Disclosure Regime and Bargaining in Vertical Markets

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Abstract

We consider the strategic implications of the disclosure regime of vertical contract terms by endogenizing them. The latter are exogenously set in the literature either as observable or as secret. By endogenizing the disclosure regime we show that the mode and intensity of the downstream competition, as well as the upstream market structure, play a significant role in the observability of the vertical contract terms. On the contrary, this decision is independent of the bargain power distribution or the product differentiation. When a common supplier bargains with each retailer over a two-part tariff contract, interim observability intensifies the commitment problem, by offering a wholesale price below the marginal cost. The same holds under linear contracts or Bertrand competition. On the other hand, under dedicated suppliers, it is more profitable to bargain over interim unobservable contracts and through them to alleviate the commitment problem. Policymakers could increase the social welfare by encouraging interim observability (unobservability) when firms compete in quantities (prices). Monopolized upstream markets are more prone to have aligned incentives with the policymakers, especially if the downstream retailers compete over quantities.

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1 Introduction

Vertical contracts in which one or more of the parties to the agreement possesses market power on the relevant market, give rise to competition concerns (Office of Fair Trading, 2004). The process of vertical contracting refers not only to the very trading terms of the vertical contracts but to the whole process of the determination of the contract terms. The various contractual provisions, broadly characterized as *vertical restraints*,[1] could produce both pro– and anti–competitive effects (Rey, 2012). Vertical restraints attract much attention due to their effect on the competition. Two important and negative effects of vertical restraints are the competition softening between some parties of the agreement and/or the facilitation of downstream collusion through the manipulation of prices. The latter, in turn, could cause negative effects in the competition and can harm consumers (European Commission, 2010). One could argue why the disclosure regime of the vertical contract terms is not part of these vertical restraints? As we will show, the disclosure regime could be used to manipulate downstream competition. The contract terms of the vertical agreements are of paramount importance, but nevertheless, the disclosure regime of these terms could, also, play a vital role in the competition process (Arya and Mittendorf, 2011).

The motivation of this research is the ongoing debate over the vertical contract disclosure regime. Assume a two-tier vertical industry, with some upstream suppliers supplying a crucial spare part to some downstream retailers through vertical contracts. Some researchers believe that each retailer is not confident about the rival contract terms, and thus the rival costs, when it comes to deciding its own output.[2] This might be because (a)each retailer fears that its rivals could receive secret deals from the suppliers, (b)the rival contract terms are too complex to follow, (c)it is impossible to verify contracts at court, or (d)the suppliers tend to renegotiate often.[3] This *secrecy* of rival contract terms leads the retailers to be unable to react optimally, and force them to form *beliefs* about rival contract terms.[4,5] Others believe that each retailer can fully *observe* and verify rival

[1]Vertical restraints are contractual provisions such as terms of payment (two–part tariffs), limiting one party's decisions (resale price maintenance) or softening competition (exclusive territory) (Rey and Verge, 2008). We argue here that the disclosure regime could be part of these vertical restraints.

[2]Katz (1991); O'Brien and Shaffer (1992); McAfee and Schwartz (1994, 1995); Rey and Verge (2004); Rey and Tirole (2006); Rey and Verge (2008); Arya and Mittendorf (2011).

[3]Knowing the number of rival costs but not the rule in which this is calculated does not change the disclosure regime. Katz (1991) mentions an illustrative example: in the US, the Securities and Exchange Commission requires firms to announce the amount of managerial compensation, but not the rule in which this compensation is calculated. Thus, any potential investor (upstream supplier of money) could not evaluate what the agent's incentives are.

[4]The situation in which the accepted vertical contracts cannot be seen by both retailers before their output decisions has been made, are labeled with many verbally different, but equivalent terms like: *secrecy* (McAfee and Schwartz, 1994; Rey and Tirole, 2006; Rey and Verge, 2008), *(interim) unobservability* (Katz, 1991; Rey and Verge, 2004), or *confidentiality* (Arya and Mittendorf, 2011; Liu and Wang, 2014). In our analysis, we use all three terms interchangeably, but we prefer the second term.

[5]Among many, the relevant literature highlights three types of beliefs: symmetric, passive and wary

terms before it makes its output decision, and contract terms are not subject to renegotiation.[6] In this vivid debate, we answer by endogenizing the vertical contract's disclosure regime and letting the firms to decide which regime is optimal, based on the specificities of the industry at hand.

In the past few decades, regulators all over the world demand for extra disclosure in the contract terms, but its efficacy is unclear (Marotta-Wugler, 2012). A question spontaneously arises: is the demand for more disclosure in the right direction? In this paper we show that the disclosure regime of the vertical contracts can be a game–changer; it can be used by market participants to soften product market competition and has significant effects on the social welfare. Furthermore, we prove that when firms compete in quantities (resp. prices) a policymaker could increase social welfare by encouraging (resp. discouraging) the disclosure of the vertical contract's terms, no matter the type of the contract (linear or two–part tariffs), and the structure of the upstream market (single common or separate dedicated supplier). In particular, this paper addresses the following research questions.

First, can the bargaining process and the intensity of the competition (as described by the product's horizontal differentiation) soften the anti-competitive effects of the vertical restraints? Marx and Shaffer (2007) show that when the suppliers have high bargain power, they tend to exclude the weaker retailers, and thus effectively softening downstream competition. In a different setup, Shaffer (2005) shows that competitive suppliers could offer wholesale prices above the marginal cost in order to soften downstream competition and maintain high prices on the retail market. Arya and Mittendorf (2011) show that when suppliers maximize the vertical chain's profits, wholesale price under observable contracts is above marginal cost. We argue that when suppliers bargain with retailers, wholesale price is below marginal cost. Furthermore, the product's substitutability acts as a bargain power's substitute: as products become more homogeneous, the supplier could use the fixed fee to extract more downstream profits without changing his bargain power.

Second, which are the different anti-competitive effects between the linear and the non-linear contracts (in particular: two-part tariffs) in the same setup? The related literature offers papers with either non-linear contracts (Arya and Mittendorf, 2011) or

beliefs. Symmetric beliefs state that retailers treat unexpected off-equilibrium offers from suppliers as perfectly correlated with the offers made to their rivals. Thus, each retailer believes that his rivals receive the same off-equilibrium offer as he does. Passive beliefs state that no matter what off-equilibrium offer is received by the retailer, he believes that the rivals have reached an equilibrium. Thus, the offers he receives are uncorrelated with the rival offers. Both symmetry and passive beliefs view off-equilibrium offers as trembles by the suppliers. On the contrary, under wary beliefs, retailers believe that any off-equilibrium offer is a deliberate choice: even if the offers are off-equilibrium, they are optimal given the rival offers. (McAfee and Schwartz, 1994).

[6] Rey and Stiglitz (1988); Katz (1988); Horn and Wolinsky (1988); Chen (2001); de Fontenay and Gans (2005); Milliou and Petrakis (2007); Marx and Shaffer (2007). Katz (1991) provides a list with several authors using observable contracts and a useful discussion.

papers with linear tariffs (Liu and Wang, 2014), but there is no single paper to address both under the same assumptions and timing. Literature has shown that non-linear contracts such as the two-part tariffs could enhance coordination and lead to joint-profit maximization, while linear contracts could create negative vertical externalities (Rey, 2012), but in this paper, we are interested in showing how the contract type could affect the disclosure regime decision and change the possible disclosure equilibria. We show that in contrast to two-part tariffs in which we encounter multiple disclosure equilibria, under linear contracts we encounter a single disclosure equilibrium.

To address our research questions, we consider a two-tier vertical market, consisting of a single common upstream supplier of a differentiated good, and a downstream Cournot duopoly, forming a bottleneck with two vertical chains. In a pre-stage, upstream and downstream firms decide simultaneously whether to publicly announce or kept secret the vertical contract terms. For a contract to remain secret, both parties of the vertical chain must keep the contract terms secret. For a contract to become observable, at least one party of the vertical chain must publicly announce the contract terms. In the first stage, the members of the vertical chain bargain over the contract terms, while in the second stage the downstream retailers compete a la Cournot in the differentiated product market.[7]

This paper fits on the broader literature of vertical contracting, and if we wish to be more precise, to the information sharing in vertical structures. The main issue of this literature is the commitment problem an upstream monopolist faces when it comes to trade with multiple downstream retailers who compete in the product market (Horn and Wolinsky, 1988; O'Brien and Shaffer, 1992; McAfee and Schwartz, 1994, 1995; Rey and Verge, 2004; Milliou and Petrakis, 2007). However, none of these papers (or any other paper from the literature) consider the optimal choice of the vertical contract terms disclosure regime. Our paper undertakes his task and highlights the important differences between the two disclosure regimes (secrecy versus observability), as well as the paramount importance of the latter to the upstream monopolist's commitment problem.

Two papers that are related to ours are Arya and Mittendorf (2011) and Liu and Wang (2014). Arya and Mittendorf (2011) use a two-tier vertical set-up, with Cournot competition downstream over a homogeneous product, while the upstream firm unilaterally decides the wholesale price. The disclosure regime is set exogenously. We depart from Arya and Mittendorf (2011) in three important points: (a)we endogenize the disclosure regime decision, by adding a pre-stage in the game, in which all the parties of the agreement decide simultaneously over the disclosure regime that maximizes their profits, (b)we let the parties to the agreement to bargain over the contract terms, (c)we extend

[7]The solution concept used here is the "Nash–in–Nash"solution concept: Nash bargain problems within a Nash equilibrium (Rey and Verge, 2017; Collard-Wexler et al., 2017). As Rey and Verge (2004) state, the "Nash–in–Nash"solution concept is somewhat implicitly related to passive beliefs.

the analysis by allowing for (horizontal) product differentiation and by characterizing the equilibrium when firms use linear contracts.

In a similar vain Liu and Wang (2014) use a two-tier vertical model with differentiated Cournot competition downstream and linear contracts. The differences with our model are the following: (i)they allow for linear contracts only, (ii)they set the supplier(s) to decide over the disclosure regime, and (iii)there is no bargain. None of these papers explores the role of the retailers' bargain power because both set the supplier(s) to unilaterally set wholesale prices. Both papers account for a single common and for two dedicated upstream suppliers, while Arya and Mittendorf (2011) accounts also for price competition in the product market.

We also contribute to the literature on vertical foreclosure. Hart and Tirole (1990) show that under secret contracting, exclusive arrangements can help an upstream monopolist to re–establish his market power. Rey and Tirole (2006) provide an excellent analysis of vertical foreclosure, featuring the anticompetitive motives for upstream firms to use exclusive secret arrangements in order to foreclose downstream retailers. In line with this strand of the literature, in this paper we show that an upstream monopolist could use the disclosure regime to re–establish his market power, increasing his profits and softening downstream competition.

Even though this paper concentrates on Industrial Organization literature and applications, the results are also valid under a Labour Economics narration: a single industry–wide worker's union supplying two downstream firms with labor. Firms and union bargain using two-part tariffs over the (upfront lump-sum) human capital investments and the monthly wages. The question here is whether the observability of the rival contract terms could alter firm's incentives to pay higher wages or to invest more money in human capital.[8]

The rest of the paper is structured as follows. In Section 2 we describe the model structure, the sequence of the events and the bargaining framework. In Section 3 we characterize the equilibrium outcomes under different disclosure regimes and determine the equilibrium regime. In Section 4 we conduct welfare analysis and some comparative statics. In Section 5 we extend our analysis by assuming Bertrand competition in the product market, or bargain over linear wholesale contracts, or dedicated exclusive suppliers. Finally, Section 6 offers the concluding remarks. The paper ends with the References, and the Appendix, in which all proofs are relegated.

