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Contracts as a Barrier to Entry: Impact of Buyer’s Asymmetric Information and Bargaining Power*

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Abstract

An incumbent seller contracts with a buyer and faces the threat of entry. The contract stipulates a price and a penalty for breach if the buyer later switches to the entrant. Sellers are heterogenous in terms of the gross surplus they provide to the buyer. The buyer is privately informed on her valuation for the incumbent’s service. Asymmetric information makes the incumbent favor entry as it helps screening buyers. When the entrant has some bargaining power vis-à-vis the buyer and keeps a share of the gains from entry, the incumbent instead wants to reduce entry. The compounding effect of these two forces may lead to either excessive entry or foreclosure, and possibly to a fixed rebate for exclusivity given to all buyers.

KEYWORDS: Foreclosure; excessive entry; exclusionary behavior; incomplete information.

JEL CODE: L12, D82.

1. INTRODUCTION

MOTIVATION. Exclusive clauses are prevalent in platform markets. In its recent anti-monopoly guidelines for platform economy, China’s competition regulator especially targeted exclusive agreements, such as the so-called “*choose one between two*” clause under which a platform prevents a merchant from selling on multiple platforms.¹ As of 2018, the Indian regulator banned exclusive contracts between platforms and merchants.² In

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¹On 7 February 2021, the Antimonopoly Committee of the State Council issued the Antimonopoly Guidelines on Platform Economic Sector, which is China’s first specific antitrust rules on platforms (see http://gkml.samr.gov.cn/nsjg/fldj/201904/t20190429_293282.html).

²“*E-commerce marketplace entity will not mandate any seller to sell any product exclusively on its platform only*,” Ministry of Commerce & Industry, Press Note No.2 (2018), available at https://dipp.gov.in/sites/default/files/pn2_2018_0.pdf.

2019, the EU Commission concluded that “*Google first imposed an exclusive supply obligation, which prevented competitors from placing any search adverts on the commercially most significant websites. Then, Google introduced what it called its “relaxed exclusivity” strategy aimed at reserving for its own search adverts the most valuable positions and at controlling competing adverts’ performance.*”³ Last, an investigation launched by the French Competition Authority unveiled that brands were tied in various ways to the dominant operator in the flash-sales market.⁴ These examples all point in the same direction: Exclusivity provisions are practices that are widely spread in the digital economy.

In this article, we revisit the rationale for exclusivity clauses in a context, particularly relevant for the digital economy, where a dominant firm deals with a large number of heterogenous buyers and faces the threat of entry by a competing seller. We shall argue that exclusivity provisions have then a screening purpose that tends to alleviate their foreclosure effect.

MODEL AND RESULTS. Our model is directly inspired from Aghion and Bolton (1987)’s seminal work on contracts as a barrier to entry, but adapt their framework to economic contexts that are particularly relevant for the digital economy. An incumbent firm (or platform) provides one unit of service (or digital service) to a buyer (a merchant) but faces the threat of entry by a rival who might be more attractive. The incumbent firm can commit ex ante to a contract with the buyer. This contract stipulates a price for the seller’s service as well as a penalty for breach (or early termination fee) if the buyer decides to switch later on to the entrant. The difference between the price and the penalty will often be referred to as a rebate for exclusivity. The penalty for breach acts as a rent-shifting tool for the seller to appropriate the potential gains of entry.

In Aghion and Bolton (1987), the incumbent and the entrant differ in their costs of providing the service and the buyer’s valuation for this service is common knowledge. We depart from this framework in some important ways. First, the incumbent and the entrant no longer differ in term of their costs of providing the service but with respect to the buyer’s value of the service that those sellers may generate. In the digital economy, (marginal) costs can be considered as being null and platform sellers are differentiated in terms of the access to various pools of customers that they give to their merchants. Second, the buyer might be privately informed on her valuation for the incumbent’s service. An alternative interpretation is that there is a continuum of heterogenous buyers who differ in terms of their valuations for that service. Again, this assumption appears quite realistic in the case of large dominant platforms which remain by and large ignorant of the market opportunities of merchants.

In this context, our first contribution is to analyze the impact of asymmetric information on the capability of the incumbent seller to erect barrier to entry through contract design, stressing the role that exclusivity provisions may serve. To isolate this impact from other forces, we first assume that the buyer has all the bargaining power in her

³See https://ec.europa.eu/ireland/news/commission-fines-google-1.49-billion-euro-for-abusive-practices-in-online-advertising_en.

⁴See Decision 14-D-18 of 28th November 2014 (<https://www.autoritedelaconcurrence.fr/fr/decision/relative-des-pratiques-mises-en-oeuvre-dans-le-secteur-de-la-vente-evenementielle-en-ligne>). Although the complaint was dismissed, the main reason being that the relevant market had not been properly defined, the decision suggests that exclusivity clauses had anti-competitive effects. Exclusivity clauses concerned the duration of the exclusivity (which exceeded by far the duration of a flash-sale) and also the scope (i.e., different products of a given brand).

relationship with the entrant; an assumption that is later relaxed. In that polar scenario, the buyer can reap all gains from entry if she buys from the entrant. Had the incumbent known the buyer's valuation for his service, those entry gains could then be perfectly pocketed by the incumbent through an adequate choice of the penalty for breach. In this context, there would be neither inefficient foreclosure nor inefficient entry. The most efficient firm would always supply the buyer and, when the entrant is the supplier, the incumbent would be able to capture those efficiency gains by means of a penalty for breach. In particular, the rebate for exclusivity would be zero; meaning that, whether he sells by himself or let the buyer purchase from the rival seller, the incumbent secures the same revenue.

This efficiency result no longer holds when the incumbent is uninformed about the buyer's valuation for its service and can no longer tailor the penalty for breach to the foregone surplus. Under asymmetric information, screening the different types of buyers now becomes an issue. In our context, and even if buyers have unit demand, screening remains feasible because buyers with higher valuations for the incumbent's service have less incentives to switch to the entrant. Therefore, the probability of letting entry occur can be used as a screening tool by playing on the penalty for breach. Under asymmetric information, information rents must then be left to those buyers to induce information revelation on surplus. To limit those rents, the incumbent is led to increase the rebate above its full information level. So doing discourages buyers from underreporting their valuations, for this would imply to forego large gains from trade with the incumbent. Increasing the rebate also means decreasing the penalty for breach relative to the price for the incumbent's service; which implies more entry. Therefore, asymmetric information makes the incumbent softer vis-à-vis the entrant and leads to socially excessive entry.

Our second contribution is to study the role of the buyer's bargaining power vis-à-vis the entrant. When the buyer does not capture all the gains associated to entry and leave the entrant with some residual, the incumbent cannot shift back entirely those gains from entry. The incumbent is then willing to inefficiently distort entry so as to reduce the share of the rent that cannot be ultimately pocketed back. The incumbent should now set a negative rebate for exclusivity; which has a foreclosure effect on the entrant. This result revisits in our specific context the so-called *rent-shifting effect*, as highlighted first by Aghion and Bolton (1987).

While asymmetric information calls for positive rebates for exclusivity as seen above, the fact that the buyer might not have all the bargaining power vis-à-vis the entrant instead requires to set negative rebates. There is thus a significant tension between the two polar objectives of the contract which are extracting information rent from the buyer and extracting bargaining rent from the entrant. When both asymmetric information and limited bargaining power on the buyer's side are present altogether, the optimal rebate trades off the two effects unveiled previously. The tension between those two objectives can be so strong that the optimal incentive compatible contract entails a fixed rebate and all buyers, whatever their types, are bunched on the same inflexible allocation.

LITERATURE REVIEW. Our article belongs to the literature that analyzes the strategic role of contracts in market contexts. The so-called Chicago School of Antitrust (Posner, 1976; Bork, 1978) defended the view that an upstream incumbent seller does not want to lock down its buyer in an exclusive relationship that inefficiently deters the entry of a more efficient competitor. In an influential article, Aghion and Bolton (1987) showed

that contracts can erect entry barrier when there is uncertainty on the efficiency gains of entry and when the incumbent cannot fully appropriate these gains. With respect to their analysis, we keep the assumption that the buyer has a unit demand but add two key ingredients. First, sellers differ not in the cost of supplying the buyer but in the surpluses they provide to the buyer. Second, there is asymmetric information about the buyer's valuation for the incumbent's service. Rebates for exclusivity have thus a screening purpose.

Several analyses have extended Aghion and Bolton (1987)'s framework towards various directions. Marx and Shaffer (1999, 2004) consider a multi-unit demand buyer and analyze how contractual restrictions may limit the incumbent seller's ability to shift back the rent from entry. Choné and Linnemer (2015, 2016) and Martimort, Pouyet and Stole (2017) further add asymmetric information (on the buyer's preferences and on the entry cost) and the possibility that the incumbent seller is a dominant firm (in the sense that it is an essential trading partner for a fraction of the buyer's demand). These articles study the exclusionary properties of nonlinear price-quantity schedules, depending on whether the price charged by the dominant firm depends on the quantity purchased from the rival firm. Ide, Figueroa and Montero (2016) examine how the surplus between the dominant seller and the buyer is shared when ex ante lump-sum transfers are ruled out. Still considering asymmetric information about the buyer's preferences, Calzolari and Denicolò (2013) investigate market-share discounts and exclusive contracts in a symmetric duopoly setting with multi-unit demand. Calzolari and Denicolò (2015) relax the symmetry assumption by assuming that one firm has a competitive advantage (either on cost or on quality) over its rivals and is thus dominant. In these papers, exclusivity plays the role of a screening device whose effects come in addition to standard screening distortions in a multi-unit demand context. Exclusivity plays also a key role as a screening tool in our context as well, with the additional constraint that only one unit of service is provided.

