Joint Ventures versus Franchising in Vertically Related Markets; A Bargaining Approach.

Emmanuel Petrakis * Panagiotis Skartados

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Abstract

The purpose of this article is to examine the (non-)equivalence of joint venture and franchising agreements, in a two-tier vertical market. There is a contractual equivalence when downstream bargain with an exclusive dedicated upstream (two separate vertical chains). In case of one common upstream supplying both downstream, there is an endogenous prevalence of joint venture agreements for the upstream, while downstream endogenously prefer franchise contracts. This holds under Cournot or Bertrand-style competition in the product market, and with vertical contracts with secret terms. When contract terms become interim observable,

*Corresponding author. Department of Economics, University of Crete, University Campus at Rethymnon GR74132, Greece, e-mail: petrakis@uoc.gr. Full responsibility for all shortcomings is ours. The usual disclaimer applies.
the contract type is endogenously determined by the bargaining power of the up-
stream, and from product’s differentiation.

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1 Introduction

Modern economic theory is concerned about choices: choices consumers make on
how to maximize their utility, and choices firms make on how to maximize their profits
(Williamson, 2002). These choices are made while consumers continuously transact with
firms, and vice versa. Markets host these transacting parties and distort their choices
due to market structure and, often, due to market failure. Looking from firm’s side of
view, a manager must make the right choice on how to allocate scarce resources between
internal and external vertical markets, under the presence of transaction costs, ”hold-up”
problem, monitoring costs and imperfect information.

These are some aspects of the well-known vertical market failure problem.¹ Managers
often overreact to this problem, by fully vertically integrate either forward or back-
ward. They do so because they fail to take into account a full set of quasi-integration
strategies such as licensing, joint ventures or franchising, which tend to involve less cap-
ital and more flexibility (Stuckey and White, 1993). Full vertical integration is often
unwanted, is always very costly to implement, and even more costly to undo, if the
market change.

¹A vertical market “fails” when transactions within are too risky, and the contracts designed to
overcome these risks are too costly. The typical features of a failed vertical market are: (a) a small number
of buyers and sellers, (b) high asset specificity, durability and intensity, and (c) frequent transactions
(Stuckey and White, 1993).
In both retail and wholesale market, contract type decision is of profound importance. Contract type is closely related with contract terms disclosure regime. In the presence of frequent transactions and renegotiations, proper disclosure of contract terms is impossible; contracts are considered as having secret terms. These two contract characteristics have attend much interest from competition authorities all over the world (Arya and Mittendorf, 2007). Transaction Cost Theory states that firms transact by using incomplete contracts; a complete contract is practically unattainable, or at best very costly to write, monitor, account and enforce. The use of the right contract type could coordinate the interests of transacting firms, and thus effectively lowering the transaction costs (Holmström and Roberts, 1998).

In this paper, we deal with the choice of the right contract type in a two-tier vertical structure, with oligopolistic competition in product market. We set as a transaction reference model the case in which the upstream suppliers deal with the downstream retailers over a simple linear contract, with no other fees or restrictions except a wholesale price per quantity. We account for franchise contracts in the form of a non-linear two-part tariff contract (fixed fee plus a wholesale price per quantity), and for vertical joint venture with a profit sharing agreement.\textsuperscript{2}

Even though joint venture agreements and franchise contracts are very complicated multi-page contracts, we are abstract, and keep them as simple as possible: we model the exclusivity between upstream and downstream, and the transaction terms. In favor of joint ventures, empirical evidence shows that when supplier opportunism or hold up

\textsuperscript{2}Joint Ventures (JV) are defined as legal arrangements where ownership, profits and management of one legal entity are shared to more than one legal entity, all working closely together for their mutual benefit. JV agreements include an ownership percentage and a profit sharing arrangement, in which the proportion of ownership of the parents to the JV entity might be different from the proportion of profit shares, e.g. the JV between AMAX and Mitsui: ownership is 80%-20%, while profit share is 50%-50% (Darrough and Stoughton, 1989). Generally, a JV agreement could be set either with one firm buying an ownership percentage from another firm, like a partial integration, or with two firms jointly creating a new firm. Our narrative is closer (but not restricted) to the first case.
problems (through supplier asset specificity) are present, the likelihood of a joint venture formation is high, in contrast to other contractual arrangements (Johnson and Houston, 2000).

Contracts have the ability to extend the boundaries of the firm by internalizing its transactions. We can move from markets to hierarchies only with the right contract (Williamson, 2002). Contracts could enlarge the boundaries of the firm without any formal legal ownership; only economic control over residual claims.

The continuous change on firm’s size must be met by a continuous change in internal organization. Internal organization is an important factor of firm’s size; a large firm cannot always do things cheaper than a collection of small firms. Firms transact with a variety of different types of contracts. If we had to group contracts, at least three groups arise: a) linear contracts (fixed wholesale price per quantity), b) non-linear contracts (with most prevailing: two-part tariffs like franchise or royalty contracts), and c) integration (partial or not, horizontal or vertical, like joint ventures). These contracts can be augmented with a set of attributes like: bundling, exclusive territory, exclusive dealing, resale price maintenance et c.

Consider the case of two separate downstream firms, competing in an oligopolistic product market. We will prove that franchising (two part tariff) and joint ventures (backward partial vertical ownership with profit sharing) distribute joint surplus equivalently only under one common monopolist upstream supplier. In case of two separate vertical chains (two upstreams, one for each downstream), there is a non-equivalence between these two contract types. This holds under Cournot or Bertrand or monopolistic competition in product market, and for secret or interim observable contract terms. Thus, the equivalence is independent of product market competition and contract terms’ disclosure.
This non-equivalence creates an incentive to endogenize the contract’s type decision. If we let the upstreams to decide over the use of two-part tariffs or (partial) vertical integration, the decision is very different form the decision the downstream would take. Furthermore, there is an alignment of interests between a policy maker (who maximizes consumer surplus) and the downstream firm. The contract that fits best the former, also fits best the latter.

Furthermore, this non-equivalence is due to the fact that under an upstream monopolist, two-part tariff’s fixed fee is independent from quantity sold and from rival’s fixed fee. On the other hand, if we use (partial) vertical ownership contracts, the upstream’s ownership percentage over one downstream’s profits, is heavily depended on the ownership percentage of common upstream over rival downstream’s profits. This creates different strategic incentives for the common upstream, who charges different wholesale prices for each type of contract.