[8]A wide literature review made by Hansson et al. (2004) shows that human capital investments affect employees' performance and firms' profitability (and not the other way around). Furthermore, human capital investments could increase firms; innovative capacity, a crucial factor in the IT sector. Finally, if we consider an environment of a single union having representatives bargaining simultaneously and separately with each firm, then an interim unobservable regime is more than possible.

2 The Model

2.1 Market structure and disclosure regimes

Consider a two-tier vertical industry, consisting of a single common upstream manufacturer $\mathcal{M}$, and two rival downstream retailers, namely $\mathcal{R}_i$ and $\mathcal{R}_j$.[9] $\mathcal{M}$ produces a differentiated good, at a constant unit cost $c > 0$. This good is sold to the retailers through non-linear two-part tariffs vertical contracts, consisting of a (consumption independent) fixed fee F_i and a (per unit) wholesale price w_i. Contract terms are bargained separately and simultaneously between $\mathcal{M}$, and each $\mathcal{R}_i$. The latter sells quantity q_i at a retail price p_i. $\mathcal{R}_i$ faces a constant unit cost k_i, which for simplicity is set equal to zero. $\mathcal{R}_i$'s only cost is the cost induced by the two-part tariff vertical contract. Both retailers face a linear inverse demand function $p_i(q_i, q_j) = \alpha - q_i - \gamma q_j$, where $c < \alpha$ and $0 < \gamma < 1$ (products are imperfect substitutes).[10]

In the pre-stage, firms decide their disclosure regime. Following the literature (Arya and Mittendorf, 2011; Liu and Wang, 2014), we consider two possible disclosure regimes:

(a)*Interim observability:* the contract terms agreed by the bargain pair $(\mathcal{R}_i, \mathcal{M})$ can be observed by the rival $\mathcal{R}_j$ just after the successful end of the bargains. For a contract to become interim observable, at least one member of the bargain pair should announce them.[11]

(b)*Interim unobservability:* the contract terms agreed by the bargain pair $(\mathcal{R}_i, \mathcal{M})$ cannot be observed by the rival $\mathcal{R}_j$ in the time interval between the successful end of the bargains and the completion of the product market competition. For a contract to remain interim unobservable, both members of the bargain pair should keep the contract terms secret.[12]

Each retailer is aware of its own contract terms, but whether or not he is aware of its rival's contract terms depends on the disclosure regime in place. Notice that in the interim unobservability regime, each retailer does not observe either the out-of-equilibrium contract offers during the bargaining process nor the ultimate equilibrium bargaining outcome (Arya and Mittendorf, 2011).[13]

[9]The analysis could be readily extended to situations with $n > 2$ retailers. Considering only two retailers makes the analysis more tractable.

[10]Following Singh and Vives (1984), we consider a unit mass of identical consumers, each having the same quadratic utility function $u(q_i, q_j) = \alpha(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$. Higher $\gamma \in (0, 1)$ indicates more homogeneous products.

[11]As stated in Rey and Verge (2004), in interim observability, contract terms remain secret up until the moment the final contract is signed. Therefore, acceptance decisions are based on beliefs. In what follows, we assume passive beliefs: retailers' do not revise their beliefs about the offers made to rivals when receiving an out-of-equilibrium offer.

[12]Consider the example of two bargain parties deciding over to sign or not a non–disclosure agreement (NDA). For the NDA to be valid, both parties must sign it. If at least one party decides not to sign it, then there is no legal restriction to disclose the trading terms of the agreement. If one party violates the NDA then it can be brought to court and be penalized.

[13]An alternative timing of the game, which can favor deviation, is mentioned in McAfee and Schwartz

2.2 Sequence of events and bargaining framework

The sequence of events is summarized in Figure 1. Firms play a 2-stage game, with a pre-stage attached. Game timing reflects the idea that the long-run decisions, such as the disclosure regime decision, may have considerable effects on the short-run decisions, such as the output decision.

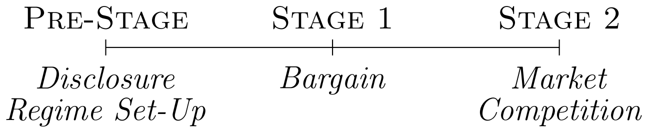

Figure 1: *Pre-Stage: firms decide their disclosure regime; Stage 1: the common manufacturer bargains simultaneously and separately with each retailer; Stage 2: rival retailers compete in the product market.*

Pre-stage: Disclosure regime set-up stage. Each firm decides simultaneously and separately over the disclosure regime that maximizes firm's profits. Firms have to choose between: (i)disclosing the trading terms of the deal (equivalently, not signing a non–disclosure agreement), which in our setup is labeled as *interim observability*, and (ii)not disclosing the contract terms (equivalently, signing a non–disclosure agreement) which in our setup is labeled as *interim unobservability.*

Stage 1: Bargaining stage. $\mathcal{M}$ bargains simultaneously and separately with either $\mathcal{R}_i$ or $\mathcal{R}_j$, over a two-part tariff contract (w_i, F_i) or (w_j, F_j).[14] To model the bargaining stage, we use the generalized asymmetric Nash bargaining product (Milliou and Petrakis, 2007). $\mathcal{M}$ has bargain power $0 < \beta < 1$ while each $\mathcal{R}_i, \mathcal{R}_j$ have bargain power $1-\beta$. Due to the multiplicity of beliefs retailers form when they receive an out-of-equilibrium offer, multiple equilibria could arise. To remedy this situation, we obtain a unique equilibrium by imposing *pairwise proofness* on the equilibrium contracts. Pairwise proofness is closely related to *passive beliefs*.[15] An additional assumption, common in the aforementioned

(1994): downstream firm first pays the fixed fee F_i under secret contract and before the determination of the wholesale price w_i, rival's contract could become observable (ex–post observability). Under this game framework, timing favors deviation because it can affect upstream firm's profitability and downstream firm's total cost.

[14]The simultaneous and separate bargains is standard in situations with multilateral contracting e.g. Horn and Wolinsky (1988); Milliou and Petrakis (2007); Rey and Verge (2004). It captures the fact that each bargaining pair has incentives to behave opportunistically. The rationale behind this assumption could be that the manufacturer has two representatives, each negotiating at the same time with a different retailer.

[15]Passive beliefs and pairwise proofness go hand in hand and are appropriate when we perceive the generalized asymmetric Nash bargaining solution as the limit equilibrium of an alternating offers-counter-offers non-cooperative bargaining game (Binmore et al., 1986). In that case, passive beliefs state that $\mathcal{R}_i$ will handle any out-of-equilibrium offer from $\mathcal{M}$ as a "tremble", uncorrelated with any offer from $\mathcal{M}$ to $\mathcal{R}_j$. $\mathcal{R}_i$ believes that under any offer received from $\mathcal{M}$, the pair $(\mathcal{M}, \mathcal{R}_j)$ has reached an equilibrium outcome. This solution concept is used widely in the relevant literature. Note that different beliefs (e.g. wary beliefs) lead to other equilibrium outcomes, but in some cases are intractable (Hart and Tirole, 1990; McAfee and Schwartz, 1994).

literature, is that the contract terms of one pair are *non-contingent* of any disagreements of the rival pair. This assumption captures nicely the idea that bargaining parties cannot commit to a permanent and irrevocable breakdown in their negotiations.[16]

Stage 2: Market competition stage. The two rival downstream retailers compete a la Cournot in the product market. To solve this dynamic multi-stage game we evoke the *Nash-in-Nash* solution concept: the Cournot-Nash equilibrium (the non-cooperative solution of stage 2) of the asymmetric generalized Nash bargaining solution (the cooperative solution of stage 1) (Rey and Verge, 2017; Collard-Wexler et al., 2017). We also assume that the negotiated outcome of a bargaining pair is non-contingent on whether the rival pair has reached or not an agreement. In other words, we impose the negotiated agreement between $(\mathcal{R}_i, \mathcal{M})$ to be immune to a bilateral deviation of the rival's agreement.

As we will explain in more detail later, the bargaining parties commit to a specific disclosure regime for two reasons. First, from the moment the disclosure regime is setup until the moment the contract is signed, it is considered as a pre-contractual arrangement, and as such is no "cheap talk". In most countries, the US and continental Europe included, if brought in a court it might be considered as binding (Schwartz and Scott, 2007). Second, after the exact moment contracts are signed, the disclosure regime is of minor importance. The retailer will choose his output based on the contract terms signed, even if the disclosure regime has changed. An implicit assumption made here is that there are no renegotiations between stages 2 and 3. A possible change in the disclosure regime with no renegotiations will not change equilibrium output, as we will mathematically show later on. In case of renegotiations, all three market participants will find themselves back to the stage 0, deciding the disclosure regime, as a pre–contractual arrangement.

Our notational convention is as follows. Superscript $\mathcal{O}$ denotes observability of vertical contract terms, while $\mathcal{S}$ denotes secrecy (or interim unobservability). Superscript $\mathcal{X}$ denotes the mixed case, in which one firm bargain under interim observability while the other firm bargain under interim unobservability (secrecy).

3 Equilibrium results

In order to set the pre-stage, in which the disclosure regime is decided, we have to characterize the equilibrium outcomes under all possible disclosure regimes. We consider the following three: (a)the *universal interim observability* regime, (b)the *interim un-*

[16]Non-contingency states that it is common knowledge that any breakdown in the negotiations between $(\mathcal{R}_i, \mathcal{M})$ is non-permanent and non-irrevocable (Horn and Wolinsky, 1988). In other words, in case of a breakdown in the bargain of $(\mathcal{R}_i, \mathcal{M})$, then $(\mathcal{R}_j, \mathcal{M})$ will not renegotiate their contract terms (Milliou and Petrakis, 2007).

observability regime, as well as (c)the *mixed regime* in which one firm is under interim observability while the other firm is under interim unobservability.