Finally, another strand of the literature, less related to our contribution, investigates how mis-coordination among several independent buyers (Rasmusen, Ramseyer and Wiley, 1991; Innes and Sexton, 1994; Segal and Whinston, 2000; Spector, 2011; Chen and Shaffer, 2014 and 2019; Bedre-Defolie and Biglaiser, 2017) or several competing buyers (Fumagalli and Motta, 2006; Simpson and Wickelgren, 2007; Abito and Wright, 2008; Asker and Bar-Isaac, 2014; Wright, 2009) might also facilitate vertical foreclosure.

ORGANIZATION OF THE PAPER. Section 2 presents the model and analyzes the benchmark case when no contract is ever signed. Section 3 considers the symmetric information scenario with contract signing and shows that entry is socially efficient when the buyer has all bargaining power vis-à-vis the entrant. Section 4 shows that asymmetric information between the incumbent and the buyer leads to an excessive level of entry. Section 5 studies the situation in which the entrant has some bargaining power vis-à-vis the buyer and shows, first, that instead entry may be restricted, and second, that inflexible contracts can emerge as a response to the conflicting objectives of extracting information rent from the buyer and bargaining rent from the entrant. All proofs are relegated to an Appendix.

2. MODEL AND BENCHMARK

MARKET STRUCTURE AND INFORMATION. We consider how the relationship between an incumbent seller I (he) and his buyer B (she) may be disrupted by the entry of a

competing seller E . I provides a service to B . To illustrate, I might be a well-established platform that attracts a traditional clientele. The buyer's valuation for I 's service is denoted by v_1 and is distributed according to a common knowledge distribution G_1 , with (strictly positive) density $g_1 = G_1'$ on a support $[0, \bar{v}]$ ($\bar{v} > 0$). We assume that the monotone hazard rate property is satisfied, i.e., $(1 - G_1)/g_1$ is decreasing.⁵ We normalize I 's cost to provide the service to 0.

A competing seller, referred to in the sequel as the entrant E , may enter the market and supply the buyer. For instance, a new platform may provide the merchant with access to a brand new and maybe more specialized clientele. The buyer's valuation for E 's service is denoted by v_2 and is distributed according to a common knowledge distribution G_2 , with (strictly positive) density $g_2 = G_2'$ on $[0, \bar{v}]$. To keep elements of the model as symmetric as possible between I and E , we also assume that $(1 - G_2)/g_2$ is decreasing and that E 's cost to provide the service is also 0.

Entry is socially efficient when E supplies B if and only $v_2 \geq v_1$, and I supplies B otherwise. In the sequel, our focus is to analyze when there is either inefficient foreclosure or excessive entry.

SPOT MARKET. Suppose that I and B have not signed any contract. In this spot market scenario, I and E compete in prices to supply B . The timing of the game then goes as follows:

0. B privately learns her valuation v_1 for I 's service.
1. I offers to supply the service at price p_1 . B may accept or reject that option to buy.
2. B 's valuation for E 's service, v_2 , is realized and is learned by both E and B .
3. A price p_E is set for E 's service. B chooses whether to buy from I or from E and pays the corresponding price.

Importantly, in the spot market scenario, the price p_1 proposed by I does not prevent B from switching to E at no extra cost if, once aware of her valuation for E 's service, she finds it more attractive to do so. In other words, in the spot market scenario, I has no commitment power to force B to purchase his own service even when moving first. Since contracts (whose details are studied below) typically give such a first-mover advantage to I , the timings of events in the scenarios with or without contracts are kept the same. I keeps a first-mover advantage over E while he remains uninformed about B 's valuation at the time of making his own offer to B . Similarly, since I remains uninformed about B 's valuation in the spot market scenario, the information structure is also unchanged from the scenario without to the scenario with contracts.⁶ In other words, the scenarios with and without contracts are the same; the sole difference comes from the impossibility for I to punish switching decisions by means of a penalty for breach. A possible alternative interpretation is that the spot market scenario also covers settings where contracts are feasible but cannot be conditioned on purchases from competitors.

⁵Bagnoli and Bergstrom (2005).

⁶In Aghion and Bolton (1987), firms compete head-to-head under complete information (about the entrant's cost) on the spot market. Therefore, when comparing the situations with and without contracts, both the timing and the information structure change in that work.

The choice of a price p_E at stage 3 of the game depends on how B and E negotiate. We follow Choné and Linnemer (2015, 2016) and Martimort, Pouyet and Stole (2017) in assuming that any trade between B and E takes place under complete information. This assumption is justified when the entrant is a more specialized platform that is better able to assess the merchants' needs.

Furthermore, and unless otherwise specified, we shall assume that B has all the bargaining power in her relationship with E . This simplifying assumption, which shall be relaxed in Section 5, is made hereafter to ease presentation. As detailed later on, it allows us to analyze how asymmetric information impacts entry absent any other distortionary motives. Notice that, since B has all the bargaining power vis-à-vis E , B can always command a price for E 's service equal to E 's marginal cost, i.e., $p_E = 0$. Put differently, when B has all bargaining power, everything happens as if the entrant were a competitive fringe with zero marginal cost.

At the last stage of the spot market game, given a price p_1 set by I , B buys from E when it is efficient to do so, i.e., when $v_2 \geq v_1 - p_1$, and from I otherwise. Observe that the switching decision depends both on the surpluses delivered by the suppliers to the buyer (i.e., v_1 and v_2) and on the prices (i.e., p_1 and $p_E = 0$). Later on, when we will consider the possibility of contract, this switching decision will also depend on the possible penalty for breach that B has to pay when dealing with E . Depending both on valuations and prices, B may thus be more or less inclined to switch to E rather than to stay with I . This stands in contrasts with Aghion and Bolton (1987). In their analysis, suppliers offer the same gross surplus v to B and differ in their unit cost. Hence, the buyer's decision to switch is independent on her valuation for the suppliers' services. Screening the different types of buyer through the penalty for breach thus becomes possible in our setting, even if the buyer has a unit demand for the suppliers' services.

B 's expected benefit to accept I 's price at stage 1 of the game is thus given by

$$(v_1 - p_1)G_2(v_1 - p_1) + \int_{v_2 \geq v_1 - p_1} v_2 dG_2(v_2).$$

B always has the option to reject I 's price and to buy directly from E . This yields an expected gain for the buyer worth

$$\int v_2 dG_2(v_2).$$

The following lemma compares B 's expected gain depending on her decision to accept or to turn down I 's price.

Lemma 1. *In the spot market, B accepts I 's price p_1 if and only if $v_1 \geq p_1$.*

When her valuation v_1 is smaller than I 's price p_1 , there is no point for B to accept I 's option to buy. When v_1 is instead greater, B prefers accepting I 's price, which gives the opportunity to buy later on, once her valuation v_2 is realized, from the supplier that provides the highest net surplus.

To characterize the outcome on the spot market, it remains to determine the price

set by the incumbent. I 's expected profit is equal to

$$\Pi_I^{sm}(p_1) = \int_{v_1 \geq p_1} p_1 G_2(v_1 - p_1) dG_1(v_1)$$

where the superscript 'sm' stands for 'spot market.' When $v_1 \leq p_1$, B rejects I 's price and buys directly from E . When $v_1 \geq p_1$, B accepts I 's price but buys from I only when switching to E is not attractive.

The optimal price p_1^{sm} maximizes the incumbent seller's profit $\Pi_I^{sm}(p_1)$. It is characterized by the following first-order condition⁷

$$(2.1) \quad p_1^{sm} = \frac{\int_{v_1 \geq p_1^{sm}} G_2(v_1 - p_1^{sm}) dG_1(v_1)}{\int_{v_1 \geq p_1^{sm}} g_2(v_1 - p_1^{sm}) dG_1(v_1)}.$$

In the spot market scenario, the price set by the incumbent trades off the following effects. A high price charged to the buyer tends to increase profit. However, such a high price also leads a buyer with a low valuation v_1 for I 's service to buy directly from the entrant and makes switching to E more attractive when the valuation v_2 for the entrant's service will be known. The next result will prove to be useful later on.

Lemma 2. *In the spot market outcome, I 's optimal price p_1^{sm} is such that $p_1^{sm} \leq \frac{1 - G_1(p_1^{sm})}{g_1(p_1^{sm})}$.*

For further reference, it is also useful to compute the buyer's expected gain in the spot market outcome. To do so, remind from Lemma 1 that a buyer with valuation $v_1 \leq p_1^{sm}$ rejects I 's offer, whereas a buyer with valuation $v_1 \geq p_1^{sm}$ accepts that offer but sometimes buys from E depending on the realization of her valuation v_2 . Hence, B 's expected rent writes as follows

$$(2.2) \quad U_B^{sm}(v_1) = \max \left\{ (v_1 - p_1^{sm}) G_2(v_1 - p_1^{sm}) + \int_{v_2 \geq p_1^{sm}} v_2 dG_2(v_2); \int v_2 dG_2(v_2) \right\}.$$

Figure 1 summarizes the key features of the spot market benchmark.⁸

3. CONTRACTS UNDER SYMMETRIC INFORMATION

From now on, I has the possibility to offer a contract to B at stage 1 of our game. A contract consists in, first a price p_1 if B buys from I , and second, a penalty for breach p_2 paid by B if she switches to E . Let $\Delta = p_1 - p_2$ be the so-called 'rebate for exclusivity,' which can a priori be either positive or negative. A positive rebate facilitates entry while a negative one erects a barrier to entry.

