

2021-07

Working paper. Economics

ISSN 2340-5031

**ON THE PRO-COMPETITIVE EFFECTS OF
PASSIVE PARTIAL BACKWARD
OWNERSHIP**

**Maria Alipranti, Emmanuel Petrakis and
Panagiotis Skartados**

Serie disponible en

<http://hdl.handle.net/10016/11>

Web:

<http://economia.uc3m.es/>

Correo electrónico:

departamento.economia@eco.uc3m.es



Creative Commons Reconocimiento-NoComercial- SinObraDerivada 3.0
España
([CC BY-NC-ND 3.0 ES](https://creativecommons.org/licenses/by-nc-nd/3.0/es/))

On the pro-competitive effects of passive partial backward ownership

Maria Alipranti, Emmanuel Petrakis, Panagiotis Skartados *

September 2021

Abstract

We consider a vertically related market in which an upstream monopolist supplier trades, via interim observable two-part tariff contracts, with two differentiated goods' downstream Cournot competitors. We show that passive partial backward ownership (PPBO) may be pro-competitive and welfare enhancing. PPBO exacerbates the upstream's commitment problem and yields lower wholesale prices, and higher industry output, consumers surplus, and welfare than in the absence of PPBO.

Keywords: passive partial backward ownership; vertical relations; two-part tariffs; interim observable contracts.

JEL classification: D43; L13; L14

*Alipranti, M.: Department of Economics, University of Macedonia, e-mail: alipranti@uom.edu.gr. Petrakis, E.: Department of Economics, University of Crete and Departamento de Economia, Universidad Carlos III de Madrid, e-mail: petrakis@uoc.gr. Skartados, P.: Athens University of Economics and Business, e-mail:skartados@aueb.gr. Petrakis acknowledges financial support from "UC3M-Santander Chairs of Excellence."The usual disclaimer applies. Full responsibility for all shortcomings is ours.

1 Introduction

Partial backward ownership is a common phenomenon in vertically related markets.¹ These ownership structures have recently attracted a lot of attention from economists and antitrust authorities mainly due to their potential anti-competitive effects that include, among others, their ability to induce higher final market prices, entry deterrence, and market foreclosure (e.g., Hunold and Stahl, 2016; Hunold, 2020; Spiegel, 2013; Brito et. al, 2016; Levy et. al, 2018;). Yet, the effects of *non-controlling* or *passive* partial backward ownership (hereafter *PPBO*) on market outcomes and welfare are still controversial since they crucially depend on the specific characteristics and the structure of the vertically related market.²

We contribute to this ongoing debate by highlighting that, in a vertically related market in which an upstream monopolist supplies an essential input to differentiated goods' Cournot duopolists via interim observable non-linear contracts, PPBO may be pro-competitive and welfare-enhancing. We also point out that in such markets, input foreclosure may arise only under stringent conditions. In addition, we indicate that the market and welfare effects of PPBO may crucially depend on the specific features of the industry, such as the type of the contract used in vertical trading, the disclosure regime of the contract terms, and the mode of downstream competition.

The effects of PPBO on welfare and market outcomes are controversial. Flath (1989) shows that in a vertically related Cournot oligopoly with trading at arms' length and constant elasticity demand, PPBO does not affect industry output and consumer surplus. Greenlee and Raskovich (2006) confirm this result in a market with an upstream monopolist, symmetric downstream firms, and uniform input pricing. In the same vein, Brito et. al (2016) shows that the market outcomes remain invariant in an industry where two downstream firms and an independent shareholder own a share of the upstream monopolist. These results imply that PPBO can act as a partial rebate of the upstream margin. In particular, PPBO can increase input demand, and thus the upstream monopolist, anticipating this increase in demand, will increase the wholesale prices charged to the downstream firms so that the

¹Partial backward ownership is common in many vertically related industries, like cable television, computer, and banking sectors. A prominent example is BSkyB, a leading TV broadcaster in the UK that in 2006 acquired a 17.9% share in ITV, the larger TV content producer in the UK (Levy et al., 2018). Another example is the Scandinavian banking group Nordea that has a lower than 10% stake in Bankgirot, a provider of payment system services to banks (Greenlee and Raskovich, 2006).