3.1 Universal Interim Observability Regime

Under interim observability, both firms observe rival contract terms just after the successful ending of the stage 2 bargains. $\mathcal{R}_i$ chooses q_i in order to maximize its net profits: $\pi_i(q_i, q_j) = (\alpha - q_i - \gamma q_j - w_i)q_i - F_i$. The first order condition (foc) gives rise to the following reaction function:

$$q_i(w_i, q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$$

A decrease in w_i moves q_i upwards, making $\mathcal{R}_i$ a more aggressive competitor in the product market. Solving the system of reaction functions we get:

$$q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma) - 2w_i + \gamma w_j}{4-\gamma^2}$$
$$\pi_i^{\mathcal{O}}(w_i, w_j, F_i) = [q_i^{\mathcal{O}}(w_i, w_j)]^2 - F_i^{\mathcal{O}}$$

In stage 1, the retailers-manufacturer vertical chains bargain simultaneously and separately over its specific two-part tariff contract. If $\mathcal{R}_i$ fails to reach an agreement with $\mathcal{F}_i$, then it can still extract some economic rents from selling products to the rival retailer $\mathcal{F}_j$. By doing so, $\mathcal{F}_j$ becomes a monopolist in the product market, thus its output equals $q_j^m(w_j) = \frac{1}{2}(a - w_j)$. Hence, $\mathcal{R}_i$'s disagreement payoff is $(w_j - c)q_j^m(w_j) + F_j$. Having that in mind, the vertical chain $(\mathcal{M}, \mathcal{R}_i)$ chooses (w_i, F_i) to maximize the following generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\mathcal{O}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{O}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{O}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where

$$\Pi^{\mathcal{O}}(w_i, w_j, F_i, F_j) = \sum_{i=1}^{2}[(w_i - c)q_i^{\mathcal{O}}(w_i, w_j) + F_i]$$

are $\mathcal{M}$'s aggregate net profits. Following O'Brien and Shaffer (1992), we maximize Nash product into two steps: (a)we use w_i to maximize joint surplus, and (b)we use F_i to distribute the joint surplus between the bargaining parties, according to their bargain power. By invoking the equilibrium symmetry, we get:

$$w^{\mathcal{O}} = c - \frac{\gamma^2\tilde{\alpha}}{2(2+\gamma^2)}, \quad q^{\mathcal{O}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p^{\mathcal{O}} = \alpha - \frac{(1+\gamma)(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}$$

where: $\tilde{\alpha} = \alpha - c > 0$. The following Lemma summarizes.

Lemma 1. *Under Cournot competition downstream, interim observable contracts, two-part tariffs, and linear demand:*

1. *Wholesale price is below marginal cost, is bargain power independent, and it decreases as products become more homogeneous* $\frac{\partial w^{\mathcal{O}}}{\partial \gamma} < 0$.

2. *Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous* $\frac{\partial q^{\mathcal{O}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.58$*, while* $\frac{\partial p^{\mathcal{O}}}{\partial \gamma} < 0$.

3. *Fixed fee increases as the manufacturer's bargain power increases* $\frac{\partial F^{\mathcal{O}}}{\partial \beta} > 0$*, while* $\frac{\partial F^{\mathcal{O}}}{\partial \gamma} > 0 \Leftrightarrow \beta > \beta^{\mathcal{O}}_{crit}(\gamma) = \frac{\gamma(2+\gamma^2-2\gamma)}{(1-\gamma)(2-\gamma^2)}$.

The intuition behind this Lemma is straightforward: a stronger manufacturer ($\beta \uparrow$) will negotiate for more fixed fee, but it will not increase wholesale price, knowing that this will create fewer profits for the retailers, and thus less fixed fee for him ($\mathcal{M}$ is treating downstream competition as inter-brand). On the other hand, a lower product differentiation ($\gamma \uparrow$) has mixed effects on both the quantity and the fixed fee.

The fact that the wholesale price is below marginal cost reflect a subsidy from the upstream supplier to the downstream retailers. This behavior is known to the strategic delegation literature (Vickers, 1985; Sklivas, 1987). A price below marginal cost leads to higher output and thus higher profits for the downstream retailer. Then the upstream supplier uses the fixed fee to extract the portion of the joint surplus his bargain power reflects, and to compensate for the wholesale price loses. Notice that $\frac{\partial w^{\mathcal{O}}}{\partial \gamma} < 0$ and $\frac{\partial F^{\mathcal{O}}}{\partial \gamma} > 0$ show that the amount of the subsidy increases with the degree of product substitutability, and thus the upstream supplier is willing to accept a lower compensation via the fixed fee.

3.2 Universal Interim Unobservability Regime

Under interim unobservability, $\mathcal{R}_i$ is unable to observe the contract terms $(\tilde{w}_j, \tilde{F}_j)$ agreed by the vertical chain $(\mathcal{R}_j, \mathcal{M})$ before he makes his output choice, thus he is unable to calculate $\tilde{q}_j = \frac{1}{2}(\alpha - \tilde{w}_j - \gamma \tilde{q}_i)$, which is treated as a constant parameter (Arya and Mittendorf, 2011; Liu and Wang, 2014).[17] The first order condition produce the following equilibrium:

$$q^{\mathcal{S}}_i(w_i; \tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma \tilde{q}_j)$$
$$\pi^{\mathcal{S}}_i(w_i, F_i; \tilde{q}_j) = [q^{\mathcal{S}}_i(w_i; \tilde{q}_j)]^2 - F^{\mathcal{S}}_i$$

[17] Based on Brandenburger and Dekel (1993), $\tilde{w}_j$ is the level 1 belief $\mathcal{R}_i$ has to form for $\mathcal{R}_j$'s wholesale price, while $\tilde{q}_i$ is the level 2 belief $\mathcal{R}_i$ has to form for $\mathcal{R}_j$'s belief over $\mathcal{R}_i$'s equilibrium output. Level 0 beliefs (common knowledge to both retailers) are: (1)the existence of a single common upstream supplier, (2)the Cournot duopoly in the product market, (3)the mutual unobservability, and (4)the use of two-part tariff contracts. Thus, as stated in Rey and Verge (2004), q_i depends on $\mathcal{R}_i$'s belief about $\tilde{q}_j$, and not the actual q_j.

Intuitively, $\mathcal{R}_i$ knows that his rival plays a Cournot game, thus he is able to formulate his equilibrium output, but he is unable to replace $\tilde{w_j}$ with a credible equilibrium value. Furthermore, $\mathcal{R}_i$ knows that $\mathcal{R}_j$ faces the same unobservability problem, and thus $\mathcal{R}_j$ has to form a belief about $\tilde{q}_i$. Consequently, $\mathcal{R}_i$ acts as a monopolist over the residual demand: $q_i^{\mathcal{S}}(w_i) = \frac{1}{2}(A - w_i)$ where $A = \alpha - \gamma\tilde{q}_j$.

Moving to Stage 1, we choose (w_i, F_i) to maximize the following generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\mathcal{S}}(w_i, w_j, F_i; \tilde{q}_j) = [\pi_i^{\mathcal{S}}(w_i, F_i; \tilde{q}_j)]^{1-\beta}[\Pi^{\mathcal{S}}(w_i, w_j, F_i, F_j; \tilde{q}_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where:

$$\Pi^{\mathcal{S}}(w_i, w_j, F_i, F_j; \tilde{q}_j) = (w_i - c)q_i^{\mathcal{S}}(w_i; \tilde{q}_j) + (w_j - c)\tilde{q}_j + F_i + F_j$$

are $\mathcal{M}$'s aggregate net profits. By obtaining the foc's of the rival vertical chain $(\mathcal{R}_j, \mathcal{M})$, and knowing that, in equilibrium, beliefs are correct (Liu and Wang, 2014), we get:

$$w^{\mathcal{S}} = c, \quad q^{\mathcal{S}} = \frac{\tilde{\alpha}}{2+\gamma}, \quad p^{\mathcal{S}} = \alpha - \frac{(1+\gamma)\tilde{\alpha}}{2+\gamma}$$

The following Lemma summarizes.

Lemma 2. *Under Cournot competition downstream, interim unobservable contracts, two-part tariffs, and linear demand:*

1. *Wholesale price is equal to marginal cost, and thus it is independent of the manufacturer's brgain power and the market features (such as product differentiation).*

2. *Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous* $\frac{\partial q^{\mathcal{S}}}{\partial \gamma} < 0$ *and* $\frac{\partial p^{\mathcal{S}}}{\partial \gamma} < 0$.

3. *Fixed fee increases with bargain power* $\frac{\partial F^{\mathcal{S}}}{\partial \beta} > 0$, *and decreases as products become more homogeneous* $\frac{\partial F^{\mathcal{S}}}{\partial \gamma} < 0$.

Wholesale price is free of any beliefs or market features, and becomes a dominant strategy for the manufacturer. The fact that each retailer cannot observe rival's contract terms, pushes wholesale price in higher levels. Thus, information structure plays a crucial role in vertical contracts. The common upstream manufacturer has maximum profits when product's substitutability is zero. The same holds true for the retailers' profits.

3.3 Mixed Regime

Under the mixed regime, and without any loss of generality let assume that $\mathcal{M}$ bargains with $\mathcal{R}_j$ under interim unobservability, while $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim observability.

In Stage 2, the two different foc's give rise to the following functions:

$$
\begin{aligned}
q_i^{\mathcal{X}}(q_j) &= \frac{1}{2}(\alpha - w_i - \gamma q_j) \\
q_j^{\mathcal{X}}(w_j; \tilde{q}_i) &= \frac{1}{2}(\alpha - w_j - \gamma \tilde{q}_i)
\end{aligned}
$$

$\mathcal{R}_i$ observes $\mathcal{R}_j$'s contract terms and thus he can react optimally ($q_i^{\mathcal{X}}$ is a function of both (w_i, w_j)). On the other hand, $\mathcal{R}_j$ cannot observe $\mathcal{R}_i$'s contract terms, and has to form beliefs in the form of $\tilde{q}_i$.

In Stage 1, the two different generalized asymmetric Nash bargain products are:

$$
\begin{aligned}
\mathcal{N}_i^{\mathcal{X}}(w_i, w_j, F_i) = {} & [(q_i^{\mathcal{X}}(w_i, w_j))^2 - F_i]^{1-\beta}[(w_i - c)q_i^{\mathcal{X}}(w_i, w_j) + \\
& + (w_j - c)q_j^{\mathcal{X}}(w_i, w_j) + F_i - (w_j - c)q_j^m(w_j)]^{\beta} \\
\mathcal{N}_j^{\mathcal{X}}(w_i, w_j, F_j; \tilde{q}_i) = {} & [(q_j^{\mathcal{X}}(w_j; \tilde{q}_i))^2 - F_j]^{1-\beta}[(w_i - c)\tilde{q}_i + \\
& + (w_j - c)q_j^{\mathcal{X}}(w_j; \tilde{q}_i) + F_j - (w_i - c)q_i^m(w_i)]^{\beta}
\end{aligned}
$$

Maximizing each Nash bargain product over its respective wholesale price and fixed fee, and following the standard procedure, we get the equilibrium values stated below:

$$
\begin{aligned}
& w_i^{\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p_i^{\mathcal{X}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha} \\
& w_j^{\mathcal{X}} = c, \quad q_j^{\mathcal{X}} = \frac{(4-\gamma(\gamma+2))\tilde{\alpha}}{4(2-\gamma^2)}, \quad p_j^{\mathcal{X}} = \alpha - \frac{(4+\gamma(2-3\gamma))\tilde{\alpha}}{4(2-\gamma^2)}
\end{aligned}
$$

The following Lemma summarizes.

Lemma 3. *Under Cournot competition downstream, mixed regime, two-part tariffs, and linear demand:*

1. *Both wholesale prices are bargain power independent, while the firm who observes the rival has wholesale price below marginal cost:* $w_i^{\mathcal{X}} < w_j^{\mathcal{X}} = c$.

2. *Both quantities are bargain power independent, while the firm who observes the rival has higher output:* $q_i^{\mathcal{X}} > q_j^{\mathcal{X}}$. *As for product differentiation, the following holds:* $\frac{\partial q_i^{\mathcal{X}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.58$, *while* $\frac{\partial q_j^{\mathcal{X}}}{\partial \gamma} < 0$.