The timing of events remains identical to that in the spot market benchmark, up to the fact that I offers now a contract (p_1, p_2) at the first stage of the game (or alternatively a pair (p_1, Δ)). At stage 3, B switches to E when $v_2 - p_2 \geq v_1 - p_1$, or equivalently when

⁷This condition is also sufficient since the maximand is quasi-concave in p_1 given monotonicity of the hazard rate.

⁸Straightforward computations show that the first expression in the right-hand side of (2.2) is strictly increasing and strictly convex for $v_1 > p_1^{sm}$ and has a slope equal to zero for $v_1 = p_1^{sm}$.

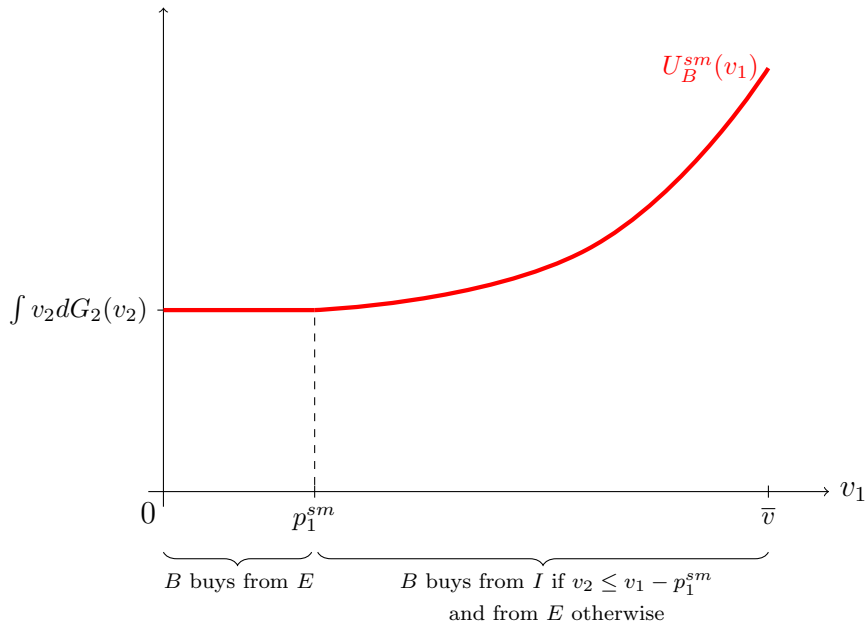


Figure 1: B 's expected rent in the spot market outcome.

$v_2 \geq v_1 - \Delta$. If B rejects I 's contract, then the game proceeds as in the spot market described in the previous section.

Since we keep the same timing of events in both sub-games (the sub-game of spot market competition and that of contract offer), the possibility to offer a contract does not empower I with any ad hoc first-mover advantage over E . Therefore, our assumption allows to clearly delineate how the additional price instrument provided by a contract can be used by the incumbent to change the competitive interaction with the entrant.

We analyze in this section the symmetric information benchmark, in which the buyer's valuation v_1 for the incumbent's service is known to I at the time of contracting. Accordingly the contract can be conditioned in v_1 and we thus denote $(p_1(v_1), \Delta(v_1))$ such contract. I 's problem is thus to determine such a contract that maximizes his profit subject to the constraint that the buyer prefers accepting this contract rather than relying on the spot market for her supply.

When the buyer accepts the contract, she purchases from I provided that $v_2 \leq v_1 - \Delta(v_1)$, and then gets a surplus $v_1 - p_1(v_1)$. She switches to E when $v_2 \geq v_1 - \Delta(v_1)$, which yields a surplus $v_2 - p_2(v_1)$. Hence, B 's expected surplus may be rewritten as⁹

$$U_B(v_1) = v_1 - p_1(v_1) + \int_{v_2 \geq v_1 - \Delta(v_1)} (1 - G_2(v_2)) dv_2.$$

Therefore, for the buyer to accept the contract, it must be that

$$(3.1) \quad U_B(v_1) \geq U_B^{sm}(v_1),$$

where $U_B^{sm}(v_1)$ is defined by (2.2).

⁹Integrating by parts, we obtain that $(v_1 - p_1)G_2(v_1 - p_1) + \int_{v_2 \geq p_1} v_2 dG_2(v_2) = v_1 - p_1 + \int_{v_2 \geq v_1 - \Delta} (1 - G_2(v_2)) dv_2$.

When the buyer accepts the contract, the incumbent earns $p_1(v_1)$ when B stays and $p_2(v_1)$ when B switches to E . Hence, I 's expected profit may be rewritten as follows

$$\Pi_I(v_1) = p_1(v_1) - \Delta(v_1)(1 - G_2(v_1 - \Delta(v_1))).$$

Next proposition describes the main properties of the optimal contract under symmetric information.

Proposition 1. *Under symmetric information, I offers a contract with no rebate for exclusivity, i.e., $\Delta^*(v_1) = 0$.*

I finds it worth offering a contract to B and that contract stipulates no rebate for exclusivity. Intuitively, since B has all the bargaining power vis-à-vis E , all gains from trade associated to switching to the entrant are captured by the buyer. Those gains can in turn be pocketed back by I by setting a penalty for breach just equal to the price if trade occurs. This strategy ensures a constant payoff to I and makes B residual claimant for the decision to switch or not; a decision solely based on the comparison of her valuations with both suppliers. I has thus no reason to inefficiently distort entry decisions when entry gains can be fully captured.

It is worth noticing that the comparison with the spot market benchmark is not really relevant here since, in this section, we have assumed symmetric information when I offers B a contract while asymmetric information prevailed in the spot market scenario. This change in the information structure explains why I always prefers contracting with B . When contracting takes place under complete information, I has of course enough price instruments to fully extract all surplus from B .

In the next two sections, we analyze how asymmetric information (Section 4) and the allocation of bargaining power between B and E (Section 5) change those results.

4. CONTRACTS UNDER ASYMMETRIC INFORMATION

We now turn to the situation where B 's valuation for I 's service is private information at stage 1 of the game. First, we find conditions that ensure B does not misrepresent her valuation for the I 's service. Second, we characterize I 's optimal contract.

INCENTIVE COMPATIBILITY. The Revelation Principle¹⁰ allows us to restrict the analysis to direct and incentive-compatible revelation mechanisms of the form $(p_1(\hat{v}_1), \Delta(\hat{v}_1))_{\hat{v}_1 \in [0, \bar{v}]}$. Such a contract stipulates a menu of prices for trade and rebates for exclusivity which are contingent on B 's report \hat{v}_1 on her valuation. Faced with such a menu, B picks the one that maximizes her expected gain and obtains thereby an expected rent worth

$$(4.1) \quad U_B(v_1) = \max_{\hat{v}_1} v_1 - p_1(\hat{v}_1) + \int_{v_2 \geq v_1 - \Delta(\hat{v}_1)} (1 - G_2(v_2)) dv_2.$$

Routine computations yield the following characterization of incentive-compatible contracts.

¹⁰Myerson (1982).

Lemma 3. *A contract $(p_1(\hat{v}_1), \Delta(\hat{v}_1))_{\hat{v}_1 \in [0, \bar{v}]}$ is incentive-compatible if and only if it satisfies for all $v_1 \in [0, \bar{v}]$*

$$(4.2) \quad \dot{U}_B(v_1) = G_2(v_1 - \Delta(v_1)),$$

and

$$(4.3) \quad \dot{\Delta}(v_1) \leq 0.$$

Lemma 3 shows that the rent profile of the buyer must be increasing with her own valuation v_1 (see Equation (4.2)). Intuitively, B has some incentives to understate her valuation v_1 in order to reduce the price paid to I .¹¹ To counter those incentives, I must give up some information rent to buyers with high valuations. Finally, observe that buyers with higher valuations are more sensitive to a decrease in the probability of entry than buyers with lower valuations. In other words, the indifference curves of buyers in the (Δ, p_1) -space have steeper slopes at higher valuations. As a result of this single-crossing condition, to be incentive-compatible and screen buyers according to their valuation, the profile of rebates must thus be non-increasing (see Equation (4.3)).

OPTIMAL CONTRACT. On top of the incentive constraints characterized in Lemma 3, the contract must also ensure that the buyer prefers, at stage 1, accepting I 's offer rather than relying on the spot market or buying directly from E . This imposes the following participation constraints

$$(4.4) \quad U_B(v_1) \geq U_B^{sm}(v_1) \quad \forall v_1 \in [0, \bar{v}].$$

From the analyses undertaken in Sections 2 and 3, we conjecture that the optimal contract is characterized by a threshold v_1^* (to be determined below) such that:

- Buyers with valuations $v_1 \leq v_1^*$ reject I 's contract, and buy either from the spot market or directly from E ;
- Buyers with valuations $v_1 \geq v_1^*$ accept I 's contract, and may switch later on depending on their valuation v_2 for E 's service.

