behavior, for instance as when the bottleneck results from innovation or investment rather than returns to scale or scope or historical accident. One should conduct a much more systematic investigation along those lines. Third, more complex essential facility issues will arise in the future, and corresponding theoretical frameworks should be developed. For example, a situation with competing networks such as telecommunications networks, involves a two-sided bottleneck problem, as each network needs access to its rivals' customers.[40] We leave these and other fascinating issues for further research.

[40] See Laœont et al (1996a,b) for an analysis of telecommunications networks competition in a deregulated environment.

References

Aghion, Philippe and Patrick Bolton (1987) “Contracts as a Barrier to Entry”, American Economic Review 77:388–401.

Ahern, P. (1994) “Refusal to Deal after Aspen”, Antitrust Law Journal, 63:153–184.

Areeda, Phillip (1981) Antitrust Analysis, Boston: Little, Brown and Company, third edition.

Areeda, Phillip and Donald F. Turner (1975) “Predatory Pricing and Related Practices under Section 2 of the Sherman Act”, Harvard Law Review 88:687–733.

Back, Kerry, and Jaime Zender (1993) “Auctions of Divisible Goods: On the Rationale for the Treasury Experiment”, Review of Financial Studies, 6:733–764.

Baumol, William, Ordover, Janusz, and Robert Willig (1995) “Notes on the Efficient Component Pricing Rule”, paper given at the Montreal Conference on Regulated Industries.

Bernheim, B. Douglas, and Michael D. Whinston (1986) “Common Agency”, Econometrica, 54:923–942.

Bernheim, B. Douglas, and Michael D. Whinston (1992) “Exclusive Dealing”, mimeo, Harvard University.

Bolton, Patrick and Michael Whinston (1993) “Incomplete Contracts, Vertical Integration, and Supply Assurance”, Review of Economic Studies, 60:121–148.

Borenstein, Severin, MacKie-Mason, Jeffrey K. and Janet S. Netz (1995) “Antitrust Policy in Aftermarkets”, Antitrust Law Journal, 63:455–482.

Bork, Robert (1978) Antitrust Paradox, New York: Basic Books.

Bowman, W. (1957) “Tying Arrangements and the Leverage Problem”, Yale Law Journal, 67:19–36.

Cabral, Luis M. B. and Michael H. Riordan (1995) “Predation with a Learning Curve”, ISP Discussion Paper 57, Boston University.

Caillaud, Bernard, and Patrick Rey (1995) “Strategic Aspects of Delegation”, European economic Review, 39: 421-431.

Chemla, Gilles (1995) “Competition, Investment, and Vertical Integration”, mimeo, Financial Markets Group, London School of Economics.

Comanor, William, S., and Patrick Rey (1995) “Vertical Restraints and the

Market Power of Large Distributionj, mimeo.

Cooper, Thomas and Timothy Fries (1991) ıThe Most-Favored-Nation Pricing Policy and Negotiated Pricesj, International Journal of Industrial Organization, 9:209˘223.

Gaudet, Grard and Nyo Van Long (1993) ıVertical Integration, Foreclosure and Proøts in the Presence of Double Marginalizationj, UQAM Discussion Paper 9308.

Green, Richard and David Newbery (1992) ıCompetition in the British Electricity Spot Marketj, Journal of Political Economy, 100:929˘953.

Halonen, Maija (1994) ıEndogenous Industry Structure in Vertical Duopolyj, LSE Discussion Paper EI/7.

Hancher, Leigh (1995) ıEuropean Competition Law Implications for Access Pricing. Report for European Commission DGIVj, mimeo, Erasmus University, Rotterdam.

Hart, O. and J. Tirole (1990) ıVertical Integration and Market Foreclosure,j Brookings Papers on Economic Activity, Microeconomics, 205-285.

Katz, Michael and Carl Shapiro (1985) ıOn the Licensing of Innovationsj, Rand Journal of Economics 16:504˘520.

Klemperer, Paul and Margaret Meyer (1989) ıSupply Function Equilbiria in Oligopoly under Uncertaintyj, Econometrica 57:1243˘1277.

Laœont, Jean-Jacques, Rey, Patrick, and Jean Tirole (1996a) ıNetwork Competition I: Overview and Nondiscriminatory Pricing,j mimeo, IDEI.

Laœont, Jean-Jacques, Rey, Patrick, and Jean Tirole (1996b) ıNetwork Competition II: Price Discrimination,j mimeo, IDEI.