²Partial backward ownership agreements are classified as *controlling* or *non-controlling* with regards to the control that a downstream firm exerts on its upstream supplier. We focus exclusively on *passive* or *non-controlling* partial backward ownership (PPBO), where the downstream firm owns a stake less than 50% in its upstream supplier and has no direct control over the upstream decisions. In *active* or *controlling* partial backward ownership, the downstream firm has stakes often exceeding 50% and, more importantly, has direct control over the upstream decisions. For the latter's competitive effects see e.g., Baumol and Ordover, 1994, Brito et. al, 2016, Levy et.al. 2018.

downstream firms' output decisions remain intact.

In contrast, Hunold and Stahl (2016) highlight the anticompetitive effects of PPBO in a market in which both upstream and downstream firms compete in prices. In this case, PPBO leads to higher downstream prices and lower consumer surplus as the downstream firms internalize each other's demand via the margin of input sales. The authors also mention that input foreclosure may arise under asymmetric ownership structures. Spiegel (2013) shows that PPBO may lead to input foreclosure in a market in which downstream firms undertake quality enhancement investments. Goncalves (2014) points out that allowing for input price discrimination in the Greenlee and Raskovich (2006) model, leads often to downstream foreclosure, higher retail prices, and lower social welfare. Brito et. al (2016) point out that PPBO may lead to input foreclosure when ownership shares are too different. In a related vein, Hunold (2020) shows that entry deterrence can occur when downstream incumbents own non-controlling shares in an upstream supplier that does not price-discriminate among its downstream partners.

We demonstrate that the invariant or anticompetitive effects of PPBO in the existing literature are model-specific. In particular, they do not hold in a vertically related market with an upstream monopolist trading with differentiated goods' Cournot downstream competitors via interim observable two-part tariffs contracts. In such markets, PPBO exacerbates the existing upstream monopolist's commitment problem, and yields more competitive outcomes with higher industry output, consumer surplus and social welfare.

Intuitively, PPBO makes the downstream firm that has stakes on the upstream supplier less aggressive in the final market since it essentially bears part of the upstream supplier's marginal cost. The upstream monopolist optimally responds to this by offering a lower wholesale price to the latter to restore its competitiveness in the final market. Further, since the upstream monopolist is subject to the well-known commitment problem, is "forced" to offer a lower wholesale price to the rival downstream firm too. As a consequence, in the presence of PPBO, the upstream monopolist faces a more severe commitment problem that translates into lower input prices for the downstream firms and thus into higher industry output, consumer surplus, and social welfare.³

We also demonstrate that input foreclosure may arise in equilibrium but only if the final goods are close substitutes, and more importantly, the upstream monopolist disposes of a commitment mechanism, such as to sign legally binding exclusive contracts. If the latter condition fails to hold, the upstream monopolist, suffering from its commitment problem,

³In a different setting with upstream bottleneck in which input price is, however, *uniform* and *exogenous*, Höffler and Kranz (2011) find that PPBO can yield higher industry output and consumers surplus than under full separation (or full integration).

will sell the input to both downstream competitors.

There is also an emerging literature that examines the effects of PPBO in various economic settings. Shekhar and Thomes (2020) examine the collusive effects of PPBO and show that it may impede downstream collusion. Hunold and Shekhar (2018) focus on how PPBO affects the incentives of downstream firms to foster supply chain innovations that increase the supplier’s efficiency. We focus instead on the competitive and welfare effects of PPBO in a two-stage game setting in which the supplier makes take-it or leave-it two-part tariff offers to the downstream firms before the latter make their output decisions.