I 's expected profit may then be rewritten as follows¹²

$$\begin{aligned} \Pi_I &= \int_{p_1^{sm}}^{v_1^*} p_1^{sm} G_2(v_1 - p_1^{sm}) dG_1(v_1) \\ &+ \int_{v_1^*}^{\bar{v}} \left(v_1 - \Delta(v_1)(1 - G_2(v_1 - \Delta(v_1))) + \int_{v_2 \geq v_1 - \Delta(v_1)} (1 - G_2(v_2)) dv_2 - U_B(v_1) \right) dG_1(v_1) \end{aligned}$$

Indeed, a buyer with a valuation for I 's service v_1 lower than v_1^* goes to the spot market and, from the analysis undertaken in Section 2, buys from I at a price p_1^{sm} only when

¹¹One intuitive way to see this is to look at the price paid by B under symmetric information, namely $p_1^*(v_1) = v_1 + \int_{v_2 \geq v_1} (1 - G_2(v_2)) dv_2 - U_B^{sm}(v_1)$. Then, we have $\dot{p}_1^*(v_1) = G_2(v_1) - G_2(v_1 - p_1^{sm}) > 0$. Therefore, B has incentives to understate her valuation to lower the price paid to I .

¹²As is usual, we express I 's problem in terms of $(\Delta(v_1), U_B(v_1))$ rather than in terms of $(p_1(v_1), p_2(v_1))$.

$v_1 \geq v_1^{sm}$. Second, when $v_1 \geq v_1^*$, the buyer accepts I 's contract but decides to switch later on to the entrant when $v_2 \geq v_1 - \Delta(v_1)$.

I 's problem is to maximize over $(v_1^*, \Delta(v_1), U_B(v_1))$ his objective Π_I subject to the incentive constraints (4.2) and (4.3), and the participation constraints (4.4). The next lemma describes some of key features of the optimal contract.

Proposition 2. *Let \tilde{v}_1 be such that $p_1^{sm} = \frac{1-G_1(\tilde{v}_1)}{g_1(\tilde{v}_1)}$. The optimal contract under asymmetric information is such that:*

- Buyers with valuations $v_1 \geq \tilde{v}_1$ receive a positive rebate for exclusivity

$$\Delta^{sb}(v_1) = \frac{1 - G_1(v_1)}{g(v_1)};$$

- Buyers with valuations $v_1 \leq \tilde{v}_1$ reject the contract and either buy from the spot market ($\tilde{v}_1 \geq v_1 \geq p_1^{sm}$) or rely on the entrant only ($v_1 \leq p_1^{sm}$)

The intuitions underlying Proposition 2 go as follows. First, as shown in Lemma 3, buyers are willing to understate their valuations. To make such a strategy less attractive, I increases the rebate with respect to the symmetric information benchmark; i.e., $\Delta^{sb}(v_1) > \Delta^*(v_1) = 0$ (with equality only for $v_1 = \bar{v}$). Increasing the rebate implies that the probability of entry increases. Indeed, by facilitating entry of the competing seller, I discourages buyers with higher valuations for his service from understating their valuations, for this would imply to forego large gains from trade with I . To summarize, excessive and socially inefficient entry arises as a way for the incumbent seller to reduce the buyer's information rent.

Asymmetric information also modifies participation. Only buyers with sufficiently large valuations $v_1 \geq \tilde{v}_1$ accept the incumbent's contract, with $\tilde{v}_1 \geq p_1^{sm}$ from the definition of p_1^{sm} and Lemma 2. Consequently, asymmetric information facilitates entry both at the intensive and at the extensive margins. At the intensive margin, those buyers who accept I 's contract switch more often to E . At the extensive margin, those buyers with low valuations for the incumbent's service ($v_1 \leq \tilde{v}_1$) either buy directly from E or from the spot market.

Figure 2 represents the optimal contract under asymmetric information.

5. BARGAINING POWER

We now relax the assumption that the buyer has all the bargaining power in her relationship with the entrant. We first show that, under symmetric information (Section 5.1), entry is now inefficiently reduced. We then consider the scenario of asymmetric information (Section 5.2) and show that there is a strong tension between efficiency and incentives, which sometimes leads to simple inflexible rules to decide on entry, i.e., bunching.

Before doing so, we first analyze the spot market outcome.

SPOT MARKET OUTCOME. The analysis closely follows the approach undertaken in Section 2, the only difference being that if B buys from E , then profits are determined according to the Nash bargaining solution with B (resp. E) having bargaining power α (resp. $1 - \alpha$), where $\alpha \in [0, 1]$. This implies that B 's and E 's profits are the sum of their

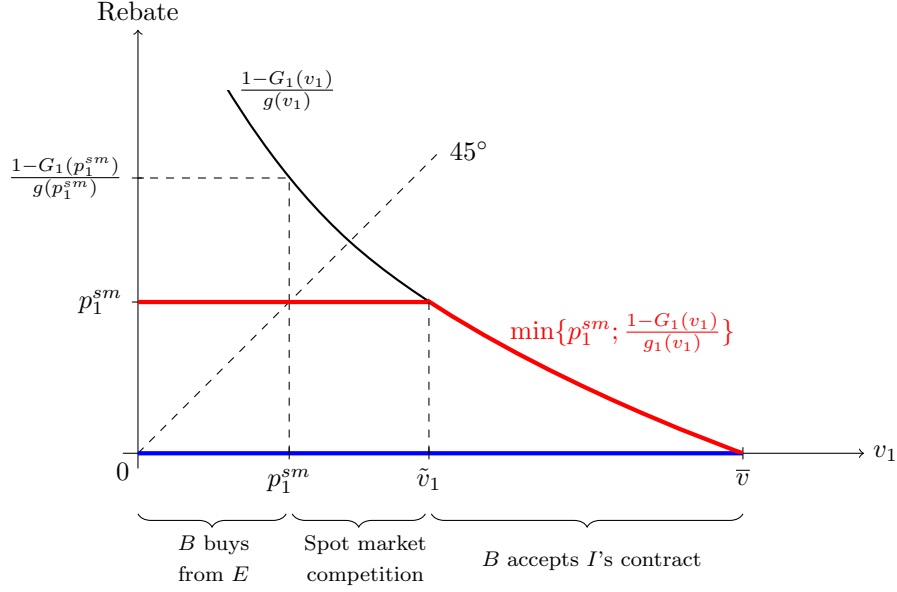


Figure 2: Optimal rebate under complete (blue) and asymmetric (red) information.

respective outside options and the share of the gains from trade corresponding to their bargaining power. To illustrate, if B decides to switch to E , her profit is the sum of her outside option, namely $v_1 - p_1$ (corresponding to the possibility of buying from I) and the share α of the gains from trade with E , namely $v_2 - (v_1 - p_1)$. Hence, at stage 3 of our game, B switches to E when $v_1 - p_1 + \alpha(v_2 - v_1 + p_1) \geq v_1 - p_1$, i.e., when $v_2 \geq v_1 - p_1$. Consequently, B 's expected gain from accepting I 's price on the spot market is given by

$$v_1 - p_1 + \alpha \int_{v_2 \geq v_1 - p_1} (v_2 - v_1 + p_1) dG_2(v_2).$$

Since B has still the possibility to turn down I 's price and to buy directly from E , in which case she gets the share α of the gains from trade v_2 , the buyer's spot market rent is given by

$$\max \left\{ v_1 - p_1 + \alpha \int_{v_2 \geq v_1 - p_1} (v_2 - v_1 + p_1) dG_2(v_2); \alpha \int v_2 dG_2(v_2) \right\}.$$

Proceeding as in Section 2, we obtain the following lemma.

Lemma 4. *In the spot market, when B has bargaining power α vis-à-vis E , I 's optimal price is still given by p_1^{sm} as characterized by (2.1). B accepts I 's price if $v_1 \geq p_1^{sm}$ and buys directly from E otherwise.*

The buyer's expected rent from the spot market is therefore given by

$$U_B^{sm}(v_1) = \max \left\{ v_1 - p_1^{sm} + \alpha \int_{v_2 \geq v_1 - p_1^{sm}} (v_2 - v_1 + p_1^{sm}) dG_2(v_2); \alpha \int v_2 dG_2(v_2) \right\}.$$

5.1. Contracts under Symmetric Information

Let us now consider the case in which there is complete information on v_1 and I offers a contract $(p_1(v_1), \Delta(v_1))$ at stage 1 of our game. The analysis closely echoes that

performed in Section 3. We simply note that the buyer's expected profit if she accepts the contract is now given by

$$U_B(v_1) = v_1 - p_1(v_1) + \alpha \int_{v_2 \geq v_1 - \Delta(v_1)} (v_2 - v_1 + \Delta(v_1)) dG_2(v_2).$$

B accepts I 's contract provided that $U_B(v_1) \geq U_B^{sm}(v_1)$. The optimal rebate under complete information is characterized in the proposition below.

Proposition 3. *Suppose there is symmetric information and B has bargaining power α vis-à-vis E . Then, I offers a contract, which is always accepted by B , that involves a rebate for exclusivity $\Delta_\alpha^*(v_1)$ characterized by*

$$(5.1) \quad \Delta_\alpha^*(v_1) = -(1 - \alpha) \frac{1 - G_2(v_1 - \Delta_\alpha^*(v_1))}{g_2(v_1 - \Delta_\alpha^*(v_1))}.$$

$\Delta_\alpha^*(v_1)$ is negative and increasing in v_1 and satisfies $\Delta_\alpha^*(\bar{v}) = 0$.