3. *Both retail prices are bargain power independent, and both decrease as product's become more homogeneous:* $\frac{\partial p_i^{\mathcal{X}}}{\partial \gamma} < 0$ *and* $\frac{\partial p_j^{\mathcal{X}}}{\partial \gamma} < 0$. *The firm who does not observe the rival sets higher retail price:* $p_j^{\mathcal{X}} > p_i^{\mathcal{X}}$.

4. *Fixed fees rise with bargain power, while the firm who observes the rival pays higher fixed fee:* $F_i^{\mathcal{X}} > F_j^{\mathcal{X}}$.

The intuition for this Lemma is along the lines of the two previous Lemmata. Higher bargain power will not change equilibrium quantities (and thus equilibrium retail prices) or equilibrium wholesale prices. But, it will affect downstream firms' profits, because a stronger upstream manufacturer will exploit the downstream firms through the use of the fixed fee. The common upstream manufacturer has maximum profits when products are independent (for $\gamma \to 0$), because $\frac{\partial \Pi^{\mathcal{X}}}{\partial \gamma} < 0$.

3.4 Disclosure regime set-up

In the pre-stage, each of the three firms of the game (the common upstream manufacturer, and the two rival downstream retailers) decide simultaneously and separately over the disclosure regime that maximizes firm's profits. For a contract to be interim unobservable, both bargain parties must decide to keep it secret (equivalently, both firms must sign a non–disclosure agreement). For a contract to be interim observable, at least one of the bargain parties must decide to disclose the contract terms (equivalently, one bargain party must decide not to sign the non–disclosure agreement).[18]

When the contract is signed, there is no reason to change the disclosure regime, because this will not change the contract terms. To illustrate this proposition, assume that the manufacturer bargains with both retailers under the interim unobservable regime. This will lead to the known result: $w_i = w_j = c$. Now, let assume that after both contracts are signed, the common manufacturer publicly announces the contract terms of both contracts. Thus, retailers will compete in the product market under interim observability. The equilibrium output for interim observability is: $q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$. Because the contracts have been signed, retailers will pay a wholesale price equal to marginal cost, no matter the disclosure regime in place. Substituting, we get: $q_i^{\mathcal{O}}(c, c) = \frac{\alpha-c}{2+\gamma} = q_i^{\mathcal{S}}$. So, a change in the disclosure regime with no renegotiations will not change the retailers' output. Similar reasoning holds for the deviation from interim observable into interim unobservable contracts (even though this deviation is not realistic). The following Lemma summarizes.

Lemma 4. *Any deviation in the disclosure regime after the sign of the contracts, cannot change the equilibrium results of the product market competition.*

From another point of view, the disclosure regime set–up is a pre–contractual arrangement or else *letter of comfort.*[19] As such, it can no longer be considered as "cheap

[18]The non–disclosure agreement is a legal contract, often part of the pre-contractual arrangements in a deal between two (or more) bargain parties. If violated, then the courts could decide to penalize the violator.

[19]In legal terminology, a pre–contractual arrangement (or letter of comfort) frame the ensuing negotiations, which in turn determine the final contractual terms. Disclosure regime, seen as a contractual arrangement could not be considered as binding by the court, yet in most countries (the US and continental Europe included) could be seen by the court that at least engages the parties to continue negotiations in good faith over the open contract terms, and eventually sign the contract (Schwartz and Scott, 2007).

talk" but are now endowed with commitment value and can be used strategically by the bargaining parties. These are valid especially when the pre–contractual arrangement contains well-defined legal elements in the text and it is written in a way that produces legal liability under the rule of reliance (Furmston et al., 2010). Having that in mind, we state the following Proposition. The proof of this proposition can be found in the Appendix.

Proposition 3.1. *Under Cournot competition, a common supplier, and bargain over two-part tariffs, both universal interim observability, and universal interim unobservability can arise as equilibria, with the former equilibrium Pareto dominating the latter.*

Proposition 3.1 suggests that independent of the supplier's bargain power or the degree of product substitutability (i.e. the competitive pressure) in the product market, both disclosure regimes could arise endogenously as equilibria. This is not something far from practical observations of the real business world; from economic sector to another, or even within the same, disclosure regimes vary. Note that asymmetric equilibria never arise, while the universal interim observability equilibrium Pareto dominates the universal interim unobservability equilibrium.

Under interim observability, the upstream supplier cannot use the wholesale price in order to influence the downstream competition, due to the lack of strategic interaction between the rival retailers. On the contrary, under interim observability, the downward sloping reaction function of retailers' equilibrium output forces the common supplier to cut wholesale prices below marginal cost, increase downstream gross profits and output, and then subsidy through the fixed fee. This situation is in favor of the consumers, as we will show in the next section 4.

Conventional wisdom suggests that suppliers should keep the contract terms secret, because this helps them to exploit both the retailers and the consumers. We show that interim observability provides a mean through which wholesale price goes below marginal cost and increases aggregate output and profits for all market participants. In contrast, interim unobservability deprives retailers from any strategic reaction and increases wholesale prices. Nevertheless, disclosure regime plays a crucial role in the determination of the downstream competition. As we will show latter on, the structure of the upstream market as well as the mode of the downstream competition could alter the forces at work.

4 Welfare Implications

4.1 Welfare Analysis

In this section, we will perform a welfare analysis and discuss briefly the regulator's incentives to encourage (or not) a certain disclosure regime over the other. Social welfare is defined as the sum of consumer surplus, retailers' profits, and manufacturer's profits:

$$SW = CS + (\pi_i + \pi_j) + \Pi$$

where $CS = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$.[20] Substituting the relevant expressions, and after having some simple algebraic manipulations, we obtain the relevant SW expressions under the three different disclosure regimes. The following Proposition summarizes.

Proposition 4.1. *Social Welfare is higher under universal interim observability, and lower under universal interim unobservability:* $SW^{\mathcal{O}} > SW^{\mathcal{X}} > SW^{\mathcal{S}}$.

The proof of the Proposition can be found in the Appendix. Proposition 4.1 shows that the highest social welfare can be obtained only under universal interim observability of vertical contract terms. The results are driven by the output, which is higher (lower) under interim observability (unobservability) regime. The mixed regime creates a mixed situation, which stands between the two interim regimes. As a consequence, the interim observability is always preferable from the policy maker's point of view. This suggests that the policy makers should encourage interim observability in the vertical contracts.

4.2 Comparative Statics

The following Lemma highlights the comparative statics between the disclosure regimes. Comparing equilibrium values is quite straightforward, based on the relevant expressions stated above.

Lemma 5. *Under Cournot competition downstream, two-part tariffs and linear demand:*

1. *Output is higher in interim observability:* $q^{\mathcal{O}} = q_i^{\mathcal{M}} > q^{\mathcal{S}} > q_j^{\mathcal{X}}$.
2. *Wholesale price is lower in interim observability:* $w^{\mathcal{S}} = w_j^{\mathcal{X}} > w_i^{\mathcal{X}} > w^{\mathcal{O}}$.
3. *Retail price is higher in interim unobservability:* $p^{\mathcal{S}} > p_j^{\mathcal{X}} > p_i^{\mathcal{X}} > p^{\mathcal{O}}$.
4. *Fixed fee is higher in observability:* $F^{\mathcal{O}} = F_i^{\mathcal{X}} > F^{\mathcal{S}} > F_j^{\mathcal{X}}$.
5. *Retailers' profits are higher in interim observability:* $\pi^{\mathcal{O}} = \pi_i^{\mathcal{X}} > \pi^{\mathcal{S}} > \pi_j^{\mathcal{X}}$.
6. *Manufacturer's profits are higher in interim unobservability:* $\Pi^{\mathcal{S}} > \Pi^{\mathcal{X}} > \Pi^{\mathcal{O}}$.

A common upstream has incentives (higher profits) to bargain with both downstream retailers under interim unobservability, getting a higher (consumption dependent) wholesale price, and a lower (consumption independent) fixed fee. On the other hand, downstream retailers have incentives (higher profits) to bargain with the common manufacturer

[20]Following Singh and Vives (1984), we substitute $p_i = \alpha - q_i - \gamma q_j$ into $u(q_i, q_j) - p_i q_i - p_j q_j$ and thus obtain the CS.

under interim observable contracts, paying a lower (consumption dependent) wholesale price, and a higher (consumption independent) fixed fee. Under the mixed regime, the upstream manufacturer collaborates with $\mathcal{R}_i$ to exploit $\mathcal{R}_{\mathbf{j}}$'s profits.

5 Extensions

In this section, we will discuss some possible extensions of the basic model. The reasoning of these extensions is to show which forces at work will change if we move to a different downstream competition or a different contract type, or we introduce two separate suppliers. Section 5.1 deals with Bertrand competition in the product market, Section 5.2 deals with bargain over wholesale linear contracts, while Section 5.3 deals with two separate dedicated exclusive upstream suppliers. All the relevant conditions can be found in the Appendix. For the needs of this section, we use the following notation: superscript $\mathcal{BK}$ stands for Bertrand competition, $\lambda\mathcal{K}$ stands for linear contracts, and finally $\delta\mathcal{K}$ stands for dedicated suppliers, while $K \in \{\mathcal{O}, \mathcal{S}, \mathcal{X}\}$.

5.1 Bertrand competition in the product market

In the aforementioned basic model, the firms produce a differentiated product and compete in quantities. This is because the wholesale market is better approximated by the quantity competition (Arya and Mittendorf, 2011). However, in this extension, we will consider how a shift to price competition could change the dynamics of the game. The following Lemma summarizes the equilibrium values in each regime.

Lemma 6. *Under Bertrand competition, a common supplier and bargain over two-part tariff contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime,

$$w^{\mathcal{BO}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad p^{\mathcal{BO}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}, \quad q^{\mathcal{BO}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}$$

(ii) Under the universal interim unobservability regime,

$$w^{\mathcal{BS}} = c, \quad q^{\mathcal{BS}} = \frac{\tilde{\alpha}}{(2-\gamma)(1+\gamma)}, \quad p^{\mathcal{BS}} = \alpha - \frac{\tilde{\alpha}}{2-\gamma}$$

(iii) Under the mixed regime,

$$w_i^{\mathcal{BX}} = c + \frac{\gamma^2(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_i^{\mathcal{BX}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}, \quad p_i^{\mathcal{BX}} = \alpha - \frac{(4+\gamma(6+\gamma(2+\gamma)))\tilde{\alpha}}{8(1+\gamma)}$$
$$w_j^{\mathcal{BX}} = c + \frac{\gamma^3(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_j^{\mathcal{BX}} = \frac{(4+\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}, \quad p_j^{\mathcal{BX}} = \alpha - \frac{(4+3\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}$$

Notice that under interim observability, and in contract to Cournot competition, wholesale price is above marginal cost. This is due to the upward sloping reaction functions in Bertrand: when one retailer reduces his retail price, it is in the best interest of the rival retailer to reduce it as well. Given the fact that wholesale and retail prices are positive correlated $\frac{\partial p}{\partial w} > 0$, this could extinguish the manufacturer's profits, and thus the manufacturer has to restrict downstream competition by agreeing on a wholesale price above the marginal cost. This has an impact on both the quantities sold and the fixed fee extracted by the manufacturer.