The remainder of the paper is structured as follows. In section 2 we introduce our basic model and its timing. In section 3 we perform our equilibrium analysis. In section 4 we state our main results. In section 5 we examine firms’ foreclosure incentives. In section 6 we extend our basic model and check the robustness of our results. In section 7 we conclude. All proofs are relegated into the Appendix.

2 The Model

We consider a two-tier industry with an upstream monopolist, U , and two downstream firms, $D_i, i = 1, 2$ that produce (horizontally) differentiated final goods, using, in a “1-to-1” proportion an essential input obtained by U . Each D_i faces an inverse demand function $p_i(q_i, q_j) = a - q_i - \gamma q_j$, $i \neq j$, where p_i and q_i are D_i ’s price and quantity and $\gamma \in (0, 1)$ is the degree of product substitutability (Singh and Vives, 1984). The higher γ , the closer substitutes the final goods are.

U produces the input at a constant marginal cost $c \in (0, a)$, and sells it to each D_i via a two-part tariff contract, consisting of a per unit of input price w_i and a fixed fee f_i . D_i ’s face no other costs than the cost of obtaining the input from U .⁴

D_1 owns an *exogenous* minority share $k \in (0, \frac{1}{2}]$ of U ’s profits and has no control over U ’s pricing decisions (passive partial backward ownership, *PPBO*).⁵ Under this ownership structure, it follows that U ’s, D_1 ’s and D_2 ’s gross (from fixed fees) profits are:

$$\pi_U(q_1, q_2) = (1 - k) \sum_{i=1}^2 (w_i - c)q_i$$

⁴Assuming zero marginal production costs for the downstream sector is without loss of generality.

⁵In other words, D_1 has a *silent financial interest* on U . Even though a $k > \frac{1}{2}$ implies control of D_1 over U , the opposite is not necessarily true. Competition authorities often inspect non-controlling minority shareholdings between 15% and 25% (Salop and O’Brien, 2000). Further, to abstract from free-rider problems among small shareholders á la Grossman and Hart (1980), we assume that each firm is owned by a single shareholder.

$$\begin{aligned}\pi_{D_1}(q_1, q_2) &= (p_1(q_1, q_2) - w_1)q_1 + k \sum_{i=1}^2 (w_i - c)q_i \\ \pi_{D_2}(q_1, q_2) &= (p_2(q_1, q_2) - w_2)q_2\end{aligned}\tag{1}$$

By inspecting $\pi_{D_1}(q_1, q_2)$, we infer that D_1 's "effective" marginal cost is $(1 - k)w_1 + kc$. So, D_1 bears a part k of U 's marginal cost c . Firms' net profits are: $\Pi_U = \pi_U(q_1, q_2) + (1 - k)(f_1 + f_2)$, $\Pi_{D_1} = \pi_{D_1}(q_1, q_2) - (1 - k)f_1 + kf_2$ and $\Pi_{D_2} = \pi_{D_2}(q_1, q_2) - f_2$, respectively.

The timing of the game is as follows. In *stage 1*, U makes a take-it-or-leave-it offer to each D_i over its two-part tariff terms (w_i, f_i) . In *stage 2*, downstream firms compete in quantities after observing each other's contract terms.⁶

Note that U makes its contract term offers to D_i s simultaneously and separately. This could be captured simply by assuming that U has two representatives, each dealing with a different downstream firm.⁷ It is known that in such settings multiple equilibria may arise. This is due to the multiplicity of beliefs that downstream firms can form when they receive out-of-equilibrium offers. Following Horn and Wolinsky (1988) and Milliou and Petrakis (2007), we obtain a unique equilibrium by imposing *pairwise proofness* on the equilibrium contracts. That is, we require that a contract signed between U and D_i is immune to a bilateral deviation of U and D_j , holding the contract with D_i constant.