Figure 3 represents the optimal rebate $\Delta_\alpha^*(v_1)$ and compares this solution with the case in which the buyer has all the bargaining power (i.e., $\alpha = 1$). Two comments are worth mentioning.

First, the rebate is now negative. Indeed, when some of the gains from trade between B and E are kept by the entrant, I can no longer fully shift back the entry rent. Entry is now reduced inefficiently by I 's contract and thus $\Delta_\alpha^*(v_1) \leq 0$. This result echoes Aghion and Bolton (1987)'s insight that inefficient foreclosure arises when the incumbent seller cannot appropriate the gains associated to entry of the competing seller.

Second, the rebate now increases with the buyer's valuation v_1 . Intuitively, buyers with higher valuations for I 's service are less likely to switch to E , so that there is less reason to reduce inefficiently entry for those buyers.

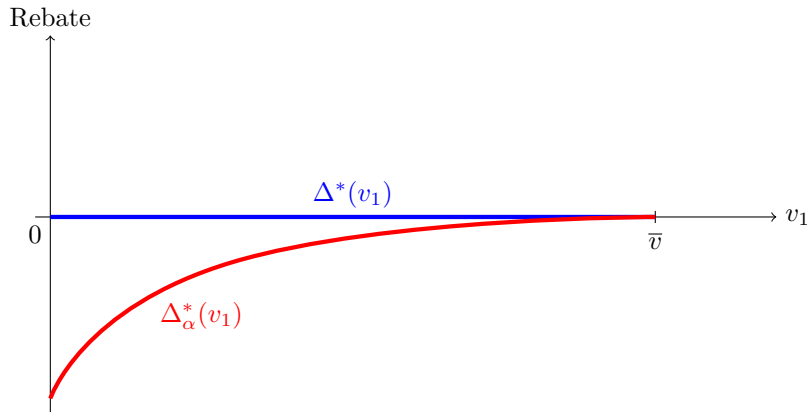


Figure 3: Optimal rebate under symmetric information: $\alpha = 1$ (blue), $\alpha < 1$ (red).

5.2. Contracts under Asymmetric Information

Let us now consider that v_1 is private information. Again, since the analysis follows closely that undertaken in Section 4, most of the technicalities are relegated in Appendix A.8.

With asymmetric information, there is now a strong conflict between, on the one hand, efficiency,¹³ and, on the other hand, incentive provision. As stated in Proposition 3, efficiency commands to implement a profile of rebates that is increasing with the buyer's valuation for the incumbent's service. However, as shown in Lemma 3, incentive compatibility requires to implement a profile of rebates that is decreasing in v_1 .¹⁴ This extreme conflict between efficiency and incentives considerations may force I to give up screening the different types of buyer and to offer a constant rebate to all those types. Put differently, full bunching may now emerge.¹⁵

To streamline the analysis, we study two polar cases. In the first setting, screening of the various buyers is always possible. In the second, all types of buyer are bunched altogether and the optimal rebate is constant.

Proposition 4. *Suppose there is asymmetric information and B has bargaining power α vis-à-vis E . Then, there exists a threshold $\tilde{v}_{1\alpha}$ such that:*

- Buyers with valuations $v_1 \geq \tilde{v}_{1\alpha}$ receive a rebate $\Delta_\alpha^{sb}(v_1)$ defined as

$$(5.2) \quad \Delta_\alpha^{sb}(v_1) = \alpha \frac{1 - G_1(v_1)}{g_1(v_1)} - (1 - \alpha) \frac{1 - G_2(v_1 - \Delta_\alpha^{sb}(v_1))}{g_2(v_1 - \Delta_\alpha^{sb}(v_1))};$$

- Buyers with valuations $v_1 \leq \tilde{v}_{1\alpha}$ reject I 's contract and either buy directly from E or rely on the spot market.

This profile of rebates involves no bunching provided that

$$(H) \quad \dot{\Delta}_\alpha^{sb}(v_1) \leq 0 \quad \forall v_1.$$

Figure 4 represents optimal rebate profile $\Delta_\alpha^{sb}(\cdot)$, assuming Condition (H) is always satisfied.¹⁶

Under asymmetric information and shared bargaining power, the optimal rebate reflects the two effects already unveiled by our analysis. First, asymmetric information calls for increasing the rebate beyond its full information level, which promotes entry. This effect is captured by the first term in the right hand-side of Equation (5.2). Second, the shared bargaining power between B and E calls for decreasing the rebate, which reduces entry. This corresponds to the second term in the right hand-side of Equation (5.2). Provided that the compounding of these two effects keeps the rebate decreasing with the buyer's valuation v_1 , so that the second-order conditions for incentive compatibility are still satisfied, the outcome is qualitatively similar to the one obtained when B has full bargaining power vis-à-vis E . When B 's valuation v_1 is low enough, she turns down I 's contract and relies either on E or on the spot market for her supplies. When v_1 is instead large enough, B accepts I 's contract and faces a positive rebate for exclusivity.

The rebate characterized in Equation (5.2) may not always satisfy the monotonicity requirement imposed by incentive compatibility, namely Condition (H). Indeed, we have

¹³Efficiency refers to the incumbent seller's objective.

¹⁴Although Lemma 3 refers to the case $\alpha = 1$, we show in Appendix A.8 that the same second-order condition for incentive compatibility must be satisfied when $\alpha < 1$.

¹⁵See Lewis and Sappington (1989) for an earlier example of such inflexible rules in incentive problems and Guesnerie and Laffont (1984) for some general analysis.

¹⁶Observe that (5.2) leads to $\Delta_\alpha^{sb}(\bar{v}) = 0$. Therefore, under Condition (H), $\Delta_\alpha^{sb}(v_1) \geq 0$ for all v_1 .

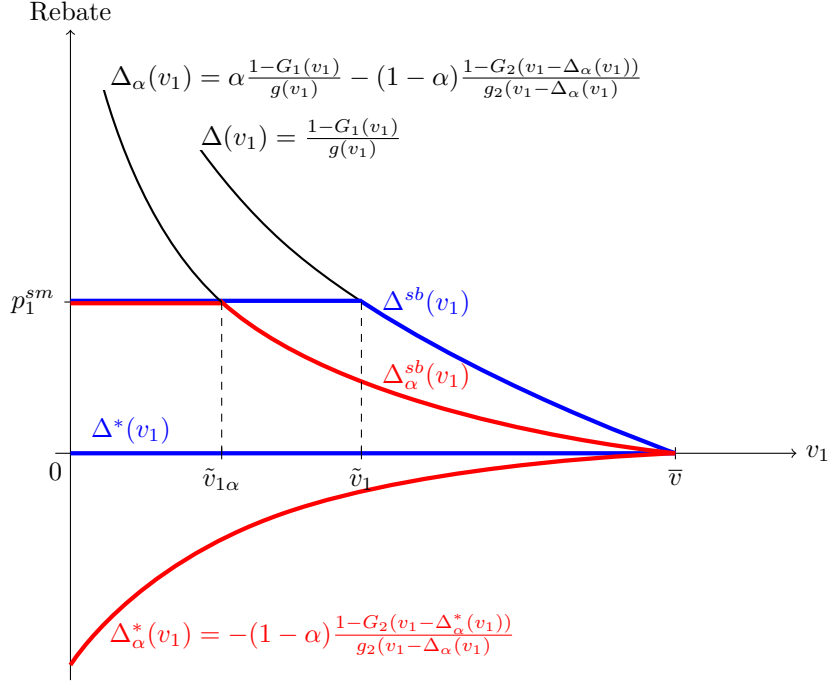


Figure 4: Optimal rebate under symmetric information and under asymmetric information when Condition (H) is satisfied (no bunching): $\alpha = 1$ (blue), $\alpha < 1$ (red).

shown that promoting entry for incentive reasons leads to a decreasing rebate profile (Proposition 2). Foreclosing entry for efficiency reasons leads however to an increasing rebate profile (Proposition 3). When the latter effect is stronger than the former, the rebate profile $\Delta_\alpha^{sb}(\cdot)$ does not satisfy Condition (H) and some bunching must occur.¹⁷

This is best illustrated in the case where B has no bargaining power vis-à-vis E , or $\alpha = 0$:¹⁸ the rebate $\Delta_0^{sb}(v_1)$ corresponding to Equation (5.2) is strictly increasing in v_1 . As a result, bunching must occur, or, put differently, I is led to offer a constant rebate to all types of buyers. We then obtain the following characterization of the optimal contract.¹⁹

Proposition 5. *Suppose there is asymmetric information and B has no bargaining power vis-à-vis E (that is, $\alpha = 0$). Then, there exists \tilde{v}_{10} such that:*

- Buyers with valuations $v_1 \geq \tilde{v}_{10}$ receive a constant negative rebate Δ_0^{sb} defined as

$$(5.3) \quad \Delta_0^{sb} = - \frac{\int_{\tilde{v}_{10}}^{\bar{v}} (1 - G_2(v_1 - \Delta_0^{sb})) dG_1(v_1)}{\int_{\tilde{v}_{10}}^{\bar{v}} g_2(v_1 - \Delta_0^{sb}) dG_1(v_1)};$$

- Buyers with valuations $v_1 \leq \tilde{v}_{10}$ reject I 's contract and either buy directly from E or rely on the spot market.