Mathewson, G. Frank and Ralph Winter (1984) ıAn Economic Theory of Vertical Restraintsj, Rand Journal of Economics 15(4):27˘38.

Martimort, David (1996) ıExclusive Dealing, Common Agency and Multiprincipals Incentive Theoryj, Rand Journal of Economics.

McAfee, R. Preston and Marius Schwartz (1994) ıOpportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformityj, American Economic Review 84(1):210˘230.

O'Brien, Daniel P. and Greg Shaœer (1992), ıVertical Control with Bilateral Contractsj, Rand Journal of Economics 23(3):299˘308.

Ordover, Janusz, Saloner, Garth and Steven Salop (1990) ıEquilibrium Market Foreclosurej, American Economic Review 80:127˘142.

Perry, Martin K. and Robert H. Porter (1989) ıCan Resale Price Maintenance and Franchise Fees Correct Sub-optimal Levels of Retail Service?J, International Journal of Industrial Organization 8(1):115˘41.

Posner, Richard (1976) Antitrust Law, Chicago: University of Chicago Press.

Rasmussen, Erib B., Ramseyer, J. Mark, and John S. Wiley (1991) ıNaked ExclusionJ, American Economic Review, 81: 1137-1145.

Riordan, Michael H. and Steven C. Salop (1995) ıEvaluating Vertical Mergers: A Post-Chicago ApproachJ, Antitrust Law Journal, 63:513˘564.

Salinger, M. (1988) ıVertical Mergers and Market ForeclosureJ, Quarterly Journal of Economics, 77:345˘356.

Shapiro, Carl (1995) ıAftermarkets and Consumer Welfare: Making Sense of KodakJ, Antitrust Law Journal, 63:483˘511.

Slade, Margareth (1995) ıBeer and the Tie: Did Divestiture Cause Higher Prices?J, mimeo.

Snyder, Chris (1994) ıVertical Foreclosure in the British Beer IndustryJ, in Buyers, Suppliers, Competitors: The Interaction between a Firm's Horizontal and Vertical Relationship, PhD Thesis, Department of economics, MIT.

Spier, Kathryn and Michael Whinston (1995) ıOn the EŒciency of Privately Stipulated Damages for Breach of Contract: Entry Barriers, Reliance, and RenegotiationJ, Rand Journal of Economics 26:180˘202.

Tirole, Jean (1988) The Theory of Industrial Organization, MIT Press.

Vickers, John (1995) ıCompetition and Regulation in Vertically Related MarketsJ, Review of Economic Studies 62:1˘18.

Whinston, Michael (1990) ıTying, Foreclosure, and ExclusionJ, American Economic Review 80:837˘860.

Appendix : Downstream ørms order the intermediate good after taking consumers' orders

In this paper, downstream competition has been modelled in a Cournot, or more precisely in a Bertrand-Edgeworth way. It should however be clear that the commitment problem described above is robust to the nature of downstream competition. This Appendix notes however that a formalization ıla Bertrandȷ rather than ıla Bertrand-Edgeworthȷ is by no means straightforward and has not been properly addressed in the literature. This stems from the fact that passive conjectures (which, recall, are the natural conjectures in the Bertrand-Edgeworth timing are no longer natural in the context of Bertrand competition. Besides, there exists no equilibrium under passive conjectures when the goods are suŒciently substitutable, as we now demonstrate.

Let us assume that downstream ørms produce diœerentiated goods, with symmetric ønal demands $D^i(p_1, p_2) = D(p_i, p_j)$, and change the timing as follows:

- Stage 1: U secretly oœers each D_i a tariœ $T_i(q_i)$.
- Stage 2: D_1 and D_2 simultaneously set their prices, p_1 and p_2, and then order q_1 and q_2 so as to satisfy demand (consumers observe both prices and choose freely between D_1 and D_2).

Assuming passive conjectures,[41] D_i expects D_j to set the same equilibrium price p_j, regardless of the contract D_i is oœered by U. Hence, given this expected price p_j, when facing a tariœ $T_i(q_i)$, D_i chooses p_i so as to maximize $p_i D(p_i\,,\,p_j) \Leftrightarrow T_i(D(p_i\,,\,p_j))$. Assume that U can only charge two-part tariœs:

$$T_i(q_i) = F_i + w_i q_i.$$

D_i's ørst-order condition is:

$$(p_i \Leftrightarrow w_i)\partial_1 D(p_i, p_j) + D(p_i, p_j) = 0, \qquad \text{(A.1)}$$

which deønes a reaction function $\tilde{R}^B(p_j\,;\,w_i)$ that is increasing in w_i (ıBȷ stands for ıBertrand competitionȷ). Given the candidate equilibrium price p_j, U will then ıchooseȷ

[41] Note that the passivity of conjectures is less appealing than in the setting where upstream production leads demand realizations. In particular, suppose that the upstream monopolist has incomplete information about each of the downstream ørms' proøt functions. Then, it is hard to extract the downstream ørms' proøts through øxed fees and under reasonable assumptions, the optimal wholesale price then exceeds marginal cost. In that case, a change in the contract oœered to D_i under passive conjectures induces the monopolist to change his contract to D_j, casting some doubt on the general validity of passive conjectures.