This is also highlighted by the fact that under two part tariff contracts with secret contract terms, wholesale price, retail price and quantity are the same for one common or two dedicated upstream suppliers. Due to contract’s secrecy, even the common upstream can not strategically influence downstreams. But, with partial vertical ownership, the common upstream can manipulate downstreams through ownership percentage. So, under secret contracts, (partial) vertical ownership is not enough to force the upstream to charge a wholesale price equal to his marginal cost, even though is a non-linear contract with two instruments.

Under Cournot competition in product market, and when one common upstream bargains with two downstreams over private contracts, under partial vertical ownership
(even if downstream is 100% owned by the upstream, because a rival’s ownership percentage exists) wholesale price is above marginal cost (in two-part tariff, wholesale price is equal to the marginal cost), while quantity is below the quantity sold with two-part tariffs. If contracts were interim observable, this effect is magnified, due to the upstream’s commitment problem.

Under Bertrand competition, because strategic interactions between downstreams are more complex, so the maximization of vertical chain’s joint profits will not give by definition wholesale price equal to marginal cost (as in Cournot case). We need to further impose symmetry in marginal response of quantity over retail price, which is something not stated thus far in literature. Nevertheless, even under Bertrand competition, wholesale prices and quantities between the two types of contracts follows the same inequality as in Cournot competition.

Our research is in the spirit of Bonanno and Vickers (1988) who state that vertical separation with two-part tariffs is more profitable for manufacturers than vertical integration. Their model is as follows: in a perfectly competitive product market, a manufacturer is better off if he sells his products in exclusive dedicated retailers via two-part tariffs and charges wholesale price equal to his marginal cost (so, has positive profits from fixed fee), than selling directly to consumers without any exclusive intermediates (so, it has to charge retail price equal to his marginal cost and make zero profits).

We deprive from their model in several ways (oligopoly competition in product market, partial vertical integration, one common upstream, we don’t assume strategic complementarity), but we also show that a monopolist manufacturer is better off by using two-part tariff contracts than partially vertical integrate.

The rest of the paper is as follows: in Section 2 we state our model assumptions,
timing of the game, and basic framework. In Section we give equilibrium results and our main proposition over the non-equivalence of two-part tariffs and partial vertical ownership. In Section we move to some extensions, such as vertical contracts with observable terms.

2 Framework

Consider an upstream monopolist manufacturer $M$, and two separate downstream retailers $R_1$ & $R_2$. Manufacturer $M$ produces a single differentiated good, at a constant unit cost $c > 0$. This good is sold to the retailers ($R_1, R_2$) in quantities ($q_1, q_2$) respectively, through a vertical contract with secret contract terms. As we will see, this vertical contract could be either a two-part tariff contract, or a (partial) vertical ownership contract. We assume that retailers buy the exact quantity they sell to consumers, so total retailer’s production, which equals total consumption is: $Q = q_1 + q_2$.

Each of the $R_i$’s face a constant unit cost $k_i$, which for simplicity are set equal to zero: $k_i \equiv 0$. $R_i$’s only cost is the cost induced by the vertical contract, which could be either: 1) a non-linear two-part tariff contract $(w_i, F_i)$, hereafter $TPT$ or 2) a partial vertical ownership contract $(w_i, a_i)$, hereafter $PVO$. We will later analyze both contracts in more detail.

Consumers have a general demand function $D_i(p_i, p_j), i = 1, 2$ which is:\footnote{As in Nocke and Rey (2014), this narrative is only expository, and does not restrict our analysis, which could be straightforward modified for different vertical relations between firms. Reader could imagine $M$ producing and distributing to $R_i$’s an essential input to use in an “1-1” basis to produce a final good, or even $M$ giving to $R_i$ a license for a patent for an essential technology.}

1. Continuously differentiable: $\forall (p_i, p_j) \geq 0, \exists \frac{\partial D_i(p_i, p_j)}{\partial p_i} \& \frac{\partial D_i(p_i, p_j)}{\partial p_j},$\footnote{These assumptions are standard in literature: Nocke and Rey, 2014; Arya and Mittendorf, 2011; Rey and Vergé, 2010; Rey and Vergé, 2004.}
2. Downward slopping in its own retail price: \( \frac{\partial D_i(p_i,p_j)}{\partial p_i} < 0 \), and upward slopping in rival’s retail price: \( \frac{\partial D_i(p_i,p_j)}{\partial p_j} > 0 \) (products are imperfect substitutes).

3. Decreasing when both \((p_i, p_j)\) increase: \( \frac{\partial D_i(p_i,p_j)}{\partial p_i} + \frac{\partial D_j(p_i,p_j)}{\partial p_j} < 0 \) (direct effects dominate; stability assumption).

We assume that a unique inverse demand function exists \( p_i(q_1, q_2), i = 1, 2 \), which is:

1. Continuously differentiable: \( \forall (q_i, q_j) \geq 0, \exists \frac{\partial p_i(q_i,q_j)}{\partial q_i} \& \frac{\partial p_i(q_i,q_j)}{\partial q_j} \),

2. Viable: \( (p_i(0,0) > c) \& (\exists \tilde{q}_i, \tilde{q}_j > 0: p_i(\tilde{q}_i,0) < c \& p_i(0,\tilde{q}_j) < c) \),

3. Products’ substitutability: \( \frac{\partial p_i(q_i,q_j)}{\partial q_i} \leq \frac{\partial p_i(q_i,q_j)}{\partial q_j} \leq 0 \), with strict inequalities hold for \( p_i(q_i, q_j) > 0 \),

To ensure that retailers’ profit maximization leads to global maximum, we assume that each retailer’s profit is up to second order continuously differentiable and concave. For retailer’s profits \( \pi_i = (p_i(q_i, q_j) - w_i) \cdot q_i \) to be concave, the following inequality must hold:

\[
\frac{\partial^2 \pi_i}{\partial q_i^2} < 0 \iff \frac{\partial^2 p_i(q_i, q_j)}{\partial q_i^2} \cdot q_i + 2 \cdot \frac{\partial p_i(q_i, q_j)}{\partial q_i} < 0 \tag{1}
\]

We assume that \( M \)’s offers and \( R_i \)’s acceptance are private information, unobservable from \( R_j \).\(^5\) We do so, to avoid any strategic commitment effects (Hart and Tirole, 1990), and equilibrium’s non-existence problems (O’Brien and Shaffer, 1992). Because of this secrecy of \( R_i \)’s contract terms, \( R_j \) must form beliefs about them. We assume that \( R_j \) forms market-to-market or passive beliefs (Hart and Tirole, 1990; McAfee and Schwartz, 1994).