Proposition 5.1. *Under Bertrand competition, a common supplier, and bargain over two-part tariffs, the unique equilibrium is the universal interim observability.*

Price competition can alter firm's strategic incentives and the forces at work, and bring out the universal interim observability as the sole equilibrium disclosure regime. A common supplier wishes to soften downstream competition, and with prices being strategic complements, can only do so by choosing to reveal vertical contract's terms. The main driver of the result of Proposition 5.1 is that price competition differs from quantity competition because contracts are more inherently independent (Arya and Mittendorf, 2011).

Using the social welfare formula stated in section 4, and after some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\mathcal{BS}} > SW^{\mathcal{BO}}$. Surprisingly, a policymaker who cares for the maximum social welfare, and when retailers compete over prices in the product market, should encourage for less disclosure, leading to interim unobservability of vertical contract terms.

Furthermore, notice that: $\forall \beta, \gamma \in (0,1) : w^{\mathcal{BS}} < w^{\mathcal{BO}}, \quad p^{\mathcal{BS}} < p^{\mathcal{BO}}$, while $q^{\mathcal{BS}} > q^{\mathcal{BO}}$, and $F^{\mathcal{BS}} > F^{\mathcal{BO}}$. In contrast to the Cournot case, when firms compete over prices, wholesale and retail price are lower under interim unobservability, while output and fixed fee are lower under interim observability. This comes to defense the previous paragraph mentioning the social welfare: when firms bargain over secrecy, they manage to keep retail price low and they give the higher fixed fee to their supplier, leading to lower net profits for them.

5.2 Bargaining over wholesale linear contracts

The use of two–part tariff contracts: (i)eliminates double marginalization problem, (ii)it maximizes joint profits, and (iii)distributes the maximized "pie"according to each member's bargain power. All these three characteristics are absent in wholesale contracts (Milliou and Petrakis, 2007). Nevertheless, common knowledge dictates that wholesale contracts are in wide use all over the business world. On these grounds, therefore it is quite useful and interesting to characterize the disclosure regime equilibrium when bargain pairs use wholesale contracts. The following Lemma summarizes.

Lemma 7. *Under Cournot competition, a common supplier and bargain over linear contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime:

$$w^{\lambda\mathcal{O}} = c + \frac{1}{2}\beta\tilde{\alpha}, \quad q^{\lambda\mathcal{O}} = \frac{(2-\beta)\tilde{\alpha}}{2(2+\gamma)}, \quad p^{\lambda\mathcal{O}} = \alpha - \frac{(2-\beta)(1+\gamma)\tilde{\alpha}}{2(2+\gamma)}$$

(ii) Under the universal interim unobservability regime,

$$w^{\lambda\mathcal{S}} = c + \frac{2\beta\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}, \quad q^{\lambda\mathcal{S}} = \frac{(2-(1-\beta)\gamma-\beta)\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}$$
$$p^{\lambda\mathcal{S}} = \alpha - \frac{(1+\gamma)(2-\beta(1-\gamma)-\gamma)\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}$$

(iii) Under the mixed regime,

$$w_i^{\lambda\mathcal{X}} = c + \frac{(\beta+\gamma)\tilde{\alpha}}{2+\gamma}, \quad q_i^{\lambda\mathcal{X}} = \frac{(2-\beta)\tilde{\alpha}}{2(2+\gamma)}, \quad p_i^{\lambda\mathcal{X}} = \frac{(2-\beta)^2(\gamma((2+\beta)\gamma+4)-8)^2\tilde{\alpha}^2}{16(2-\gamma)^2(2+\gamma)^4}$$
$$w_j^{\lambda\mathcal{X}} = c + \frac{\beta(4+\beta\gamma)\tilde{\alpha}}{4(2+\gamma)}, \quad q_j^{\lambda\mathcal{X}} = \frac{(2-\beta)(4+\beta\gamma)\tilde{\alpha}}{8(2+\gamma)}, \quad p_j^{\lambda\mathcal{X}} = \alpha - \frac{(2-\beta)(4+(4+\beta)\gamma)\tilde{\alpha}}{8(2+\gamma)}$$

Proposition 5.2. *Under Cournot competition, a common supplier, and bargain over linear contracts, the unique equilibrium is the universal interim observability.*

Linear contracts lack some important features of the two–part tariff contracts, but nevertheless are in wide use all over the world. The lack of proper distribution of vertical chain's profits, based on each participant's bargain power, push both members of the bargain pair to seek universal interim observability. Notice that: $k^{\lambda\mathcal{S}} > k^{\lambda\mathcal{O}} \Leftrightarrow \beta > \frac{\gamma}{1+\gamma}$, where: $k \in \{\pi, w, p\}$, while $m^{\lambda\mathcal{S}} > m^{\lambda\mathcal{O}} \Leftrightarrow \beta < \frac{\gamma}{1+\gamma}$, where: $m \in \{\Pi, q\}$. The intuition behind this is straightforward: for an area of low (high) bargain power, firms wish to bargain under secrecy (observability), but it is in the best interest of the supplier to make the contract terms observable (secret).

Using the social welfare formula stated in section 4, and after some simple algebraic manipulations, it is easy to show that: $\forall\beta, \gamma \in (0,1) : SW^{\lambda\mathcal{S}} < SW^{\lambda\mathcal{O}}$. Obviously, a policymaker who cares for the maximum social welfare, and when wholesale contracts prevail, should encourage for more disclosure, leading to the interim observability of vertical contract terms. The following Lemma compares the equilibrium outcomes between the two types of contracts.

Lemma 8. *Under Cournot competition, and one common upstream monopolist,* $w^{\mathcal{O}} < c < w^{\lambda\mathcal{O}} >$ *and* $c = w^{\mathcal{S}} < w^{\lambda\mathcal{S}}$.

The economic intuition behind this result is based on the so–called "output externality"(Horn and Wolinsky, 1988). Under wholesale contracts, a decrease on the wholesale price below marginal cost could not be subsidized by a fixed fee, thus it will lead to negative profits for the upstream supplier (either one common or two separate). Because the output externality in the case of linear contracts is positive (a negative output externality is possible only under non-linear contracts, see the following Lemma 10), a common upstream could internalize it (because he sells to both retailers), in contrast to a dedicated supplier (Milliou and Petrakis, 2007).

5.3 Dedicated upstream suppliers

The upstream market structure plays an important role in the contract type selection (Milliou and Petrakis, 2007). Consequently, we expect to play a role in the disclosure regime selection. In this extension, we will change the vertical chain by assigning an exclusive dedicated upstream supplier to each downstream retailer. As Arya and Mittendorf (2011) notice, a common upstream supplier has incentives to treat downstream competition as intra–brand, and thus seeks to soften it by inflating retail prices. In contrast, a dedicated upstream supplier treats downstream competition as inter–brand, and thus has to gain from fierce price cuts. The following Lemma summarizes.

Lemma 9. *Under Cournot competition, dedicated suppliers and bargain over two-part tariff contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime,

$$w^{\delta\mathcal{O}} = c - \frac{\gamma^2\tilde{\alpha}}{4+(2-\gamma)\gamma}, \quad q^{\delta\mathcal{O}} = \frac{2\tilde{\alpha}}{4+(2-\gamma)\gamma}, \quad p^{\delta\mathcal{O}} = \alpha - \frac{2(1+\gamma)\tilde{\alpha}}{4+(2-\gamma)\gamma}$$

(ii) Under the universal interim unobservability regime,

$$w^{\delta\mathcal{S}} = c, \quad q^{\delta\mathcal{S}} = \frac{\tilde{\alpha}}{\gamma+2}, \quad p^{\delta\mathcal{S}} = \alpha - \frac{(1+\gamma)\tilde{\alpha}}{2+\gamma}$$

(iii) Under the mixed regime,

$$w_i^{\delta\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\delta\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p_i^{\delta\mathcal{X}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}$$
$$w_j^{\delta\mathcal{X}} = c, \quad q_j^{\delta\mathcal{X}} = \frac{(4-\gamma(2+\gamma))\tilde{\alpha}}{4(2-\gamma^2)}, \quad p_j^{\delta\mathcal{X}} = \alpha - \frac{(4-\gamma(3\gamma-2))\tilde{\alpha}}{4(2-\gamma^2)}$$

Proposition 5.3. *Under Cournot competition, dedicated suppliers, and bargain over two-part tariffs, the unique equilibrium is the universal interim unobservability.*

Proposition 5.3 offers an interesting insight in the difference between a common or dedicated suppliers. Notice that $\forall\beta,\gamma \in (0,1) : w^{\delta\mathcal{O}} < w^{\delta\mathcal{S}} = c$, but $F^{\delta\mathcal{O}} > F^{\delta\mathcal{S}}$, and $\Pi^{\delta\mathcal{O}} < \Pi^{\delta\mathcal{S}}$. That is, a dedicated supplier has higher profits under interim unobservability, even though the higher wholesale price could lead to lower output and higher retail prices.

The following Lemma compares the equilibrium outcomes of the two–part tariff contracts under one common or two separate upstream supplier(s).

Lemma 10. *Under Cournot competition and two–part tariffs, the following inequalities hold:* $w^{\mathcal{S}} = w^{\delta\mathcal{S}} = c$ *and* $F^{\delta\mathcal{S}} = F^{\mathcal{S}}$*, while* $w^{\mathcal{O}} < w^{\delta\mathcal{O}} < c$ *and* $F^{\delta\mathcal{O}} < F^{\mathcal{O}}$*.*

The economic intuition behind this Lemma is as follows. When the bargains are under interim unobservable (secret) contracts, the status of the upstream market could not change the incentives of the upstream supplier to bargain using a wholesale price equal to marginal cost, neither could help him to extract a higher fixed fee. On the contrary, when the bargains are under interim observable contracts, a dedicated supplier has incentives to trade with a higher wholesale price but lower fixed fee compared to the upstream monopolist. the intuition behind this result is based on the so–called "output externality"(Milliou and Petrakis, 2007). An increase in w_i will not only decrease q_i but it will also increase q_j (downward sloping reaction functions). Under two–part tariffs, this output externality is negative. An upstream monopolist dealing with both retailers could internalize this negative output externality and compensate from both retailers via the fixed fee, and thus has higher incentives to keep wholesale prices as low as possible, compared to a dedicated upstream supplier.

Using the social welfare formula stated in section 4, and after some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\delta\mathcal{S}} < SW^{\delta\mathcal{O}}$. Obviously, a policymaker who cares for the maximum social welfare, and when exclusivity in the supply chain prevails, should encourage for more disclosure, leading to the interim observability of vertical contract terms.

5.3.1 Merger incentives

In this section, we will examine the upstream firms' merger incentives under interim unobservable contracts. Milliou and Petrakis (2007) have shown that when firms bargain over interim observable two–part tariff contracts, then the upstream suppliers always prefer to remain separate. This is in contrast to the merger incentives under linear contracts, who favor the upstream merger (Horn and Wolinsky, 1988). The following Lemma states our result.