D_i's price so as to maximize their aggregate proøt:

$$(p_i \Leftrightarrow c)D(p_i, p_j) + (w_j \Leftrightarrow c)D(p_j, p_i).$$

This price p_i is characterized by:

$$(p_i \Leftrightarrow c)\partial_1 D(p_i, p_j) + D(p_i, p_j) + (w_j \Leftrightarrow c)\partial_2 D(p_j, p_i) = 0. \tag{A.2}$$

Combining $(A.1)$ and $(A.2)$ yields:

$$(w_i \Leftrightarrow c)\partial_1 D(\cdot) + (w_j \Leftrightarrow c)\partial_2 D(\cdot) = 0. \tag{A.3}$$

Conditions $(A.3)$, where $\partial_i D(\cdot)$ is evaluated at the Nash equilibrium retail prices, provide a system of two equations with two unknowns, the wholesale prices. A full rank argument then implies $w_1 = w_2 = c$: The equilibrium marginal transfer price equals the marginal cost. This in turn implies that a candidate equilibrium (for passive conjectures) must yield the Bertrand price and proøt (with $R^B(p) \equiv \tilde{R}^B(p; c)$):

$$\begin{aligned} p_1 &= p_2 = p^B < p^m \quad \text{such that} \quad p^B \equiv R^B(p^B) \\ \pi_U &= 2\pi^B < \pi^m. \end{aligned}$$

The reader may ønd this result, due to O'Brien and Shaœer (1992),[42] surprising for the following reason. The presumption under passive conjectures is that the downstream competitors wage whatever form of competition is relevant, internalizing exactly the marginal cost of upstream production. There is an extra twist under Bertrand competition, though: Because orders lag price setting, a change in the wholesale price w_i charged to a downstream competitor i aœects its ønal price p_i and thus the proøt $(w_j \Leftrightarrow c)D(p_j, p_i)$ made on downstream competitor j. But this indirect eœect (which does not exist when orders are placed before demand is realized) vanishes exactly when $w_i = c$, that is when the wholesale price is equal to marginal cost.

Let us now show that, if demands are symmetric and the cross-price elasticity is at least one half of the own-price elasticity, there exists no passive conjectures equilibrium. [Note that in the Hotelling case, the cross-price elasticity is equal to the own-price elasticity at a symmetric equilibrium. More generally what is needed for the reasoning below is that there is enough substitutability between the two products.]

With passive conjectures, the upstream ørm's proøt can be written as $\pi_i(w_i, w_j) + \pi_j(w_j, w_i)$ where

[42] They moreover show that the Bertrand equilibrium is still the unique candidate equilibrium, even when U can oœer general nonlinear tariœs.

$$\pi_i(w_i, w_j) = (p_i^r(w_i) \Leftrightarrow w_i)\, D\left(p_i^r(w_i), p_j\right) + (w_i \Leftrightarrow c) D\left(p_i^r(w_i), p_j^r(w_j)\right),$$

and π_j is deøned analogously. Fixing anticipated equilibrium prices (this is the passive conjectures assumption), $p_i^r(w_i)$ is deøned by

$$p_i^r(w_i) = \arg\ \max(p_i \Leftrightarrow w_i) D(p_i, p_j^e).$$

Using the ørst-order condition for $p_i^r(\cdot)$, it is easy to show that at the candidate equilibrium $(w_i = c)$,

$$\frac{\partial^2 \pi_i}{\partial w_i^2} = \frac{\partial D^i}{\partial p_i} \frac{dp_i^r}{dw_i} \quad , \quad \frac{\partial^2 \pi_i}{\partial w_i \partial w_j} = \frac{\partial D^i}{\partial p_j} \frac{dp_j^r}{dw_j} \quad , \quad \frac{\partial^2 \pi_i}{\partial w_j^2} = 0.$$

And so, the Hessian of $\pi_i + \pi_j$ is semi-deønite negative only if

$$\Leftrightarrow \frac{\partial D^i}{\partial p_i} > 2 \frac{\partial D^i}{\partial p_j}$$

(using the symmetry of the candidate equilibrium).