\(^5\)Secrecy could be caused also by non-complete self-enforcing contracts, or contracts often renegotiable. In Section 4, as an extension, we consider the case of vertical contracts with observable terms.
Under passive beliefs, retailers don’t revise their beliefs when they receive an out-of-equilibrium offer from manufacturer. They treat it as an uncorrelated tremble; \( R_j \) believes that \( R_i \) has settled in an equilibrium contract. Passive beliefs are the natural selection of beliefs under secret contract terms (Arya and Mittendorf, 2011), and go side-by-side with pairwise proofness (Milliou and Petrakis, 2007).

The timing of the game is as follows:

- **Stage 1 - Bargain**: Manufacturer \( M \) bargains secretly, simultaneously, and separately with both retailers \( (R_i, R_j) \), over either:
  - A two-part tariff contract \( TPT: (w_i, F_i), \ i = 1, 2 \) where \( w_i > 0 \) is a consumption-based wholesale price, and \( F_i > 0 \) is a consumption-independent fixed fee, or
  - A partial vertical ownership contract \( PVO: (w_i, a_i), \ i = 1, 2 \) where \( w_i > 0 \) is a consumption-based wholesale price, and \( 0 < a_i < 1 \) is an ownership (profit share) percentage.

- **Stage 2 - Competition**: Retailers \( (R_i, R_j) \) compete à la Cournot in product market.

Manufacturer \( M \) bargains with each retailer \( (R_i, R_j) \) with secret contract terms. This secrecy is necessary up to the moment contracts are signed. After that, any deviation from secrecy to observability is strategically pointless, because it will not alter (the already signed) contract terms.

The bargain between \( M \) and \( R_i \) is modeled with asymmetric Nash bargain product, with \( 0 < \beta < 1 \) being manufacturer’s \( M \) bargain power, which assumed exogenous and constant throughout the game.
3 Equilibrium Results

To extract equilibrium results we use the standard in literature sub-game perfection, and Nash equilibrium of simultaneous generalized Nash bargaining problems.

3.1 Downstream competition

Retailers \((R_i, R_j)\) are engaged in a Cournot style oligopolistic competition. \(R_i\)’s profit maximization over quantity leads to:

\[
\max_{q_i} \left[ \pi_i(q_i, q_j) \right] \Rightarrow p_i(q_i, q_j) - w_i + q_i \cdot \frac{\partial p_i}{\partial q_i} = 0 \quad (2)
\]

If the equilibrium exists, it is characterized by Eq. 2.\(^6\) Due to the secrecy of contract terms, \(R_i\) must form passive beliefs for \(R_j\)’s contract terms, so: \(q_i = q_i(w_i, \tilde{w}_j, \tilde{q}_i), i = 1, 2\), where \(\tilde{w}_j\) is the belief \(R_i\) has formed about \(R_j\)’s unobserved wholesale price, and \(\tilde{q}_i\) is what \(R_i\) believe that \(R_j\) believe about \(R_i\)’s quantity\(^7\).

Manufacturer \(M\) bargains secretly, simultaneously, and separately with both retailers \((R_i, R_j)\). The subject of the bargains could be either a two-part tariff contract \(TPT\): \((w_i, F_i)\), or a partial vertical ownership contract \(PVO\): \((w_i, a_i)\). We will treat each type of contract in separate subsections.

\(^6\)In any case, the assumptions taken in this paper guarantee the existence and uniqueness of an equilibrium. They also guarantee that this equilibrium is an internal (not corner) solution.

\(^7\)As in Brandenburger and Dekel (1993), each retailer has a type, which is a single entity with an hierarchy of beliefs. Level 0 belief is the common knowledge, e.g. a) each retailer maximizes profits over quantity, so it must have a downward slopping reaction function, b) products are substitutes so certain signs for some partial derivatives hold etc. Level 1 beliefs are the ones \(R_i\) has formed about his equilibrium values \(q^*_i\). Level 2 beliefs are the ones \(R_i\) has formed about \(R_j\)’s (unobserved) equilibrium values \(\tilde{q}_j\). Level 3 beliefs are the ones \(R_i\) has formed about what \(R_j\) believe about \(R_i\)’s equilibrium values \(\tilde{q}_i\), etc. These different levels of beliefs do not contradict each other (coherency concept).
3.1.1 Two-part tariff contracts

Manufacturer $M$ bargains with retailer $R_i$ over a two-part tariff contract (TPT):

$$NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i) = [\pi_i(w_i, \tilde{w}_j, \tilde{q}_i) - F_i]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + F_i + (\tilde{w}_j - c) \cdot q_j(\tilde{w}_j, \tilde{q}_i) + \tilde{F}_j - OutOpt_i(\tilde{w}_j, \tilde{F}_j)]^\beta$$

where: $OutOpt_i(\tilde{w}_j, \tilde{F}_j) = (\tilde{w}_j - c) \cdot q_j^{Mon}(\tilde{w}_j) - \tilde{F}_j$ is the outside option (disagreement payoff) that $R_i$ faces from $M$. Quantity $q_j^{Mon}(\tilde{w}_j)$ stands for quantity sold from $R_j$ in case of being a monopolist in product market.\(^8\)

Outside option is non-consistent to permanent and irrevocable breakdown in negotiations between pairs (Horn and Wolinsky, 1988; Milliou and Petrakis, 2007).\(^9\)

Following the TPT’s two step maximization (O’Brien and Shaffer, 1992), we first maximize Nash bargain product $NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i)$ over fixed fee $F_i$, and then we maximize the excess joint profits $EJP_i(w_i, \tilde{w}_j, \tilde{q}_i)$ over $w_i$.

$$\max_{F_i} [NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i)] \Rightarrow F_i^*(w_i, \tilde{w}_j, \tilde{q}_i) = \beta \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) - (1 - \beta) \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{q}_i) - q_j^{Mon}(\tilde{w}_j))]$$

Substituting $F_i^*(w_i, \tilde{w}_j, \tilde{q}_i)$ to $NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i)$ we get:

$$NBP_i^*(w_i, \tilde{w}_j, \tilde{q}_i, F_i^*(w_i, \tilde{w}_j, \tilde{q}_i)) = (1 - \beta)^{1-\beta} \cdot \beta^\beta \cdot EJP_i(w_i, \tilde{w}_j, \tilde{q}_i),$$

where:

$$EJP_i(w_i, \tilde{w}_j, \tilde{q}_i) = \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) + (w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{q}_i) - q_j^{Mon}(\tilde{w}_j))$$

\(^8\)We set: $q_j^{Mon}(\tilde{w}_j) \equiv \arg \max_{\tilde{q}_j} \Pi_j^{Mon}(\tilde{q}_j)$.