¹⁷If valuation v_i , $i = 1, 2$, is distributed according to a distribution with linear hazard rate $\beta_i(\bar{v} - v_i)$, then Condition (H) amounts to $\alpha\beta_1 \geq (1 - \alpha)\beta_2$, which holds when B 's bargaining power vis-à-vis E is sufficiently large.

¹⁸Notice, incidentally, that $\alpha = 0$ corresponds to Aghion and Bolton (1987)'s assumption.

¹⁹In Appendix A.8, we characterize the optimal contract for all values of α when there is bunching for all types of buyer.

Figure 5 compares the profile of rebates in the two polar cases of full bargaining power and no bargaining power.

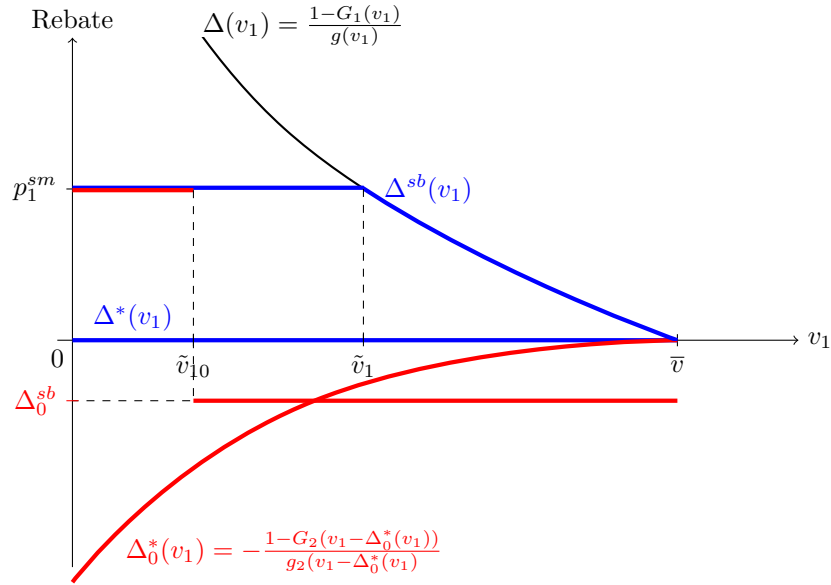


Figure 5: Optimal rebate under symmetric information and under asymmetric information when Condition (H) is never satisfied: $\alpha = 1$ (blue), $\alpha = 0$ (red).

6. CONCLUSION

Aghion and Bolton (1987) have shown that a dominant seller tends to foreclose a more efficient competitor when the gains from trade associated to entry cannot be fully appropriated by the buyer and pocketed back by the dominant seller. From this starting point, we introduce some frictions in the relationship between the dominant seller and the buyer, which takes place now under asymmetric information. Asymmetric information calls instead for promoting (socially inefficient) entry in order to discourage buyers from understating their valuations for the incumbent's service. Therefore, asymmetric information between the dominant seller and the buyer tends to soften the antitrust concern about the foreclosure of more efficient rival sellers. We also show that when the buyer has a weak bargaining power vis-à-vis the entrant seller, the incumbent seller loses his ability to screen the various types of buyers and is led to offer a constant rebate that forecloses inefficiently entry.

Our analysis could be extended in several dimensions. For instance, we have assumed that the buyer has independent valuations for the incumbent's and the entrant's services. It may be worth investigating alternative frameworks in which these valuations are (imperfectly) correlated. In a similar vein, asymmetric information could endogenize how the gains from entry are shared between the buyer and the seller. This is left for future research.

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A. APPENDIX

A.1. Proof of Lemma 1

Notice that $(v_1 - p_1)G_2(v_1 - p_1) + \int_{v_2 \geq v_1 - p_1} v_2 dG_2(v_2) \geq \int v_2 dG_2(v_2)$ amounts to

$$(A.1) \quad (v_1 - p_1)G_2(v_1 - p_1) \geq \int_{v_2 \leq v_1 - p_1} v_2 dG_2(v_2).$$

Let $\varphi(x) : x \mapsto xG_2(x) - \int_0^x v_2 dG_2(v_2)$. It is straightforward to show that $\varphi'(x) \geq 0 \forall x$ and $\varphi(0) = 0$. Therefore, (A.1) is satisfied iff $v_1 \geq p_1$.

A.2. Proof of Lemma 2

Integrating by parts the numerator, (2.1) can be rewritten as follows

$$p_1^{sm} = \frac{\int_{v_1 \geq p_1^{sm}} g_2(v_1 - p_1^{sm})(1 - G_1(v_1))dv_1}{\int_{v_1 \geq p_1^{sm}} g_2(v_1 - p_1^{sm})g_1(v_1)dv_1}.$$

Since G_1 satisfies the monotone hazard rate property, $\frac{1-G_1(v_1)}{g(v_1)} \leq \frac{1-G_1(p_1^{sm})}{g(p_1^{sm})}$ for all $v_1 \geq p_1^{sm}$. Therefore

$$\begin{aligned} p_1^{sm} &\leq \frac{\int_{v_1 \geq p_1^{sm}} g_2(v_1 - p_1^{sm})g_1(v_1) \frac{1-G_1(p_1^{sm})}{g_1(p_1^{sm})} dv_1}{\int_{v_1 \geq p_1^{sm}} g_2(v_1 - p_1^{sm})g_1(v_1)dv_1} \\ &= \frac{1 - G_1(p_1^{sm})}{g_1(p_1^{sm})}. \end{aligned}$$

This proves the result. Notice that the inequality is strict as soon as $v_1 > p_1^{sm}$.

A.3. Proof of Proposition 1

From Lemma 1, we know that $U_B^{sm}(v_1) = \int v_2 dG_2(v_2)$ if $v_1 \leq p_1^{sm}$ and $U_B^{sm}(v_1) = v_1 - p_1^{sm} + \int_{v_2 \geq v_1 - p_1^{sm}} (v_2 - v_1 + p_1^{sm})dG_2(v_2)$ if $v_1 \geq p_1^{sm}$.

The participation constraint must bind at the optimum for, otherwise, I could raise his price $p_1(v_1)$ and $p_2(v_1)$ by the same small positive amount, which would increase his profit.²⁰ I 's problem becomes thus

$$\max_{\Delta(v_1)} v_1 + \int_{v_2 \geq v_1 - \Delta(v_1)} (1 - G_2(v_2))dv_2 - \Delta(v_1)(1 - G_2(v_1 - \Delta(v_1))) - U_B^{sm}(v_1).$$

The first-order condition writes as follows

$$-\Delta(v_1)g_2(v_1 - \Delta(v_1)) = 0,$$

which holds iff $\Delta(v_1) = 0$. Observe that this condition also shows that the objective is increasing in $\Delta(v_1)$ for $\Delta(v_1) \leq 0$ and decreasing in $\Delta(v_1)$ for $\Delta(v_1) \geq 0$. Hence, the objective is quasi-concave in $\Delta(v_1)$, and the first-order condition is both necessary and sufficient.

When $v_1 \leq p_1^{sm}$, I 's profit when using a contract is thus equal to $v_1 + \int_{v_2 \geq v_1} (v_2 - v_1)dG_2(v_2) - \int v_2 dG_2(v_2) \geq 0$ (with a strict inequality as soon as $v_1 > 0$). Hence, I offers a contract.

When $v_1 \geq p_1^{sm}$, I 's payoff is $v_1 + \int_{v_2 \geq v_1} (1 - G_2(v_2))dv_2 - (v_1 - p_1^{sm} + \int_{v_2 \geq v_1 - p_1^{sm}} (v_2 - v_1 + p_1^{sm})dG_2(v_2))$ when using a contract. If I does not use a contract and relies on the spot market

²⁰See Laffont and Martimort (2002) for instance.

only, his gain is $\max_{p_1} \int_{v_2 \geq p_1} p_1 G_2(v_1 - p_1) dG_2(v_2)$. Therefore, I prefers using a contract iff

$$v_1 + \int_{v_2 \geq v_1} (1 - G_2(v_2)) dv_2 \geq U_B^m(v_1) + \max_{p_1} \int_{v_2 \geq p_1} p_1 G_2(v_1 - p_1) dG_2(v_2),$$

which holds since the left-hand side is the joint surplus of I and B maximized over $p_1(v_1)$ and $p_2(v_1)$, whereas the right-hand side is the joint surplus of I and B when $p_1(v_1)$ is set to maximize I 's profit only.

A.4. Proof of Lemma 3

Let $U_B(v_1, \hat{v}_1) = v_1 - p_1(\hat{v}_1) + \int_{v_2 \geq v_1 - \Delta(\hat{v}_1)} (1 - G_2(v_2)) dv_2$ be the expected gain of a buyer with type v_1 who claims to be of type \hat{v}_1 . The local first- and second-order conditions for truthful reporting are

$$\left. \frac{\partial U_B}{\partial \hat{v}_1}(v_1, \hat{v}_1) \right|_{\hat{v}_1=v_1} = 0 \quad \text{and} \quad \left. \frac{\partial^2 U_B}{\partial \hat{v}_1^2}(v_1, \hat{v}_1) \right|_{\hat{v}_1=v_1} \leq 0.$$

Using B 's expected gain as given by (4.1), the two conditions above can be rewritten as (4.2) and (4.3) respectively.