Lemma 11. *Under Cournot competition downstream, two–part tariff contracts and interim unobservability, the upstream suppliers are indifferent between merging horizontally or not.*

The proof of this Lemma comes from a straightforward algebraic manipulation of the difference of the upstream profits $\Pi^{\mathcal{S}} - 2\Pi^{\delta\mathcal{S}}$, which is equal to zero $\forall \beta, \gamma \in (0,1)$. The relevant equilibrium expressions of the upstream profits could be found in the Appendix. The economic intuition behind this Lemma is the following. A downstream firm who trades with his upstream supplier under secrecy deprives any strategic interaction with his rival retailer. So, the equilibrium output will be the same under both merger cases. Consequently, the upstream supplier will extract the fixed fee the same amount of joint surplus, no matter if he trades with both retailers or not. So, effectively, has no incentives to merge. This result is new to the relevant literature, and underlines the importance of the disclosure regime because the latter could severely affect the upstream firms' incentives to merge.

6 Conclusions

There is a vivid discussion, over the past year, about the enhancement of competition an augmented disclosure of contract terms could bring. Vertical contracts and the various contractual provisions give rise to serious competition concerns. Among the latter is the disclosure regime of the contract's terms. For the last decades, policymakers around the world have opted for more disclosure, but is this decision in the right direction?

To answer this question we have setup a differentiated two-tier market duopoly model, in which firms, both upstream and downstream, decide over the desired disclosure regime. For a contract to have interim observable terms, at least one bargain member should announce them; for a contract to have interim unobservable terms, both bargain members should keep them secret. We have shown that once the bargaining stage is over, there is no reason for any firm to deviate from its disclosure regime because this will not change the contract terms.

A Cournot duopolist facing a single supplier and bargaining over a two-part tariff contract has incentives to reveal the contract terms. The same holds for the supplier himself. Even if the retailers compete in quantities, or the vertical chain bargain over linear wholesale contracts, the forces at work won't change, leaving the disclosure regime equilibrium exactly the same. On the other hand, a dedicated supplier has incentives to bargain with his respective retailer over interim unobservable contracts. Even if this lowers the output and makes the product more expensive, it is a disclosure regime that maximizes the profits of both members of the vertical chain.

The following two tables summarize the findings of the paper.

	Cournot Common U 2PT	Bertrand Common U 2PT	Cournot Dedicated U_i 2PT	Cournot Common U Linear
Observable	X	X		X
Unobservable	X		X	

Table 1: Optimal disclosure regime; upstream firms' point of view.

Table 1 summarizes the disclosure regime equilibria stated in this paper. When firms compete over quantities, the upstream market structure as well as the type of the contract play a significant role in the disclosure regime setup. A common upstream who bargains over a two–part tariff contract, treats downstream competition as intra-brand competition and he is willing to accept both interim observability and unobservability, even though the former Pareto dominates the latter. Under contrary, when the same common supplier bargains over linear contract, due to double marginalization and the lack of joint profit maximization, he is not willing to bargain under interim unobservability. At the same time, the existence of two separate dedicated exclusive upstream suppliers could change, once again, the disclosure regime equilibrium. The latter, understanding the downstream competition as inter-brand competition, are willing to bargain under interim unobservability to give their respective retailers a competitive advantage over the rival firm. On the other hand, when firms compete over prices, the strategic complementarity of the differentiated products pushes the common upstream to bargain under interim observability only. This decision softens downstream competition by charging higher wholesale prices, and thus avoiding any unnecessary (for them) competition intensity.

	Cournot Common U 2PT	Bertrand Common U 2PT	Cournot Dedicated U_i 2PT	Cournot Common U Linear
Observable	X		X	X
Unobservable		X		

Table 2: Optimal disclosure regime; policymaker's point of view.

The picture seems to change when it comes for a policymaker to choose the disclosure regime that maximizes social welfare (Table 2). It seems that the existence of a common upstream supplier and downstream competition over quantity guarantees the alignment of interests between the firms and the policymaker. On the opposite side, when firms compete over prices, or the upstream market is not monopolized, the interests of the firms are the opposite of the policymaker.

This paper focused on a theoretical approach to the disclosure regime of vertical contracts. We have shown that the downstream competition mode and intensity, as well as the upstream market structure play a significant role in the observability or not of the vertical contracts. Any future work should be focused on the empirical side of this problem. There is a testable implication that emerges from thee findings. The theoretical model implies that exclusivity leads to poor disclosure. It might be quite interesting to check if data from the real world show a correlation between upstream market competition and disclosure regime of the vertical contracts.

Our findings lead to a number of testable implications. First, the usage of observable contracts in sectors with Bertrand type competition must be relatively high, compared to sectors with Cournot type of competition. Further, the usage of observable contracts from firms in sectors with a monopolist supplier must be significantly higher compared to sectors with dedicated suppliers.

There are a few questions still open in the theoretical literature. For instance, Manasakis and Petrakis (2009) analyze the impact of the usptream market structures on the firms' incentives to form research joint ventures (RJV's) aiming to split high R&D costs and share positive spillovers. An interesting direction for further research could be to study the role of observability or secrecy on the formation of research joint ventures, and whether disclosure regime could ease the hold–up problem provoked by the presence of a powerful upstream monopolist.

7 Appendix

7.1 Proofs

Proof. Proposition 3.1. The equilibrium profits of the firms π_i and the common supplier Π, under different disclosure regimes are:

$$\pi^{\mathcal{O}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi^{\mathcal{S}} = \frac{(1-\beta-1)\tilde{\alpha}^2}{(2+\gamma)^2}, \quad \Pi^{\mathcal{O}} = \frac{(2-\gamma)(\beta(2-\gamma)(2-\gamma^2)-\gamma^3)\tilde{\alpha}^2}{4(2-\gamma^2)^2}$$
$$\pi_i^{\mathcal{X}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi_j^{\mathcal{X}} = \frac{(1-\beta)(16-\gamma(16+\gamma^3-4\gamma))\tilde{\alpha}^2}{32(2-\gamma^2)}$$
$$\Pi^{\mathcal{S}} = \frac{2\beta\tilde{\alpha}^2}{(2+\gamma)^2}, \quad \Pi^{\mathcal{X}} = \frac{(\beta(2-\gamma^2)(32-\gamma(32+\gamma^3-8\gamma))-\gamma^3(8+\gamma^3-8\gamma))\tilde{\alpha}^2}{32(2-\gamma^2)^2}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision.

(i) After some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1)$: $\pi^{\mathcal{S}} > \pi_j^{\mathcal{X}}$ and $\Pi^{\mathcal{S}} > \Pi^{\mathcal{X}}$, thus universal interim unobservability is an equilibrium.

(ii) It can be readily verified that for all β, γ in $(0,1)$ the following hold: $\pi^{\mathcal{O}} = \pi_i^{\mathcal{X}}$ while $\Pi^{\mathcal{O}} < \Pi^{\mathcal{X}}$, so universal interim observability is an equilibrium.

(iii) If we Pareto rank them, universal interim observability dominates universal interim unobservability: $\forall \beta, \gamma \in (0,1) : \quad \pi^{\mathcal{O}} > \pi^{\mathcal{S}}$. □

Proof. Proposition 4.1. The Social Welfare expressions are:

$$SW^{\mathcal{O}} = \frac{(8(1-\gamma)+\gamma^3)\tilde{\alpha}^2}{2(2-\gamma^2)^2}, \quad SW^{\mathcal{S}} = \frac{4\tilde{\alpha}^2}{(\gamma+2)^2}$$
$$SW^{\mathcal{X}} = \frac{(128-\gamma(128+\gamma(16-(32-\gamma)\gamma)))\tilde{\alpha}^2}{32(2-\gamma^2)^2}$$

It can be readily verified that $\forall \beta, \gamma \in (0,1)$ the following inequalities hold: $SW^{\mathcal{O}} > SW^{\mathcal{X}}$ and $SW^{\mathcal{X}} > SW^{\mathcal{S}}$. □

Proof. Lemma 6. Assume the linear demand function: $q_i(p_i,p_j) = \frac{\alpha}{1+\gamma} - \frac{1}{1-\gamma^2}p_i + \frac{\gamma}{1-\gamma^2}p_j$, and price competition in the product market.

Universal Interim Observability regime: Under interim observability, the product market competition is characterized by the following equations: $\max_{p_i}[\pi_i(p_i,p_j)] \Rightarrow p_i^*(p_j) = \frac{1}{2}(\alpha(1-\gamma)+w_i+\gamma p_j)$. Following the standard procedure, we get: $p_i^{\mathcal{BO}}(w_i,w_j) = \frac{\alpha(2-\gamma^2-\gamma)+2w_i+\gamma w_j}{4-\gamma^2}$. Moving to Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{BO}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{BO}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{BO}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^\beta$$

where: $\Pi^{\mathcal{BO}}(w_i, w_j, F_i, F_j) = (w_i - c)q_i^{\mathcal{BO}}(w_i, w_j) + (w_j - c)q_j^{\mathcal{BO}}(w_i, w_j) + F_i + F_j$ are $\mathcal{M}$'s profits, while $q_j^m(w_j)$ is the monopoly output realized by $\mathcal{R}_j$ in the case of a (non–permanent and non–irrevocable) breakdown in the negotiations between $\mathcal{R}_i$ and $\mathcal{M}$. Following the standard procedure, we get:

$$w^{\mathcal{BO}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad q^{\mathcal{BO}} = \frac{(\gamma + 2)\tilde{\alpha}}{4(\gamma + 1)}, \quad p^{\mathcal{BO}} = \alpha - \frac{1}{4}(2 + \gamma)\tilde{\alpha}$$

In contrast to the interim observability regime under Cournot competition, wholesale price is above marginal cost, and it increases as products become more homogeneous $\frac{\partial w^{\mathcal{BO}}}{\partial \gamma} > 0$. Quantity and retail price are bargain power independent, while the fixed fee increases with bargain power $\frac{\partial F^{\mathcal{BO}}}{\partial \beta} > 0$. Quantity, retail price and fixed fee are always decreasing when products become more homogeneous $\frac{\partial p^{\mathcal{BO}}}{\partial \gamma} < 0$ and $\frac{\partial q^{\mathcal{BO}}}{\partial \gamma} < 0$ and $\frac{\partial F^{\mathcal{BO}}}{\partial \gamma} < 0$.

Universal Interim Unobservability regime: Having the same considerations as in Cournot case, and following the standard procedure, we get: $\max_{p_i}[\pi_i(p_i; \tilde{p}_j)] \Rightarrow p_i^{\mathcal{BS}}(w_i; \tilde{p}_j) = \frac{1}{2}(\alpha(1 - \gamma) + \gamma\tilde{p}_j + w_i)$. We model the 1st Stage as follows:

$$\mathcal{N}_i^{\mathcal{BS}}(w_i, w_j, F_i; \tilde{p}_j) = [\pi_i^{\mathcal{BS}}(w_i, F_i; \tilde{p}_j)]^{1-\beta}[\Pi^{\mathcal{BS}}(w_i, w_j, F_i, F_j; \tilde{p}_j) - (w_j - c)q_j^m(w_j) - F_j]^\beta$$

where: $\Pi^{\mathcal{BS}}(w_i, w_j, F_i, F_j; \tilde{p}_j) = (w_i - c)q_i^{\mathcal{BS}}(w_i; \tilde{p}_j) + (w_j - c)q_j^{\mathcal{BS}}(w_i; \tilde{p}_j) + F_i + F_j$ are $\mathcal{M}$'s profits. Maximizing Nash product and following the standard procedure, we get:

$$w^{\mathcal{BS}} = c, \quad q^{\mathcal{BS}} = \frac{\tilde{\alpha}}{(2 - \gamma)(\gamma + 1)}, \quad p^{\mathcal{BS}} = \alpha - \frac{\tilde{\alpha}}{2 - \gamma}$$

Wholesale price equals marginal cost, and thus is independent of the manufacturer's bargain power and the market features (such as product's differentiation). Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous: $\frac{\partial q^{\mathcal{BS}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.5$ and $\frac{\partial p^{\mathcal{BS}}}{\partial \gamma} < 0$. Fixed fee increases with bargain power $\frac{\partial F^{\mathcal{BS}}}{\partial \beta} > 0$, and decreases as products become more homogeneous $\frac{\partial F^{\mathcal{BS}}}{\partial \gamma} < 0$.