\(^9\)The assumption of contingent contract models a situation where firms could break down permanently their negotiations. This creates a "stronger" outside option for the manufacturer thus it shifts equilibrium to his favor. Retailer’s outside option is set equal to zero.
Maximizing \( EJP_i(w_i, \tilde{w}_j, \tilde{q}_i) \) over \( w_i \), and using Eq. 2 we get:

\[
\max_{w_i} [EJP_i(w_i, \tilde{w}_j, \tilde{q}_i)] \overset{(2)}{\Rightarrow} \frac{\partial EJP_i(w_i, \tilde{w}_j, \tilde{q}_i)}{\partial w_i} = 0 \Rightarrow w_i^{TPT} = c
\]

Solving the same problem for \( R_j \) we, also, get: \( w_j^{TPT} = c \) (without the need to impose symmetry). Notice that in equilibrium, \( R_j \)'s beliefs and equilibrium values are the same: \( \tilde{w}_i = w_i \) and \( \tilde{q}_i = q_i \). We use Eq. 2 to get equilibrium quantity:

\[
p_i(q_i^*, q_j^*) - c + q_i^* \cdot \frac{\partial p_i(q_i^*, q_j^*)}{\partial q_i^*} = 0 \Rightarrow q_i^{TPT} = \frac{-(p_i^{TPT} - c)}{\frac{\partial p_i^{TPT}}{\partial q_i^{TPT}}}
\]

(3)

Notice that if we substitute \( w_i^{TPT} = w_j^{TPT} = c \) to fixed fee \( F_i^*(w_i, \tilde{w}_j, \tilde{q}_i) \) we get:

\[
F_i^{TPT} = F_i^*(c, c, q_i^{TPT}) = \beta \cdot \Pi_i(c, c, q_i^{TPT}) = \beta \cdot (q_i^{TPT})^2 \cdot \frac{\partial p_i^{TPT}}{\partial q_i^{TPT}} \overset{Eq.3}{=} \beta \cdot \frac{(p_i^{TPT} - c)^2}{\frac{\partial p_i^{TPT}}{\partial q_i^{TPT}}}
\]

In our analysis, we suppose that: \( \left. \frac{\partial NBP_i}{\partial w_i} \right|_{w_i^{TPT}} = 0 \), and \( \left. \frac{\partial NBP_i}{\partial F_i} \right|_{F_i^{TPT}} = 0 \). To ensure that \( (w_i^{TPT}, F_i^{TPT}) \) exists and is (at least) a local maximum point of Nash bargain product \( NBP_i = NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i) \), we refer to the second partial derivative test, using the determinant and the trace of the Hessian 2X2 matrix of partial derivatives:

**Assumption:** For \( (w_i^{TPT}, F_i^{TPT}) \) to be local maximum of \( NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, F_i) \), we assume that all three second partial derivatives \( \frac{\partial^2 NBP_i}{\partial w_i^2}, \frac{\partial^2 NBP_i}{\partial F_i^2}, \frac{\partial^2 NBP_i}{\partial w_i \partial F_i} \) exist, and satisfy the following two inequalities:

\[
\frac{\partial^2 NBP_i}{\partial w_i^2} \bigg|_{(w_i^{TPT}, F_i^{TPT})} + \frac{\partial^2 NBP_i}{\partial F_i^2} \bigg|_{(w_i^{TPT}, F_i^{TPT})} < 0 \text{ , and }
\]

\[
\frac{\partial^2 NBP_i}{\partial w_i^2} \bigg|_{(w_i^{TPT}, F_i^{TPT})} \cdot \frac{\partial^2 NBP_i}{\partial F_i^2} \bigg|_{(w_i^{TPT}, F_i^{TPT})} - \left( \frac{\partial^2 NBP_i}{\partial w_i \partial F_i} \bigg|_{(w_i^{TPT}, F_i^{TPT})} \right)^2 > 0
\]

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That is, for a critical point to be a local maximum, the trace of the Hessian 2X2 matrix of partial derivatives must be negative, while the determinant must be positive. As an exercise, we will check the Assumption by using a linear inverse demand function:

\[ p_i(q_i, q_j) = \alpha - q_i - \gamma \cdot g_j, \] where \( \alpha > 0 \) is the choke price, and \( 0 < \gamma < 1 \) is the differentiation factor.

Indeed, under the previous linear inverse demand function:

\[ w_{TPT} = c, \quad F_{TPT} = \beta \cdot (\alpha - c)^{(1-\beta)^2}, \quad q_{TPT} = \alpha - c \]

so:

\[ \frac{\partial^2 NBP_i}{\partial w_i^2} \bigg|_{(w_{TPT}, F_{TPT})} + \frac{\partial^2 NBP_i}{\partial F_i^2} \bigg|_{(w_{TPT}, F_{TPT})} = \frac{-(2 - \beta)(\beta + 1) - \frac{2(2+\gamma)^2}{(\alpha-c)^2}}{2\beta(1-\beta)^2} < 0, \]

and

\[ \frac{\partial^2 NBP_i}{\partial w_i^2} \bigg|_{(w_{TPT}, F_{TPT})} \cdot \frac{\partial^2 NBP_i}{\partial F_i^2} \bigg|_{(w_{TPT}, F_{TPT})} - \left( \frac{\partial^2 NBP_i}{\partial w_i \partial F_i} \bigg|_{(w_{TPT}, F_{TPT})} \right)^2 = \frac{(1-\beta)(\gamma+2)^2}{2\beta(\alpha-c)^2(1-\beta)^2} > 0 \]

Denote that \( \alpha > c > 0, \quad 0 < \gamma < 1 \) and \( 0 < \beta < 1 \).