Global incentive compatibility for the type- v_1 buyer requires that for all \hat{v}_1

$$(IC_{v_1}) \quad U_B(v_1) \geq U_B(v_1, \hat{v}_1) = U_B(\hat{v}_1) + (v_1 - \hat{v}_1) + \varphi(v_1, \Delta(\hat{v}_1)) - \varphi(\hat{v}_1, \Delta(\hat{v}_1)),$$

where $\varphi(v_1, \Delta) = \int_{v_2 \geq v_1 - \Delta} (1 - G_2(v_2)) dv_2$. Summing constraints (IC_{v_1}) and $(IC_{\hat{v}_1})$ leads to

$$\varphi(v_1, \Delta(v_1)) - \varphi(\hat{v}_1, \Delta(v_1)) \geq \varphi(v_1, \Delta(\hat{v}_1)) - \varphi(\hat{v}_1, \Delta(\hat{v}_1)),$$

which can be rewritten as

$$\int_{\hat{v}_1}^{v_1} \int_{\Delta(\hat{v}_1)}^{\Delta(v_1)} \frac{\partial^2 \varphi}{\partial v_1 \partial \Delta} d\Delta dv_1 \geq 0.$$

Observe now that $\frac{\partial^2 \varphi}{\partial v \partial \Delta} = -g_2(v_1 - \Delta) \leq 0$. Therefore, provided that $\Delta(\cdot)$ is non-decreasing, the menu of contracts is globally incentive compatible.

A.5. Proof of Proposition 2

From (4.2), the rent profile $U_B(\cdot)$ must be non-decreasing in v_1 . Observe also that for $v_1 \geq p_1^{sm}$, $\dot{U}_B^{sm}(v_1) = G_2(v_1 - p_1^{sm})$. Consequently, $\dot{U}_B(v_1) - \dot{U}_B^{sm}(v_1) = G_2(v_1 - \Delta(v_1)) - G_2(v_1 - p_1^{sm})$. Let us assume for the moment, and check later on, that $\Delta(v_1) \leq p_1^{sm}$. This implies that $\dot{U}_B(v_1) - \dot{U}_B^{sm}(v_1) \geq 0$ so that (4.4) can be replaced by $U_B(v_1^*) \geq U_B^{sm}(v_1^*)$. That constraint must bind at the optimum, or $U_B(v_1^*) = U_B^{sm}(v_1^*)$. Using this and (4.2), B 's rent may be written as follows

$$U_B(v_1) = U_B^{sm}(v_1^*) + \int_{v_1^*}^{v_1} G_2(x - \Delta(x)) dx,$$

which allows in turn to express B 's expected rent as follows

$$\int_{v_1^*}^{\bar{v}} U_B(v_1) dG_1(v_1) = U_B^{sm}(v_1^*) (1 - G_1(v_1^*)) + \int_{v_1^*}^{\bar{v}} G_2(v_1 - \Delta(v_1)) \frac{1 - G_1(v_1)}{g_1(v_1)} dG_1(v_1).$$

We can use this expression of B 's expected rent to rewrite I 's objective as follows

$$\int_{p_1^{sm}}^{v_1^*} p_1^{sm} G_2(v_1 - p_1^{sm}) dG_1(v_1) - U_B^{sm}(v_1^*)(1 - G_1(v_1^*)) \\ + \int_{v_1^*}^{\bar{v}} \left(v_1 - \Delta(v_1)(1 - G_2(v_1 - \Delta(v_1))) + \int_{v_2 \geq v_1 - \Delta(v_1)} (1 - G_2(v_2)) dv_2 - G_2(v_1 - \Delta(v_1)) \frac{1 - G_1(v_1)}{g_1(v_1)} \right) dG_1(v_1),$$

which has to be maximized over v_1^* and $\Delta(v_1)$.

Pointwise optimization on $[v_1^*, \bar{v}]$ leads to the following first-order condition $\Delta^{sb}(v_1) = \frac{1 - G_1(v_1)}{g_1(v_1)}$. The second-order condition is $-g_2'(v_1 - \Delta(v_1))(\Delta(v_1) + \frac{1 - G_1(v_1)}{g_1(v_1)}) - g_2(v_1 - \Delta(v_1)) \leq 0$. That condition holds locally for $\Delta(v_1) = \Delta^{sb}(v_1)$ and globally if g_2' is negligible w.r.t. g_2 for instance.

The first-order condition w.r.t. v_1^* yields (using the fact that $\Delta^{sb}(v_1^*) = \frac{1 - G_1(v_1^*)}{g_1(v_1^*)}$)

$$(A.2) \quad v_1^* - \Delta^{sb}(v_1^*) + \int_{v_1^* - \Delta^{sb}(v_1^*)}^{\bar{v}} (1 - G_2(v_2)) dv_2 \\ = p_1^{sm} G_2(v_1^* - p_1^{sm}) - \dot{U}_B^{sm}(v_1^*) \frac{1 - G_1(v_1^*)}{g_1(v_1^*)} + U_B^{sm}(v_1^*).$$

Now, let \tilde{v}_1 be such that $p_1^{sm} = \frac{1 - G_1(\tilde{v}_1)}{g_1(\tilde{v}_1)}$. We have $\tilde{v}_1 \geq p_1^{sm}$ from Lemma 2. Observe that $(\tilde{v}_1 - p_1^{sm})G_2(\tilde{v}_1 - p_1^{sm}) + \int_{\tilde{v}_1 - p_1^{sm}}^{\bar{v}} v_2 dG_2(v_2) = (\tilde{v}_1 - p_1^{sm}) + \int_{\tilde{v}_1 - p_1^{sm}}^{\bar{v}} (1 - G_2(v_2)) dv_2$ and that $(\tilde{v}_1 - p_1^{sm}) + \int_{\tilde{v}_1 - p_1^{sm}}^{\bar{v}} (1 - G_2(v_2)) dv_2 \geq \int_0^{\bar{v}} v_2 dG_2(v_2)$ (since the function $x \mapsto \varphi(x) = x + \int_x^{\bar{v}} (1 - G_2(v_2)) dv_2$ is increasing in x with $\varphi(0) > 0$). Therefore, we have $\dot{U}_B^{sm}(\tilde{v}_1) = G_2(\tilde{v}_1 - p_1^{sm})$.

It is then straightforward to show that the first-order condition (A.2) is satisfied at $v_1^* = \tilde{v}_1$. Last, for all $v_1 \geq v_1^* = \tilde{v}_1$, $\Delta^{sb}(v_1) \leq \Delta^{sb}(v_1^*) = \Delta^{sb}(\tilde{v}_1) = p_1^{sm}$.

A.6. Proof of Lemma 4

Notice that $v_1 - p_1 + \alpha \int_{v_2 \geq v_1 - p_1} (v_2 - v_1 + p_1) dG_2(v_2) \geq \alpha \int v_2 dG_2(v_2)$ amounts to

$$(v_1 - p_1)[G_2(v_1 - p_1) + (1 - \alpha)(1 - G_2(v_1 - p_1))] - \alpha \int_{v_1 \leq v_1 - p_1} v_2 dG_2(v_2) \geq 0.$$

The function $x \mapsto \varphi(x) = x[G_2(x) + (1 - \alpha)(1 - G_2(x))] - \alpha \int_{v_1 \leq x} v_2 dG_2(v_2)$ is increasing in $x \geq 0$ and takes value 0 at $x = 0$. Therefore, B accepts I 's price iff $v_1 \geq p_1$.

I 's profit is thus given by $\int_{v_1 \geq p_1} p_1 G_2(v_1 - p_1) dG_1(v_1)$, and is maximized for $p_1 = p_1^{sm}$.

A.7. Proof of Proposition 3

I 's problem is to maximize over $(p_1(v_1), \Delta(v_1))$ his expected profit $p_1(v_1) - \Delta(v_1)(1 - G_2(v_1 - \Delta(v_1)))$ subject to the participation constraint $v_1 - p_1(v_1) + \alpha \int_{v_2 \geq v_1 - \Delta(v_1)} (v_2 - v_1 + \Delta(v_1)) dG_2(v_2) \geq U_B^{sm}(v_1)$. The price $p_1(v_1)$ is such that the participation constraint binds. Replacing in I 's objective and optimizing w.r.t. $\Delta(v_1)$ leads to the following first-order condition

$$-\Delta(v_1)g_2(v_1 - \Delta(v_1)) - (1 - \alpha)(1 - G_2(v_1 - \Delta(v_1))) = 0,$$

which leads to (5.1) after rearranging terms. Notice that $\psi : \Delta \mapsto \psi(\Delta) = -\Delta - (1 - \alpha)(1 - G_2(v_1 - \Delta))/g_2(v_1 - \Delta)$ is such that $\psi'(\Delta) < 0$, so that the objective is quasi-concave in Δ .

Totally differentiating (5.1) w.r.t. v_1 leads to

$$\dot{\Delta}_\alpha^*(v_1) \left(1 - (1 - \alpha) \left(\frac{d}{dv_2} \frac{1 - G_2(v_2)}{g_2(v_2)} \right) \Big|_{v_1 - \Delta_\alpha^*(v_1)} \right) = -(1 - \alpha) \left(\frac{d}{dv_2} \frac{1 - G_2(v_2)}{g_2(v_2)} \right) \Big|_{v_1 - \Delta_\alpha^*(v_1)}$$

which implies, thanks to the Monotone Hazard Rate Property, that $\dot{\Delta}_\alpha^*(v_1) > 0$ for any $\alpha < 1$.