- Vertical integration

The thorny issue of conjectures does not arise in the case of vertical integration since the nonintegrated unit knows that the integrated one purchases at marginal cost, and by construction the integrated downstream ørm knows the tariœ oœered to the other one.

a) No possible bypass of the bottleneck supplier.

Consider ørst the case without alternative supplier for the intermediate good. Let us now assume that U and D_1 merge. Through the choice of the marginal transfer price to D_2, w_2, U generates for D_2 a response to its expected price p_1^e given by:

$$p_2^r(w_2; p_1^e) = \arg\max_{p_2} (p_2 \Leftrightarrow w_2) D(p_2, p_1^e).$$

[This is the same reaction curve as previously, but we now explicit the rival's expected price.]

Conversely, given a transfer price w_2 and an expected retail price p_2^e, $U \Leftrightarrow D_1$'s optimal response is given by:

$$p_1^r(w_2; p_2^e) = \arg\max_{p_1} \left\{(p_1 \Leftrightarrow c) D(p_1, p_2^e) + (w_2 \Leftrightarrow c) D(p_2^e, p_1)\right\}.$$

Hence, a marginal transfer price w_2 generates a conditional equilibrium $(\hat{p}_1(w_2), \hat{p}_2(w_2))$ given by: $p_1 = p_1^r(w_2; p_2)$ and $p_2 = p_2^r(w_2; p_1)$. The optimal transfer price then maximizes

$$(\hat{p}_1(w_2) \Leftrightarrow c)\, D\left(\hat{p}_1(w_2), \hat{p}_2(w_2)\right) + (\hat{p}_2(w_2) \Leftrightarrow c)\, D\left(\hat{p}_2(w_2), \hat{p}_1(w_2)\right).$$

Assuming the retail prices are strategic complements, both $\hat{p}_1$ and $\hat{p}_2$ increase with w_2. Moreover, the curve $\mathcal{F} \equiv (\hat{p}_1(w_2), \hat{p}_2(w_2))_{w_2}$ of feasible price pairs goes through the Bertrand equilibrium point (for $w_2 = c$), and never crosses the curve $p_1 = R^m(p_2)$ ($p_1(w_2) = R^m(p_2(w_2)) \equiv \arg\max_{p_1}(p_1 \Leftrightarrow c)D(p_1, p_2(w_2)) + (p_2(w_2) \Leftrightarrow c)D(p_2(w_2), p_1)$ would require $p_2(w_2) = w_2$, which is impossible). Moreover, as w_2 goes to $+\infty$ (which amounts to exclusive dealing with D_1), $p_2(w_2)$ goes to $+\infty$ too (since $p_2(w_2) > w_2$). Hence the curve $\mathcal{F}$ crosses the curve $p_2 = R_2^m(p_1)$ to the left of the monopoly point M (see Figure 6).