3.1.2 Partial vertical ownership contracts

Manufacturer \( M \) bargains with retailer \( R_i \) over a partial vertical ownership contract (PVO):

\[ NBP_i(w_i, \tilde{w}_j, \tilde{q}_i, a_i, \tilde{a}_j) = [(1 - a_i) \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i)]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + a_i \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot q_j(\tilde{w}_j, \tilde{q}_j) + \tilde{a}_j \cdot \Pi_j(\tilde{w}_j, \tilde{q}_j) - OutOpt_i(\tilde{w}_j, \tilde{a}_j)]^{\beta} \]

where: \( OutOpt_i(\tilde{w}_j, \tilde{a}_j) = (\tilde{w}_j - c) \cdot q_j^{Mon}(\tilde{w}_j) + \tilde{a}_j \cdot \Pi_j^{Mon}(\tilde{w}_j) \) is the outside option
Lemma 1. Ownership percentage (profit share) $a_i \cdot \Pi_i$ can transfer more utility between bargain parties, compared to the fixed fee $F_i$, under any bargain power, product differentiation or wholesale price.

Substituting $a_i^*(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j)$ to $NPB_i(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j)$ we get:

$$NPB_i^*(w_i, q_j, a_i^*(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j), \tilde{a}_j) = (1 - \beta) \cdot \beta^\beta \cdot EJP_i(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j),$$

where:

$$\max_{a_i}[NPB_i(w_i, \tilde{w}_j, \tilde{q}_i, a_i, \tilde{a}_j)] \Rightarrow a_i^*(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j) = \frac{1}{\Pi_i(w_i, \tilde{w}_j, \tilde{q}_i)} \cdot [\beta \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) - (1 - \beta) \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{q}_i) - q_j^{Mon}(\tilde{w}_j)) + \tilde{a}_j \cdot (\Pi_j(\tilde{w}_j, \tilde{q}_i) - \Pi_j^{Mon(\tilde{w}_j)})]]$$

Notice that due to the fact that Nash bargain under partial vertical ownership can be written as:

$$NPB_i(w_i, \tilde{w}_j, \tilde{q}_i, a_i, \tilde{a}_j) = [\Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) - a_i(w_i, \tilde{w}_j, \tilde{q}_i)]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{q}_i) + a_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot q_j(\tilde{w}_j, \tilde{q}_i) + \tilde{a}_j - OutOpt_i(\tilde{w}_j, \tilde{a}_j)]^\beta$$

where: $a_i(w_i, \tilde{w}_j, \tilde{q}_i) = a_i \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i)$ and $\tilde{a}_j = \tilde{a}_j \cdot \Pi_j(\tilde{w}_j, \tilde{q}_i)$, there is a common sense that fixed fee $F_i(w_i, \tilde{w}_j, \tilde{q}_i)$ and ownership percentage (profit share) $a_i(w_i, \tilde{w}_j, \tilde{q}_i)$ are, at least, equivalent. We show that they are not equivalent, because:

$$a_i \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) - F_i(w_i, \tilde{w}_j, \tilde{q}_i) = (1 - \beta) \cdot \tilde{a}_j \cdot (\Pi_j^{Mon(\tilde{w}_j)} - \Pi_j(\tilde{w}_j, \tilde{q}_i))$$

For $0 < \tilde{a}_j < 1$ and $0 < \beta < 1$ obviously: $a_i \cdot \Pi_i > F_i$. This inequality justifies the following Lemma:
\[ EJP_i(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j) = \Pi_i(w_i, \tilde{w}_j, \tilde{q}_i) + (w_i - c) \cdot \tilde{q}_i(w_i, \tilde{w}_j, \tilde{q}_i) + (\tilde{w}_j - c) \cdot [q_j(\tilde{w}_j, \tilde{q}_i) - q_j^{Mon}(\tilde{w}_j)] + \tilde{a}_j \cdot [\Pi_j(\tilde{w}_j, \tilde{q}_i) - \Pi_j^{Mon}(\tilde{w}_j)] \]

So: \[ \max_{w_i} [EJP_i(w_i, \tilde{w}_j, \tilde{q}_i, \tilde{a}_j)] \overset{(2)}{\Rightarrow} w_i^{PVO} = c - a_j \cdot q_j^{PVO} \cdot \frac{\partial p_i^{PVO}}{\partial q_i^{PVO}} \]

Under two-part tariff with secret contract terms, \( M \) cannot use wholesale price to strategically control the retailers, because \( w^{TPT} = c \). This is not the case under partial vertical ownership with secret contract terms. The fact that \( M \) has an ownership (profit share) percentage over \( R_j \), forces \( R_i \) to accept a wholesale price above marginal cost \( w^{PVO} > c \).10

Under partial vertical ownership, each time \( M \) bargains with \( R_i \) has to stabilize three opposite profit sources: \( (w_i) \), \( (a_i \cdot \Pi_i) \), and \( (a_j \cdot \Pi_j) \). If \( R_i \) accept high wholesale price \( w_i \), this will increase retail price \( p_i \) so will lower \( R_i \)'s profits \( \Pi_i \), so \( M \) will earn more from wholesale price \( w_i \), but less from profit share percentage \( a_i \cdot \Pi_i \). This deal will give a bigger market share to \( R_j \), so \( M \) will gain more from profit share \( a_j \cdot \Pi_j \). In contrast, under two-part tariff contracts, the choice of \( F_i \) is unaffected by \( F_j \), because the latter is not part of pair’s (\( M, R_i \)) excess joint profits.

Using Eq. 2, we get equilibrium quantity:

\[ q_i^{PVO} = \frac{c - p_i^{PVO} \cdot \frac{\partial p_i}{\partial q_i} - a_j \cdot (c - p_j^{PVO}) \cdot \frac{\partial p_j}{\partial q_j}}{\frac{\partial p_i}{\partial q_j} - a_i \cdot a_j \cdot \frac{\partial p_i}{\partial q_i} \cdot \frac{\partial p_j}{\partial q_j} - \frac{\partial p_i}{\partial q_i} \cdot \frac{\partial p_j}{\partial q_j}} \]

Notice that even for \( a_i = 0 \) we do not get equilibrium quantity of two-part tariff contracts, it has to be rival’s \( a_j = 0 \). In case of symmetry: \( \frac{\partial p_i}{\partial q_i} = \frac{\partial p_j}{\partial q_j} = \frac{\partial p_i}{\partial q_j} = \frac{\partial p_j}{\partial q_i} \), and \( p_i = p_j \), and \( a_i = a_j \), so: \( q^{PVO} = \frac{c-p^{PVO}}{(1+a)^2} \). These findings leads to the following Lemma:

\[ \text{\footnotesize{This holds when products are substitutes because: } } \frac{\partial p_j}{\partial q_i} < 0. \text{ When products are complements: } w^{PVO} < c \text{ because: } \frac{\partial p_j}{\partial q_i} > 0. \]
Lemma 2. Under one common upstream supplier, private contract terms, and Cournot competition in product market, wholesale price $w^TPT_i$ (quantity $q^TPT_i$) in two-part tariff contracts is below (above) wholesale price $w^PVO_i$ (quantity $q^PVO_i$) of partial vertical ownership contracts.