Mixed regime: Following the standard procedure we assume that bargain pair $(\mathcal{M}, \mathcal{R}_i)$ is under interim unobservability, while bargain pair $(\mathcal{M}, \mathcal{R}_j)$ is under interim observability. This gives rise to the following first order conditions: $\max_{p_i}[\pi_i(p_i; \tilde{p}_j)]$ and $\max_{p_j}[\pi_j(p_i, p_j)]$ lead to $p_i^{\mathcal{BX}}(w_i, w_j)$ and $p_j^{\mathcal{BX}}(w_j; \tilde{p}_i)$ respectively. Moving to the 1st stage, the two different asymmetric generalized Nash bargain products are:

$$\mathcal{N}_i^{\mathcal{BX}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{BX}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{BX}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^\beta$$
$$\mathcal{N}_j^{\mathcal{BX}}(w_i, w_j, F_j; \tilde{p_i}) = [\pi_j^{\mathcal{BX}}(w_j, F_j; \tilde{p_i})]^{1-\beta}[\Pi^{\mathcal{BX}}(w_i, w_j, F_i, F_j; \tilde{p_i}) - (w_i - c)q_i^m(w_i) - F_i]^\beta$$

Maximizing these two Nash products with respect to wholesale price and fixed fee, and having in mind that beliefs are true in equilibrium, we get:

$$w_i^{\mathcal{BX}} = c + \frac{\gamma^2(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_i^{\mathcal{BX}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}, \quad p_i^{\mathcal{BX}} = \alpha - \frac{(4+\gamma(6+\gamma(2+\gamma)))\tilde{\alpha}}{8(1+\gamma)}$$
$$w_j^{\mathcal{BX}} = c + \frac{\gamma^3(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_j^{\mathcal{BX}} = \frac{(4+\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}, \quad p_j^{\mathcal{BX}} = \alpha - \frac{(4+3\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}$$

Wholesale prices, quantities and retail prices are bargain power independent, while $w_i^{\mathcal{BX}}$ (respectively, $q_i^{\mathcal{BX}}$, $w_j^{\mathcal{BX}}$ and both retail prices) decrease (respectively, increase) as products become more homogeneous. □

Proof. Proposition 5.1. Based on the analysis and reasoning of the proof of the Lemma 6, the equilibrium values of profits, for both the supplier and the retailers, under all disclosure regimes, are stated below:

$$\pi^{\mathcal{BO}} = \frac{(1-\beta)(\gamma+2)(4+\gamma^4-\gamma^3-2\gamma)\tilde{\alpha}^2}{32(1+\gamma)}, \quad \pi^{\mathcal{BS}} = \frac{(1-\beta)(1-\gamma)\tilde{\alpha}^2}{(2-\gamma)^2(\gamma+1)}$$
$$\Pi^{\mathcal{BO}} = \frac{(2+\gamma)(4\beta-(1-\beta)\gamma^4+(1-\beta)\gamma^3-2\beta\gamma)\tilde{\alpha}^2}{16(1+\gamma)}, \quad \Pi^{\mathcal{BS}} = \frac{2\beta(1-\gamma)\tilde{\alpha}^2}{(2-\gamma)^2(\gamma+1)}$$
$$\pi_i^{\mathcal{BX}} = \frac{(1-\beta)(2+\gamma)(16+\gamma(8-\gamma(8-\gamma(4-\gamma(4-\gamma(2+\gamma(2+\gamma)))))))\tilde{\alpha}^2}{128(1+\gamma)^2}$$
$$\pi_j^{\mathcal{BX}} = \frac{(1-\beta)(32+(2-\gamma)\gamma(16+\gamma(2+\gamma)(2-\gamma(4+\gamma))))\tilde{\alpha}^2}{128(1+\gamma)^2}$$
$$\Pi^{\mathcal{BX}} = \frac{\beta\tilde{\alpha}^2}{128(1+\gamma)^2}[(64+\gamma(64-\gamma(16-\gamma(32-\gamma(18-\gamma(1+\gamma)(4+\gamma(3+\gamma)))))))+ + (1-\gamma)\gamma^3(1+\gamma)(2+\gamma)(4+\gamma(2+\gamma))]$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision. It can be readily verified that $\forall \beta, \gamma \in (0,1)$ the following inequalities hold:

(i) $\pi^{\mathcal{BS}} < \pi_j^{\mathcal{BX}}$ and $\Pi^{\mathcal{BS}} < \Pi^{\mathcal{BX}}$ thus universal interim unobservability can never be an equilibrium because both bargain parties have incentives to reveal the contract terms.

(ii) $\pi^{\mathcal{BO}} > \pi_i^{\mathcal{BX}}$ and $\Pi^{\mathcal{BO}} > \Pi^{\mathcal{BX}}$, so universal interim observability is an equilibrium because at least one of the bargain parties (in this case, both) has incentives to reveal the contract terms.

□

Proof. Lemma 7. We assume the same model, market structure, and disclosure regimes as in section 3, with the sole exemption of the usage of linear vertical contracts.

Universal Interim Observability Regime: The product market competition between the two retailers (Stage 2 of the game) is characterized by the following equations: $\max_{q_i}[\pi_i(q_i, q_j)] = \max_{q_i}[(\alpha - q_i - \gamma q_j - w_i)q_i] \Rightarrow q_i^*(q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$. Following a similar reasoning for $\mathcal{R}_j$ and solving the system of the two reaction functions we get: $q_i^{\lambda\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, $\pi_i^{\lambda\mathcal{O}}(w_i, w_j) = [q_i^*(w_i, w_j)]^2$. Moving to Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\lambda\mathcal{O}}(w_i, w_j) = [\pi_i^{\lambda\mathcal{O}}(w_i, w_j)]^{1-\beta}[\Pi^{\lambda\mathcal{O}}(w_i, w_j) - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta}$$

where: $\Pi^{\lambda\mathcal{O}}(w_i, w_j) = (w_i - c)q_i^{\lambda\mathcal{O}}(w_i, w_j) + (w_j - c)q_j^{\lambda\mathcal{O}}(w_i, w_j)$ are the profits of the manufacturer $\mathcal{M}$ from selling through linear contracts to both retailers. Maximizing Nash product over the wholesale price we get: $\max_{w_i} \mathcal{N}_i^{\lambda\mathcal{O}}(w_i, w_j) \Rightarrow w_i^{\lambda\mathcal{O}}(w_j) = \frac{1}{2}\gamma w_j + \frac{2-\gamma}{4}(2 + \tilde{\alpha}\beta)$. Following a similar reasoning for $\mathcal{R}_j$, solving the system of the foc's, and imposing symmetry in equilibrium, we get:

$$w^{\lambda\mathcal{O}} = c + \frac{1}{2}\beta\tilde{\alpha}, \quad q^{\lambda\mathcal{O}} = \frac{(2-\beta)\tilde{\alpha}}{2(\gamma+2)}$$

Wholesale price is above marginal cost $w^{\lambda\mathcal{O}} > c$, is independent of product's substitutability, and increases with bargain power: $\frac{\partial w^{\lambda\mathcal{O}}}{\partial \beta} > 0$. Quantity decreases as bargain power increases $\frac{\partial q^{\lambda\mathcal{O}}}{\partial \beta} < 0$. As products become more homogeneous ($\gamma \to 1$), quantity decreases $\frac{\partial q^{\lambda\mathcal{O}}}{\partial \gamma} < 0$.

Universal Interim Unobservability Regime: Maximizing profits over quantity we get: $\max_{q_i}[\pi_i(q_i; \tilde{q}_j)] \Rightarrow q_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma\tilde{q}_j)$, $\pi_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j) = (q_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j))^2$. In Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\lambda\mathcal{S}}(w_i, w_j; \tilde{q}_j) = [\pi_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j)]^{1-\beta}[\Pi^{\lambda\mathcal{S}}(w_i, w_j; \tilde{q}_j) - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta}$$

where: $\Pi^{\lambda\mathcal{S}}(w_i, w_j; \tilde{q}_j) = (w_i - c)q_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j) + (w_j - c)\tilde{q}_j$ are the profits of $\mathcal{M}$. Maximizing Nash product over the wholesale price, and following the standard procedure, we get:

$$w^{\lambda\mathcal{S}} = c + \frac{2\beta\tilde{\alpha}}{4 + \gamma(\beta - (1-\beta)\gamma)}, \quad q^{\lambda\mathcal{S}} = \frac{(\beta(\gamma-1) - \gamma + 2)\tilde{\alpha}}{4 + \gamma(\beta - (1-\beta)\gamma)}$$

Wholesale price is above marginal cost $w^{\lambda\mathcal{S}} > c$, it increases when $\mathcal{M}$'s bargain power increases $\frac{\partial w^{\lambda\mathcal{S}}}{\partial \beta} > 0$, and $\frac{\partial w^{\lambda\mathcal{S}}}{\partial \gamma} \gtrless 0 \Leftrightarrow \beta \lesseqgtr \beta_{crit} = \frac{2\gamma}{1+2\gamma}$. Quantity decreases when bargain power increases $\frac{\partial q^{\lambda\mathcal{S}}}{\partial \beta} < 0$, and it decreases as products become more homogeneous $\frac{\partial q^{\lambda\mathcal{S}}}{\partial \gamma} < 0$.