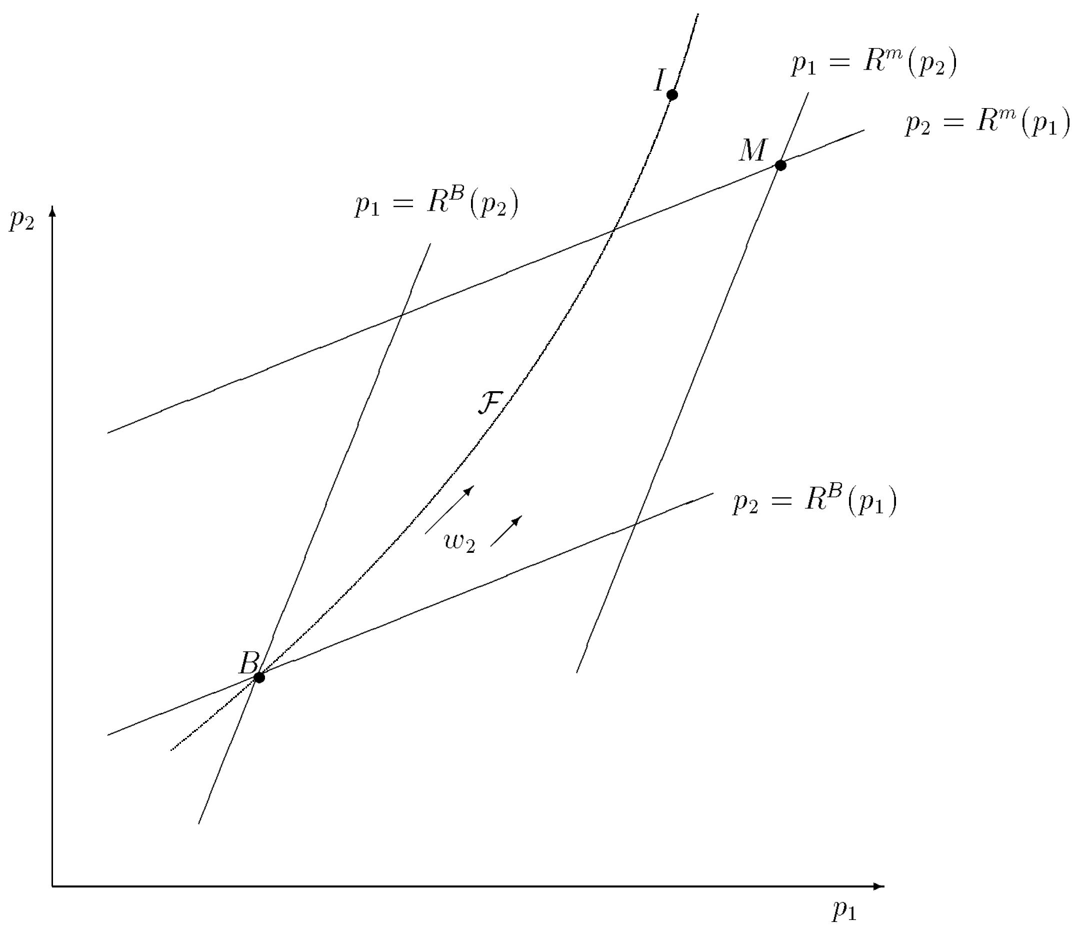

Figure 6

It is clear that, starting from B ($w_2 = c$), a small increase in w_2, which increases both prices $\hat{p}_1$ and $\hat{p}_2$, strictly increases $U \Leftrightarrow D_1$'s aggregate proøt. Hence vertical integration yields $w_2 > c$. The point I which represents the optimal pair of prices (p_1^*, p_2^*) actually lies above the curve $p_2 = R^m(p_1)$. To see this, evaluate the impact of a slight increase in

w_2, starting from the value w_2 such that $\hat{p}_2 = R^m(\hat{p}_1(w_2))$:

$$\frac{d}{dw_2}\left((\hat{p}_1(w_2) \Leftrightarrow c) D(\hat{p}_1(w_2), \hat{p}_2(w_2)) + (\hat{p}_2(w_2) \Leftrightarrow c) D(\hat{p}_2(w_2), \hat{p}_1(w_2))\right)$$

$$= \frac{d}{dw_2}\left((\hat{p}_1(w_2) \Leftrightarrow c) D(\hat{p}_1(w_2), p_2) + (p_2 \Leftrightarrow c) D(p_2, \hat{p}_1(w_2))\right) \Big|_{p_2 = \hat{p}_2(w_2)}$$

$$= (\hat{p}_2(w_2) \Leftrightarrow w_2) D_2(\hat{p}_2(w_2), \hat{p}_1(w_2)) \frac{d\hat{p}_1}{dw_2} > 0,$$

where the ørst equality stems from $\hat{p}_2 = R^m(\hat{p}_1)$. Note ønally that the equilibrium prices satisfy $w_2 > c$ and $p_2^* > p_1^*$ (since I lies to the right of $p_1 = R^m(p_2)$ and above $p_2 = R^m(p_1)$.) In that sense, vertical integration does lead to foreclosure: The unintegrated ørm D_2 faces a higher marginal transfer price and sets a higher price than its rival. Foreclosure in general is incomplete, however, when the two downstream ørms are diœerentiated: In that case, vertical integration yields more proøt than exclusive dealing (which would correspond here to $w_2 = \infty$.)

b) Possible bypass of the bottleneck supplier.

Let us now introduce upstream an alternative supplier $\hat{U}$ with marginal cost $\hat{c} \geq c$. The timing is as follows:

- Stage 1: U and $\hat{U}$ secretly oœer each D_i a tariœ, $T_i(q_i)$ and $\hat{T}_i(\hat{q}_i)$;
- Stage 2: D_1 and D_2 simultaneously set their prices, p_1 and p_2, and then choose between the two suppliers and order so as to satisfy demand.