Superscript TPT stands for two-part tariff contracts, while PVO stands for partial vertical ownership contracts. Lemma’s proof is a straightforward comparison of the two wholesale prices $w^TPT_i$ & $w^PVO_i$, and quantities $q^TPT_i$&$q^PVO_i$, for $a_i > 0$. Based on Lemmas 1 and 2, we derive the following Proposition:

Proposition 3.1. Two-part tariffs and partial vertical ownership are not equivalent.

4 Extensions

4.1 Observable Contracts

$R_i$ maximize his profits over quantity:

$$\max_{q_i} [\Pi_i(q_i, q_j)] \Rightarrow p_i(q_i, q_j) - w_i + q_i \cdot \frac{\partial p_i}{\partial q_i} = 0$$

The difference with secret contracts is that under observability $R_i$ can observe $R_j$’s contract terms and react optimally: $q_i = q_i(w_i, w_j)$. At the same time, $M$ is strategically committed to wholesale prices agreed with retailers, so in contrast to private vertical contracts, is forced to agree to lower wholesale price but to higher fixed fees (in two-part tariff contracts).
4.1.1 Two-Part tariff contracts

$M$ bargains with $R_i$ over an observable two-part tariff contract:

$$NBP_i(w_i, w_j, F_i) = [\Pi_i(w_i, w_j) - F_i]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, w_j) + F_i + (w_j - c) \cdot (q_j(w_i, w_j) - q_j^{Mon}(w_j))]^\beta$$

We use the same two step maximization process as before. First, we maximize Nash bargain product over fixed fee:

$$\max_{F_i} [NBP_i(w_i, w_j, F_i)] \Rightarrow F_i^* = \beta \cdot \Pi_i(w_i, w_j) - (1 - \beta) \cdot [(w_i - c) \cdot q_i(w_i, w_j) + (w_j - c) \cdot (q_j(w_i, w_j) - q_j^{Mon}(w_j))]$$

We set excess joint profits equal to the sum of $M & R_i$ profits:

$$EJP_i(w_i, w_j) = \Pi_i(w_i, w_j) + (w_i - c) \cdot q_i(w_i, w_j) + (w_j - c) \cdot [q_j(w_i, w_j) - q_j^{Mon}(w_j)]$$

and then, we maximize excess joint profits over wholesale price:

$$\max_{w_i} [EJP_i(w_i, w_j)] \Rightarrow w_i^{TPT} = \frac{c \cdot \frac{\partial q_i}{\partial w_i} \cdot (\frac{\partial q_i}{\partial w_j} + \frac{\partial q_j}{\partial w_j}) + ((p_i^{TPT} - p_j^{TPT}) \cdot \frac{\partial q_i}{\partial w_i} + p_i^{TPT} \cdot \frac{\partial q_j}{\partial w_i}) \cdot \frac{\partial q_j}{\partial w_j}}{\frac{\partial q_i}{\partial w_i} \cdot \frac{\partial q_i}{\partial w_j} + \frac{\partial q_j}{\partial w_j} \cdot (\frac{\partial q_i}{\partial w_i} + \frac{\partial q_j}{\partial w_i})}$$

In case of symmetry: $\frac{\partial q_i}{\partial w_i} = \frac{\partial q_i}{\partial w_j}$ and $\frac{\partial q_j}{\partial w_i} = \frac{\partial q_j}{\partial w_j}$, then $q_i = q_j$ and $p_i = p_j$, we get:

$$w^{TPT} = \frac{1}{3} \cdot (2c + p^{TPT})$$

and using Eq.2 $q^{TPT} = \frac{2(2c - p^{TPT})}{3 \frac{\partial q}{\partial q}}$.

Lemma 3. Under two part tariff contracts: $w^{Obs} > w^{Sec}$ & $q^{Obs} = \frac{2}{3} \cdot q^{Sec}$.

Proof of the Lemma is straightforward. Notice that: $w^{Obs} - w^{Sec} = \frac{1}{3}(p^{Obs} - c)$. 

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This can be explained by downward slopping reaction functions in Cournot competition.

\[ q_j^{RF} = \begin{cases} \text{RF}_{j}^{Sec}(q_i|w_j = c) & \text{if } q_i^{Sec} > q_i^{Obs} \\ \text{RF}_{j}^{Obs}(q_i|w_j > c) & \text{if } q_i^{Obs} \leq q_i^{Sec} \end{cases} \]

\[ q_i^{Obs} > q_i^{Sec} \]

Figure 1: Comparison of quantities under secret and observable contracts.

In Cournot competition in product market, when firms bargain over secret contracts, wholesale price equals marginal cost. Under observable contracts, wholesale price is above marginal cost (double marginalization problem) \( c = w_i^{Sec} < w_i^{Obs} \). This drives the downstreams to buy more quantity, compared to observable contracts \( q_i^{Sec} > q_i^{Obs} \).

4.1.2 Partial Vertical Ownership contracts

\( M \) bargains with \( R_i \) over an observable partial vertical ownership contract:

\[ NBP_i(w_i, w_j, a_i, a_j) = [(1 - a_i) \cdot \Pi_i(w_i, w_j)]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, w_j) + a_i \cdot \Pi_i(w_i, w_j) + (w_j - c) \cdot (q_j(w_i, w_j) - q_j^{Mon}(w_j)) + a_j \cdot (\Pi_j(w_i, w_j) - \Pi_j^{Mon}(w_j))]^{\beta} \]

To understand better the outside option of \( M \), consider that \( M \) is willing to bargain with \( R_i \) for profits higher than those gained if he makes \( R_j \) a monopolist (because Cournot duopolist gains more than a monopolist: \( \Pi_j(w_i, w_j) > \Pi_j^{Mon}(w_j) \)).