Mixed Regime: In the mix regime, we assume that $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim unobservability, and with $\mathcal{R}_j$ under interim observability. Consequently, in stage 2, the two retailers maximize different profit functions: $\max_{q_i}[\pi_i(q_i, q_j)] \Rightarrow q_i^{\lambda\mathcal{X}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, while: $\max_{q_j}[\pi_j(q_j; \tilde{q}_i)] \Rightarrow q_j^{\lambda\mathcal{X}}(w_j; \tilde{q}_i) = \frac{1}{2}(\alpha - w_j - \gamma\tilde{q}_i)$. We model the bargains in Stage 1 using the generalized asymmetric Nash bargain product:

$$\begin{aligned}
\mathcal{N}_i^{\lambda\mathcal{X}}(w_i, w_j) &= [(q_i^{\lambda\mathcal{X}}(w_i, w_j))^2]^{1-\beta}[(w_i - c)q_i^{\lambda\mathcal{X}}(w_i, w_j) + (w_j - c)q_j^{\lambda\mathcal{X}}(w_i, w_j) \\
&\quad - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta} \\
\mathcal{N}_j^{\lambda\mathcal{X}}(w_i, w_j; \tilde{q}_i) &= [(q_j^{\lambda\mathcal{X}}(w_j; \tilde{q}_i))^2]^{1-\beta}[(w_i - c)\tilde{q}_i + (w_j - c)q_j^{\lambda\mathcal{X}}(w_j; \tilde{q}_i) - \frac{1}{2}(w_i - c)(\alpha - w_i)]^{\beta}
\end{aligned}$$

Maximizing each Nash bargain product over its respective wholesale price, and following the standard procedure, we get:

$$\begin{aligned}
w_i^{\lambda\mathcal{X}} &= c + \frac{(\beta+\gamma)\tilde{\alpha}}{2+\gamma}, \quad q_i^{\lambda\mathcal{X}} = \frac{(2-\beta)(\alpha - c)}{2(2+\gamma)} \\
w_j^{\lambda\mathcal{X}} &= c + \frac{\beta(4+\beta\gamma)\tilde{\alpha}}{4(2+\gamma)}, \quad q_j^{\lambda\mathcal{X}} = \frac{(2-\beta)(4+\beta\gamma)\tilde{\alpha}}{8(2+\gamma)}
\end{aligned}$$

Both wholesale prices are above marginal cost $w_{i,j}^{\lambda\mathcal{X}} > c$, they both increase with bargain power $\frac{\partial w_{i,j}^{\lambda\mathcal{X}}}{\partial \beta} > 0$, while the unobserved wholesale price increases as products become more homogeneous $\frac{\partial w_i^{\lambda\mathcal{X}}}{\partial \gamma} > 0$, while the observable wholesale price decreases $\frac{\partial w_j^{\lambda\mathcal{X}}}{\partial \gamma} < 0$. Both quantities decrease as bargain power increases $\frac{\partial q_{i,j}^{\lambda\mathcal{X}}}{\partial \beta} < 0$. □

Proof. Proposition 5.2. Based on the analysis and reasoning of the Lemma 7, the equilibrium values for the supplier's and the retailers' profits are:

$$\begin{aligned}
\pi^{\lambda\mathcal{O}} &= \frac{(2-\beta)^2\tilde{\alpha}^2}{4(\gamma+2)^2}, \quad \Pi^{\lambda\mathcal{O}} = \frac{(2-\beta)\beta\tilde{\alpha}^2}{2(2+\gamma)} \\
\pi^{\lambda\mathcal{S}} &= \frac{(2-\beta(1-\gamma)-\gamma)^2\tilde{\alpha}^2}{(4+\gamma(\beta-(1-\beta)\gamma))^2}, \quad \Pi^{\lambda\mathcal{S}} = \frac{4\beta(2-\beta(1-\gamma)-\gamma)\tilde{\alpha}^2}{(4+\gamma(\beta-(1-\beta)\gamma))^2} \\
\pi_i^{\lambda\mathcal{X}} &= \frac{(2-\beta)^2\tilde{\alpha}^2}{4(2+\gamma)^2}, \quad \pi_j^{\lambda\mathcal{X}} = \frac{(2-\beta)^2(4+\beta\gamma)^2\tilde{\alpha}^2}{64(2+\gamma)^2} \\
\Pi^{\lambda\mathcal{X}} &= \frac{(2-\beta)(\beta+16\gamma(32+\beta\gamma(8+\beta\gamma)))\tilde{\alpha}^2}{32(2+\gamma)^2}
\end{aligned}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision.

It can be readily verified that $\forall \beta, \gamma \in (0,1)$ the following inequalities hold:

(i) $\pi^{\lambda\mathcal{S}} < \pi_j^{\lambda\mathcal{X}}$ and $\Pi^{\lambda\mathcal{S}} < \Pi^{\lambda\mathcal{X}}$ thus universal interim unobservability can never be an equilibrium because both bargain parties have incentives to reveal the contract terms.

(ii) $\pi^{\lambda\mathcal{O}} > \pi_i^{\lambda\mathcal{X}}$ and $\Pi^{\lambda\mathcal{O}} > \Pi^{\lambda\mathcal{X}}$, so universal interim observability is an equilibrium because at least one of the bargain parties (in this case, both) has incentives to reveal the contract terms. $\square$

Proof. Lemma 9. We assume the same model and market structure, and the same disclosure regimes as in section 3, with the sole exemption of the existence of two dedicated separate exclusive upstream suppliers.

Universal Interim Observability Regime: The product market competition between the two retailers (Stage 2 of the game) is characterized by the following equations: $\max_{q_i}[\pi_i(q_i, q_j, F_i)] = \max_{q_i}[(\alpha - q_i - \gamma q_j - w_i)q_i - F_i] \Rightarrow q_i^*(q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$. Following a similar reasoning for $\mathcal{R}_j$ and solving the system of the two reaction functions we get: $q_i^{\delta\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, $\pi_i^{\delta\mathcal{O}}(w_i, w_j, F_i) = [q_i^*(w_i, w_j)]^2 - F_i$. Moving to Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\delta\mathcal{O}}(w_i, w_j, F_i) = [\pi_i^{\delta\mathcal{O}}(w_i, w_j, F_i)]^{1-\beta}[(w_i - c)q_i^{\delta\mathcal{O}}(w_i, w_j) + F_i]^{\beta}$$

Following the standard procedure, we get:

$$w^{\delta\mathcal{O}} = c - \frac{\gamma^2\tilde{\alpha}}{4 + (2-\gamma)\gamma}, \quad q^{\delta\mathcal{O}} = \frac{2\tilde{\alpha}}{4 + (2-\gamma)\gamma}$$

Wholesale price is below marginal cost $w^{\delta\mathcal{O}} < c$, is independent of bargain power, and decreases as products become more homogeneous: $\frac{\partial w^{\delta\mathcal{O}}}{\partial\gamma} < 0$. Quantity is bargain power independent, and decreases as products become more homogeneous: $\frac{\partial q^{\delta\mathcal{O}}}{\partial\gamma} < 0$.

Universal Interim Unobservability Regime: Maximizing profits over quantity we get: $\max_{q_i}[\pi_i(q_i; \tilde{q}_j)] \Rightarrow q_i^{\delta\mathcal{S}}(w_i; \tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma\tilde{q}_j)$, $\pi_i^{\delta\mathcal{S}}(w_i, F_i; \tilde{q}_j) = (q_i^{\delta\mathcal{S}}(w_i; \tilde{q}_j))^2 - F_i$. In Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\delta\mathcal{S}}(w_i, w_j, F_i; \tilde{q}_j) = [\pi_i^{\delta\mathcal{S}}(w_i, F_i; \tilde{q}_j)]^{1-\beta}[(w_i - c)q_i^{\lambda\mathcal{S}}(w_i; \tilde{q}_j) + F_i]^{\beta}$$

Maximizing Nash product over the wholesale price, and following the standard procedure, we get:

$$w^{\delta\mathcal{S}} = c, \quad q^{\delta\mathcal{S}} = \frac{\tilde{\alpha}}{2+\gamma}$$

Wholesale price equals marginal cost, and is independent of the product's differentiation factor and the bargain power. Quantity is bargain power independent, and it decreases as products become more homogeneous $\frac{\partial q^{\delta\mathcal{S}}}{\partial\gamma} < 0$.

Mixed Regime: In the mix regime, we assume that $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim unobservability, and with $\mathcal{R}_j$ under interim observability. Consequently, in stage 2, the two retailers maximize different profit functions: $\max_{q_i}[\pi_i(q_i, q_j, F_i)] \Rightarrow q_i^{\delta\mathcal{X}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, while: $\max_{q_j}[\pi_j(q_j, F_j; \tilde{q}_i)] \Rightarrow q_j^{\delta\mathcal{X}}(w_j; \tilde{q}_i) = \frac{1}{2}(\alpha - w_j - \gamma\tilde{q}_i)$. We model the bargains in Stage 1 using the generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\delta\mathcal{X}}(w_i, w_j, F_i) = [(q_i^{\delta\mathcal{X}}(w_i, w_j))^2 - F_i]^{1-\beta}[(w_i - c)q_i^{\delta\mathcal{X}}(w_i, w_j) + F_i]^{\beta}$$
$$\mathcal{N}_j^{\delta\mathcal{X}}(w_i, w_j, F_i; \tilde{q}_i) = [(q_j^{\delta\mathcal{X}}(w_j; \tilde{q}_i))^2 - F_j]^{1-\beta}[(w_j - c)q_j^{\delta\mathcal{X}}(w_j; \tilde{q}_i) + F_j]^{\beta}$$

Maximizing each Nash bargain product over its respective wholesale price, and following the standard procedure, we get:

$$w_i^{\delta\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\delta\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}$$
$$w_j^{\delta\mathcal{X}} = c, \quad q_j^{\delta\mathcal{X}} = \frac{(4-\gamma(2+\gamma))\tilde{\alpha}}{4(2-\gamma^2)}$$

Notice that $w_i^{\delta\mathcal{X}} < c$ while $w_j^{\delta\mathcal{X}} = c$, and they both are bargain power independent, while the unobserved wholesale price decreases as products become more homogeneous $\frac{\partial w_i^{\delta\mathcal{X}}}{\partial\gamma} < 0$. Both quantities are bargain power independent, and the observed quantity decreases as products become more homogeneous $\frac{\partial q_i^{\delta\mathcal{X}}}{\partial\gamma} < 0$. □

Proof. Proposition 5.3. Based on the analysis and reasoning of the Lemma 9, the equilibrium values for the supplier's and the retailers' profits are:

$$\pi^{\delta\mathcal{O}} = \frac{2(1-\beta)(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma)\gamma)^2}, \quad \Pi^{\delta\mathcal{O}} = \frac{2\beta(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma)\gamma)^2}$$
$$\pi^{\delta\mathcal{S}} = \frac{(1-\beta)\tilde{\alpha}^2}{(2+\gamma)^2}, \quad \Pi^{\delta\mathcal{S}} = \frac{\beta\tilde{\alpha}^2}{(2+\gamma)^2}$$
$$\pi_i^{\delta\mathcal{X}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi_j^{\delta\mathcal{X}} = \frac{(1-\beta)(4-\gamma(2+\gamma))^2\tilde{\alpha}^2}{16(2-\gamma^2)^2}$$
$$\Pi_i^{\delta\mathcal{X}} = \frac{\beta(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \Pi_j^{\delta\mathcal{X}} = \frac{\beta(4-\gamma(2+\gamma))^2\tilde{\alpha}^2}{16(2-\gamma^2)^2}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision. It can be readily verified that $\forall\beta, \gamma \in (0, 1)$ the following inequalities hold:

(i) $\pi^{\delta\mathcal{S}} > \pi_j^{\delta\mathcal{X}}$ and $\Pi^{\delta\mathcal{S}} > \Pi_j^{\delta\mathcal{X}}$ thus universal interim unobservability is an equilibrium because both bargain parties have incentives not to reveal the contract terms.

(ii) $\pi^{\delta\mathcal{O}} < \pi_i^{\delta\mathcal{X}}$ and $\Pi^{\delta\mathcal{O}} < \Pi_i^{\delta\mathcal{X}}$, so universal interim observability can't be an equilibrium because both bargain parties have incentives to move to the mix regime. □

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