We assume that U and D_1 are integrated, and so it is common knowledge that D_1 can purchase from U at marginal cost c. As before, by adjusting the marginal transfer price to D_2,w_2, U can generate the same pair of retail prices $(\hat{p}_1(w_2), \hat{p}_2(w_2))$ as in the absence of bypass, provided that D_2 does not turn to $\hat{U}$ rather than to U. To ensure that this is indeed the case, the integrated ørm must abandon a proøt equal to

$$\max_p (p \Leftrightarrow \hat{c}) D(p, p_1).$$

to D_2. So, the integrated ørm must choose $(\hat{p}_1, \hat{p}_2) \equiv (\hat{p}_1(w_2), \hat{p}_2(w_2))$ so as to maximize

$$(\hat{p}_1 \Leftrightarrow c) D(\hat{p}_1, \hat{p}_2) + (\hat{p}_2 \Leftrightarrow c) D(\hat{p}_2, \hat{p}_1) \Leftrightarrow \max_p (p \Leftrightarrow \hat{c}) D(p, \hat{p}_1). \qquad \text{(A.4)}$$

Now, by choosing $w_2 = c$, the integrated ørm would generate $(\hat{p}_1, \hat{p}_2) = (p^B, p^B)$. But then, a small increase in w_2 increases both $\hat{p}_1$ above $R^B(\hat{p}_2) = p^B$ and $\hat{p}_2$ above

$R^B(\hat{p}_1) = p^B$, and thus increases the integrated firm's profit. Equilibrium prices are however lower than in the absence of bypass.[43]

• Upstream versus downstream bottleneck. When the bottleneck lies downstream in the no bypass case, it purchases the two differentiated goods produced by C_1 and C_2 at marginal transfer price equal to marginal cost, regardless of the structure of integration. It therefore achieves the monopoly outcome. In the presence of bypass opportunities, that is when an inefficient producer of good 1, $\hat{M}$, competes on the downstream segment, both M and $\hat{M}$ sell both differentiated goods in the case of nonintegration; if the cost differential, $\hat{c} - c$, between them is not too large, M undercuts slightly $\hat{M}$ on each of the two products, and thus $p_1 = p_2 = \hat{c}$.

Next, assume that C_1 and M merge. C_1 then no longer supplies $\hat{M}$. And, again assuming that $\hat{c} - c$ is not too large, the integrated firm slightly undercuts $\hat{M}$ when distributing good 2: $p_2 = \hat{c}$. So, the integrated firm chooses p_1 so as to maximize

$$(p_1 - c)D(p_1, \hat{c}) + (\hat{c} - c)D(\hat{c}, p_1).$$

Equilibrium prices are therefore $p_1 = R^m(\hat{c})$ and $p_2 = \hat{c}$. Vertical integration forecloses $\hat{M}$'s access to good 1 and raises the price of that good. Note also that, unlike in the Cournot case, there is never productive inefficiency, as M undercuts $\hat{M}$ and therefore avoids inefficient production by the latter.

An important result for the Cournot case was that welfare is higher when the more competitive segment is downstream. This result carries over to the Bertrand case when U and C_1 merge.

[43] Fix the optimal p_2 and rewrite the objective function as

$$(p_1 - c)D(p_1, p_2) + \wedge(p_1, p_2, \hat{c}).$$

Note that $\partial^2 \wedge / \partial p_1 \partial \hat{c} > 0$, and so, by revealed preference the optimal p_1 is increasing in $\hat{c}$. So this solution is lowest for $\hat{c} = c$. Next, let $\bar{p}_2$ denote the solution to $\max(p - c)D(p, p_1)$, with (see the previous footnote) $\bar{p}_2 < p_2$. And consider the objective function for $\hat{c} = c$:

$$(p_1 - c)D(p_1, p_2) + \wedge(p_1, p_2, c).$$

When $\wedge = 0$, $p_1 = R^B(p_2)$. So we need to study the impact of $\wedge$ on the optimal choice of p_1. Note that $\wedge(p_1, \bar{p}_2, c) = 0$ and that $\partial^2 \wedge / \partial p_1 \partial p_2 = (p_2 - c)\dfrac{\partial^2 D}{\partial p_1 \partial p_2} + \dfrac{\partial D}{\partial p_1}$. Thus unless the cross-partial derivative of D is very negative, $\partial^2 \wedge / \partial p_1 \partial p_2 > 0$, and by revealed preference, the optimal p_1, given p_2, satisfies: $p_1 > R^B(p_2)$. This a fortiori holds for $\hat{c} > c$.