\( M \)'s outside option models bargains that are non-contingent to permanent breakdown in negotiations (Milliou and Petrakis, 2007). \( M \) is more profitable to sell to both retailers, than selling to just one, so he will always return to bargains. We maximize
Nash bargain product over partial vertical ownership percentage:

$$\max_{a_i}[NBP_i(w_i, w_j, a_i, a_j)] \Rightarrow a_i^*(w_i, w_j, a_j) = \frac{1}{\Pi_i(w_i, w_j)} \cdot [\beta \cdot \Pi_i(w_i, w_j) - (1 - \beta) \cdot [\pi_i(w_i, w_j) + (w_i - c) \cdot q_i(w_i, w_j) + (w_j - c) \cdot (q_j(w_i, w_j) - q_j^{Mon}(w_j))] + a_j \cdot (\Pi_j(w_i, w_j) - \Pi_j^{Mon}(w_j))]$$

and then we maximize excess joint profits over wholesale price:

$$EJP_i(w_i, w_j, a_j) = \Pi_i(w_i, w_j) + (w_i - c) \cdot q_i(w_i, w_j) + (w_j - c) \cdot (q_j(w_i, w_j) - q_j^{Mon}(w_j))] + a_j \cdot (\Pi_j(w_i, w_j) - \Pi_j^{Mon}(w_j))]$$

If we assume symmetry in equilibrium, then:

$$w^{PVO} = \frac{1}{3}(2c - a \cdot q^{PVO} \cdot \frac{\partial p}{\partial q} + p^{PVO})$$

$$q^{PVO} = \frac{2(c - p^{PVO})}{(3 + a) \cdot \frac{\partial p}{\partial q}}$$

**Lemma 4.** Under partial vertical ownership contracts:

$$w^{Obs} \leq \frac{1}{\sqrt{1 + a}} w^{Sec} \iff (p^{PVO} - c) \leq \frac{1}{\sqrt{1 + a}} (q^{PVO} \cdot a \cdot \frac{\partial p}{\partial q})$$

$$q^{Obs} = \frac{2(1 + a)}{3 + a} \cdot q^{Sec} \leq \frac{1}{\sqrt{1 + a}} q^{Obs} < q^{Sec}$$
contrast to wholesale price under two-part tariff contracts, see Lemma 3). Ownership percentage (profit share) \( a \) plays a crucial role to this inequality, because it is the only variable that is bargained between the upstream and the downstream.

While under both PVO and TPT contracts: \( q^{Obs} < q^{Sec} \), the existence of ownership percentage creates incentives for the upstreams to bargain with wholesale prices lower than marginal cost \( c \), due to the expected profits rebate from the profit share \( a \).

4.2 Bertrand competition in product market

We account for Bertrand competition in product market, in order to highlight the fact that the non-equivalence of two-part tariffs and partial vertical ownership does not depend on the type of competition in product market.

4.2.1 Downstream Competition

\( R_i \)’s profits in price competition are: \( \Pi_i(p_i, p_j) = (p_i - w_i) \cdot q_i(p_i, p_j) \). \( R_i \) maximizes his profits over retail price:

\[
\max_{p_i} [\Pi_i(p_i, p_j)] \Rightarrow q_i(p_i, p_j) + (p_i - w_i) \cdot \frac{\partial q_i}{\partial p_i} = 0 \tag{4}
\]

Notice that, under private contracts, in equilibrium: \( p_i = p_i(w_i, \tilde{w}_j, \tilde{p}_i) \). Reasoning is the following: \( \tilde{w}_j \) is the belief \( R_i \) has formed about \( R_j \)’s unobservable wholesale price, and \( \tilde{p}_i \) is the belief \( R_i \) has formed about the belief \( R_j \) has for \( R_i \)’s retail price.

4.2.2 Bargains

\( M \) bargains privately, simultaneously and separately with both \( (R_i, R_j) \).
Two-Part tariff contracts  In case of using two-part tariff contracts, Nash bargain product is:

\[
NBP_i(w_i, \tilde{w}_j, \tilde{p}_i, F_i) = \left[\Pi_i(w_i, \tilde{w}_j, \tilde{p}_i) - F_i\right]^{1-\beta} \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{p}_i) + F_i +
+ (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{p}_i) - q_j^{Mon}(\tilde{w}_j))]^\beta
\]

Maximizing \( NBP_i \) over \( F_i \), and solving first order condition for \( F_i^* \) we get:

\[
F_i^*(w_i, \tilde{w}_j, \tilde{p}_i) = \beta \cdot \Pi_i(w_i, \tilde{w}_j, \tilde{p}_i) - (1 - \beta) \cdot [(w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{p}_i) +
+ (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{p}_i) - q_j^{Mon}(\tilde{w}_j))]
\]

Excess joint profits are:

\[
EJP_i(w_i, \tilde{w}_j, \tilde{p}_i) = \Pi_i(w_i, \tilde{w}_j, \tilde{p}_i) + (w_i - c) \cdot q_i(w_i, \tilde{w}_j, \tilde{p}_i) + (\tilde{w}_j - c) \cdot (q_j(\tilde{w}_j, \tilde{p}_i) - q_j^{Mon}(\tilde{w}_j))
\]

Maximizing them over wholesale price, using beliefs symmetry in equilibrium \( \tilde{w}_i = w_i \) & \( \tilde{p}_i = p_i \), and using Eq. 4, we get:

\[
\max_{w_i} [EJP_i] \Rightarrow w_i^{TPT} = c + \frac{(c - w_j^{TPT}) \cdot \frac{\partial q_j}{\partial p_i} \cdot \frac{\partial q_i}{\partial p_i}}{\frac{\partial q_i}{\partial p_i} \cdot \frac{\partial q_j}{\partial p_i} - \frac{\partial q_j}{\partial p_i} \cdot \frac{\partial q_j}{\partial p_j}}
\]

If we assume symmetry in equilibrium: \( w^{TPT} = c \), and from Eq. 4: \( q^{TPT} = (c - p^{TPT}) \cdot \frac{\partial q}{\partial p} \).

Lemma 5. In two-part tariff vertical contracts with secret terms, and in contrast to Cournot competition, in Bertrand competition maximization of excess joint profits does
not lead to \( w^{TPT} = c \). To derive \( w^{TPT} = c \), symmetry must be applied.

This Lemma covers a gap in recent literature. As stated in Arya & Mittendorf (2011), contracts in Bertrand competition are inherently more inter-dependent, and are characterized by lack of separability. Our previous Lemma is an extension of Lemma 5 of the latter, adding a non-symmetry perspective.