When $v_1 \geq p_1^{sm}$, B 's outside option is $v_1 - p_1^{sm} + \alpha \int_{v_2 \geq v_1 - p_1^{sm}} (v_2 - v_1 + p_1^{sm}) dG_2(v_2)$. An argument similar to the one used in the Proof of Proposition 1 in Appendix A.3 can be used to show that I always prefers using a contract.

When $v_1 \leq p_1^{sm}$, B 's outside option is $\int v_2 dG_2(v_2)$. I 's profit if he offers a contract is then equal to $v_1 + \alpha \int_{v_2 \geq v_1 - \Delta_\alpha^*(v_1)} (v_2 - v_1 + \Delta_\alpha^*(v_1)) dG_2(v_2) - \alpha \int v_2 dG_2(v_2) - \Delta_\alpha^*(v_1) (1 - G_2(v_1 - \Delta_\alpha^*(v_1)))$. The derivative of this expression w.r.t. α is $\int_{v_2 \geq v_1 - \Delta_\alpha^*(v_1)} (v_2 - v_1 + \Delta_\alpha^*(v_1)) dG_2(v_2) - \int v_2 dG_2(v_2)$, which is negative. Since we have shown in Appendix A.3 that I prefers offering a contract when $v_1 \leq p_1^{sm}$ and $\alpha = 1$, this also holds true when $v_1 \leq p_1^{sm}$ and $\alpha < 1$.

A.8. Proof of Proposition 4

B 's expected gain if she reveals truthfully her valuation is now given by

$$U_B(v_1) = v_1 - p_1(v_1) + \alpha \int_{v_2 \geq v_1 - \Delta(v_1)} (v_2 - v_1 + \Delta(v_1)) dG_2(v_2).$$

Applying the same methodology as in Section A.4, the first- and second-order conditions for incentive compatibility are now given by

$$\dot{U}_B(v_1) = 1 - \alpha(1 - G_2(v_1 - \Delta(v_1))) \quad \text{and} \quad \dot{\Delta}(v_1) \leq 0.$$

For $v_1 \geq p_1^{sm}$, we have $\dot{U}_B^{sm}(v_1) = 1 - \alpha(1 - G_2(v_1 - p_1^{sm}))$ (see Section A.6). Therefore, $\dot{U}_B(v_1) \geq \dot{U}_B^{sm}(v_1)$ iff $p_1^{sm} \geq \Delta(v_1)$. Let us assume, and check a posteriori, that this indeed the case.

Define now $v_{1\alpha}^*$ such that for $v \geq v_{1\alpha}^*$, $U_B(v) \geq U_B^{sm}(v)$ and for $v \leq v_{1\alpha}^*$, $U_B(v) \leq U_B^{sm}(v)$. We can use the first-order incentive constraint to obtain

$$\int_{v_{1\alpha}^*}^{\bar{v}} U_B(v) dG_1(v) = (1 - G_1(v_{1\alpha}^*)) U_B^{sm}(v_{1\alpha}^*) + \int_{v_{1\alpha}^*}^{\bar{v}} \frac{1 - G_1(v)}{g_1(v)} \left(1 - \alpha(1 - G_2(v - \Delta(v))) \right) dG_1(v).$$

This expression can be used to rewrite I 's objective as follows

$$\begin{aligned} & \int_{p_1^{sm}}^{v_{1\alpha}^*} p_1^{sm} G_2(v_1 - p_1^{sm}) dG_1(v_1) - (1 - G_1(v_{1\alpha}^*)) U_B^{sm}(v_{1\alpha}^*) \\ & + \int_{v_{1\alpha}^*}^{\bar{v}} \left(v_1 + \int_{v_2 \geq v_1 - \Delta(v_1)} \left(\alpha(v_2 - v_1) - (1 - \alpha)\Delta(v_1) \right) dG_2(v_2) - \frac{1 - G_1(v_1)}{g_1(v_1)} \left(1 - \alpha(1 - G_2(v_1 - \Delta(v_1))) \right) \right) dG_1(v_1, \end{aligned}$$

which has to be maximized over $\Delta(\cdot)$ and $v_{1\alpha}^*$, and which must satisfy, for all v_1 , $p_1^{sm} \geq \Delta(v_1)$ (to ensure that the net rent is increasing) and the second-order conditions for incentive compatibility $\dot{\Delta}(v_1) \leq 0 \forall v_1$.

RELAXED PROBLEM. Let us determine the solution of the so-called relaxed problem in which the constraint $\dot{\Delta}(\cdot) \leq 0$ is neglected. Pointwise optimization w.r.t. $\Delta(v_1)$ on $[v_{1\alpha}^*, \bar{v}]$ leads to (5.2). It is immediate to check that the objective is quasi-concave in $\Delta(v_1)$. Straightforward

computations then show that Condition (H) stated in Proposition 4 amounts to

$$\dot{\Delta}_\alpha^{sb}(v_1) \leq 0 \Leftrightarrow \alpha \frac{d}{dv_1} \left(\frac{1 - G_1(v_1)}{g_1(v_1)} \right) \leq (1 - \alpha) \frac{d}{dv_2} \left(\frac{1 - G_2(v_2)}{g_2(v_2)} \right) \Big|_{v_1 - \Delta_\alpha^{sb}(v_1)},$$

which is satisfied provided that B 's bargaining power α is large enough.

It remains to optimize over $v_{1\alpha}^*$. Using the fact that $U_B^{sm}(v_{1\alpha}^*) = v_{1\alpha}^* - p_1^{sm} + \alpha \int_{v_2 \geq v_{1\alpha}^* - p_1^{sm}} (v_2 - v_{1\alpha}^* + p_1^{sm}) dG_2(v_2)$ and $\dot{U}_B^{sm}(v_{1\alpha}^*) = 1 - \alpha(1 - G_2(v_{1\alpha}^* - p_1^{sm}))$, the first-order condition w.r.t. $v_{1\alpha}^*$ can be rewritten as follows (we assume that the second-order condition is satisfied)

$$(A.3) \quad \Delta_\alpha^{sb}(v_{1\alpha}^*)(1 - G_2(v_{1\alpha}^* - \Delta_\alpha^{sb}(v_{1\alpha}^*))) - p_1^{sm}(1 - G_2(v_{1\alpha}^* - p_1^{sm})) = 0.$$

Letting $\tilde{v}_{1\alpha}$ be such that $\Delta_\alpha^{sb}(\tilde{v}_{1\alpha}) = p_1^{sm}$, it is immediate to check that (A.3) holds for $v_{1\alpha}^* = \tilde{v}_{1\alpha}$.

Observe now that for $v_1 \geq \tilde{v}_{1\alpha}$, $\Delta_\alpha^{sb}(v_1) \leq \Delta_\alpha^{sb}(\tilde{v}_{1\alpha})$ (since $\dot{\Delta}_\alpha^{sb}(\cdot) \leq 0$), so that $p_1^{sm} \geq \Delta_\alpha^{sb}(v_1)$ on the relevant interval.

Last, there exists a spot market zone iff $\tilde{v}_{1\alpha} \geq p_1^{sm}$; otherwise all buyers with valuations $v_1 \geq p_1^{sm}$ accept I 's contract. Moreover, it comes immediately that $\Delta_\alpha^{sb}(\bar{v}) = 0$. Therefore, if $\dot{\Delta}_\alpha^{sb}(v_1) \leq 0 \forall v_1$, then $\Delta_\alpha^{sb}(v_1) \geq 0 \forall v_1$.

FULL BUNCHING. Suppose now that Condition (H) is never satisfied, or, equivalently, that the solution of the relaxed problem $\Delta_\alpha^{sb}(\cdot)$ violates the second-order incentive constraint for all possible values of v_1 . The solution involves then a constant rebate Δ_α^{sb} for all valuations $v_1 \geq \tilde{v}_{1\alpha}$, where the threshold $\tilde{v}_{1\alpha}$ has to be determined endogenously.

Maximizing the same objective as in the case of the relaxed problem but with a fixed rebate, the first-order condition associated to Δ_α^{sb} can now be written as follows

$$(A.4) \quad \Delta_\alpha^{sb} = \frac{\int_{\tilde{v}_{1\alpha}}^{\bar{v}} \left(\alpha(1 - G_1(v_1))g_2(v_1 - \Delta_\alpha^{sb}) - (1 - \alpha)(1 - G_2(v_1 - \Delta_\alpha^{sb}))g_1(v_1) \right) dv_1}{\int_{\tilde{v}_{1\alpha}}^{\bar{v}} g_1(v_1)g_2(v_1 - \Delta_\alpha^{sb}) dv_1}.$$

The first-order condition w.r.t. $\tilde{v}_{1\alpha}$ leads to (after some manipulations) the following characterization (assuming that the second-order condition is satisfied)

$$(A.5) \quad \int_{\tilde{v}_{1\alpha} - p_1^{sm}}^{\tilde{v}_{1\alpha} - \Delta_\alpha^{sb}} \left(\alpha \frac{1 - G_1(\tilde{v}_{1\alpha})}{g_1(\tilde{v}_{1\alpha})} - (1 - \alpha) \frac{1 - G_2(v_2)}{g_2(v_2)} + (v_2 - \tilde{v}_{1\alpha}) \right) dG_2(v_2) = 0.$$

Δ_α^{sb} and $\tilde{v}_{1\alpha}$ are jointly determined by (A.4) and (A.5). Putting $\alpha = 0$ in (A.4) leads to (5.3).