**Partial Vertical Ownership contracts** Using standard methodology, we maximize Nash bargain product over ownership percentage (profit share), and excess joint profits over wholesale price, reaching the following equilibrium values:

\[
 w_i^{PVO} = c - a_j \cdot (p_j^{PVO} - w_j^{PVO}) \cdot \frac{\partial p_i}{\partial w_i} \cdot \frac{\partial q_j}{\partial p_j} \\
= c + \frac{a_j \cdot q_j^{PVO} \cdot \partial p_i}{\partial w_i} \cdot \frac{\partial q_j}{\partial p_j} \\
\Leftrightarrow w_i^{PVO} > c
\]

If we assume symmetry, and using Eq. 4 we get: \( q^{PVO} = \frac{(c - p^{PVO}) \cdot \partial q}{1 - a \cdot \frac{\partial q}{\partial p}} \)

**Lemma 6.** In Bertrand competition, and under secret contract terms: \( w^{TPT} < w^{PVO} \) and \( q^{TPT} > q^{PVO} \).

Lemma’s proof is straightforward: For wholesale prices: \( w^{PVO} - w^{2PT} = \frac{a \cdot q^{PVO} \cdot \partial p}{\partial q} \cdot \frac{\partial q}{\partial p} \), while for quantities: \( q^{PVO} = \frac{q^{2PT}}{1 - a \cdot \frac{\partial q}{\partial w}} \).
4.2.3 Bertrand with observable contracts

5 Endogenous Contact’s Decision

To endogenize the contract decision, we assume the special case of linear inverse demand function: \( p_i(q_i, q_j) = \alpha - q_i - \gamma \cdot q_j \), with \( a > 0 \) and \( 0 < \gamma < 1 \) the differentiation factor.

Lemma 7. Under Cournot competition in product market, linear inverse demand functions, and when vertical chains bargain over either secret or observable contracts:

- A dedicated upstream firm is indifferent between a two-part tariff contract or a backward partial vertical ownership.
- A common upstream firm always prefers a partial vertical ownership deal when bargain with a downstream firm.
- Downstream firms prefer a two-part tariff contract when bargain with a common upstream.

Under Bertrand competition in product market and linear inverse demand functions:

- When vertical chains bargain over observable contracts, a common upstream is in favor of a joint venture for: \( \beta > \beta_{\text{crit.}} = \frac{\gamma^4 - \gamma^3 + 2\gamma^2}{\gamma^3 - 2\gamma + 4} \), or Area I in Figure 2.
- When vertical chains bargain over observable contracts, a downstream firm is in favor of a joint venture for: \( \beta < \beta_{\text{crit.}} = \frac{\gamma^4 - \gamma^3 + 2\gamma^2}{\gamma^3 - 2\gamma + 4} \), or Area II in Figure 2.
- When vertical chains bargain over secret contracts, the same results as Cournot competition applies.
Lemma 7 summarizes the findings of the following Table 1. The decision to endog-
enize vertical contract types is not affected by product market competition when contract
terms are secret. On the contrary, when contract terms are observable, in Bertrand com-
petition, a common upstream supplier has incentives to use both contract types, under
different bargain power and product differentiation. Both the previous Lemma 7 and the
following Table 1 are based on straightforward comparisons, with some minor algebraic
manipulations, of the expressions cited in the Appendix. Formal proofs are available
upon request.

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<th>Bertrand Competition</th>
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Table 1: Equilibria of endogenous decision over PVO deals or 2PT contracts

In Table 1 we can check all these endogenous equilibria. When downstreams face
dedicated upstreams, then both are indifferent between a PVO deal or a TPT contract.
Things change with the existence of one common upstream monopolist. Is is useful to check that a policy maker (who maximizes consumer surplus) has the same endogenous equilibria as the downstream firms (nd not the same as the upstream).

In case of Bertrand competition in product market, and when one common upstream deals with observable vertical contract terms with downstreams, then the decision of equilibrium type of contract depends on the bargain power $\beta_{\text{crit.}}$ of the common upstream. common upstream with high bargain power is more likely to prefer a PVO deal, while a common upstream with lower bargain power is more likely to prefer TPT contract.

6 Conclusions

In this paper we show that the type of vertical contract plays a major role in the competition on the product market. When downstreams are supplied by exclusive dedicated upstreams, the use of non-linear two-part tariff contracts (TPT) is equivalent with the use of backward partial vertical ownership contracts (PVO). But, under one common upstream monopolist, TPT contracts are quite different compared to PVO contracts.

If we assume secret contract terms, then the famous result that wholesale price equals marginal cost is not valid, because under PVO wholesale price is above marginal cost. This is due to the ownership percentage the common upstream has to both the downstreams, so by lowering wholesale price he effectively lowers his profit shares expected to receive from PVO contract.

More than this, we show that under Bertrand competition in product market, and when vertical chains bargain over secret contract terms, the maximization of excess joint profits does not lead automatically to set wholesale price equal to marginal cost. We
have to add an extra assumption, and that is symmetry. Under asymmetric downstream firms (with different marginal costs), wholesale price does not equal marginal cost.
7 References


### Partial Vertical Ownership

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<tr>
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#### Cournot Competition

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### Bertrand Competition

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<td>$\gamma(\gamma + 2)(\alpha - c)^2$</td>
<td>$\gamma(\gamma + 2)(\alpha - c)^2$</td>
<td>$\gamma(\gamma + 2)(\alpha - c)^2$</td>
</tr>
<tr>
<td>$\nu_D$</td>
<td>$(\gamma^2 + 2\gamma - 2\gamma^2)(\alpha - c)^2$</td>
<td>$(\gamma^2 + 2\gamma - 2\gamma^2)(\alpha - c)^2$</td>
<td>$(\gamma^2 + 2\gamma - 2\gamma^2)(\alpha - c)^2$</td>
<td>$(\gamma^2 + 2\gamma - 2\gamma^2)(\alpha - c)^2$</td>
</tr>
<tr>
<td>$\nu_U$</td>
<td>$(\gamma + 2)(\alpha - c)^2$</td>
<td>$(\gamma + 2)(\alpha - c)^2$</td>
<td>$(\gamma + 2)(\alpha - c)^2$</td>
<td>$(\gamma + 2)(\alpha - c)^2$</td>
</tr>
</tbody>
</table>

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\[K(\beta, \gamma) = \gamma(\beta((\gamma - 3)\gamma + 2) + 4) + \gamma(-\gamma^2 + \gamma + 6) - 12) + 8\]