To guarantee that all firms are active in the market under all circumstances, we make the following assumption:

Assumption 1: $k \leq k(\gamma) = \min\left[\frac{1}{2}, \frac{2(2-\gamma^2)[32(1-\gamma)-16\gamma^2+8\gamma^3+8\gamma^4-\gamma^6-\gamma^3\sqrt{16(1-\gamma)+2\gamma^4}]}{128(1-\gamma)-96\gamma^2+64\gamma^3+56\gamma^4-8\gamma^5-16\gamma^6+\gamma^8}\right]$

Note that $k(\gamma)$ is (weakly) decreasing in γ , it is positive for all $\gamma < 0.8812$ and equals $\frac{1}{2}$ for all $\gamma \leq 0.7888$.

3 Equilibrium Analysis

In the last stage, each D_i chooses q_i to maximize gross profits. The resulting reaction functions are:

$$\begin{aligned}R_1(q_2) &= \frac{1}{2}(a - \gamma q_2 - w_1 + k(w_1 - c)) \\ R_2(q_1) &= \frac{1}{2}(a - \gamma q_1 - w_2)\end{aligned}\tag{2}$$

Notice that a reduction in the wholesale price charged to D_i shifts out its reaction function

⁶According to Rey and Vergé (2004)'s terminology, we assume that contracts are interim observable. A similar assumption can be found in, e.g., Horn and Wolinsky (1988), or Milliou and Petrakis (2007).

⁷This is a standard assumption in situations of multilateral contracting (see e.g., Cremer and Riordan, (1987), or O'Brien and Shaffer, (1992)).

and turns it to a more aggressive downstream competitor. If $w_1 > c$ ($w_1 < c$) an increase in k shifts R_1 outwards (inwards), making D_1 more (less) aggressive in the final market. Moreover, R_2 is independent of k .

Solving the system of reaction functions (2), we obtain the quantities in terms of wholesale prices:

$$\begin{aligned} q_1(w_1, w_2) &= \frac{a(2 - \gamma) + 2k(w_1 - c) - 2w_1 + \gamma w_2}{4 - \gamma^2} \\ q_2(w_1, w_2) &= \frac{a(2 - \gamma) - \gamma k(w_1 - c) - 2w_2 + \gamma w_1}{4 - \gamma^2} \end{aligned} \quad (3)$$

Note that $q_1(\cdot)$ increases, while $q_2(\cdot)$ decreases, with k if and only if $w_1 > c$. This is an immediate consequence of our discussion above. By substituting (3) into (1) we get: $\pi_U(w_1, w_2)$ and $\pi_{D_i}(w_1, w_2)$, $i = 1, 2$.

Next, we turn to determine the equilibrium contract terms. In stage 1, U chooses the contract terms (w_i, f_i) to offer to D_i , taking as given the contract terms offered to D_j , (w_j, f_j) . Thus, U solves the following maximization problems: $\max_{w_i} \Pi_U(w_1, w_2)$ subject to $\Pi_{D_i}(w_1, w_2) \geq O_{D_i}$, $i = 1, 2$, where O_{D_i} is D_i 's outside option. O_{D_2} is nil because in case of disagreement with U , D_2 neither produces nor has any external rents. But, in case of disagreement with U , D_1 still enjoys a share k of U 's net profits, $O_{D_1} = k(w_2 - c)q^m(w_2) + kf_2$, with $q^m(w_2) = \frac{1}{2}(a - w_2)$ being the output of a monopolist D_2 that faces a wholesale price w_2 . Note that, as U possesses two instruments, w_i and f_i , it chooses w_i to maximize its profits subject to the participation constraint of D_i , and f_i to extract all D_i 's excess profits (O'Brien and Shaffer, 1992).⁸ The resulting equilibrium wholesale prices are:

$$\begin{aligned} w_1^B &= c - \frac{(a - c)\gamma^2}{4 - \gamma^2(2 - k) - 4k} \\ w_2^B &= c - \frac{(a - c)\gamma^2(4 - (2 - k)\gamma^2 - 4k + 2\gamma k)}{2(2 - \gamma^2)(4 - \gamma^2(2 - k) - 4k)} \end{aligned} \quad (4)$$

Notice that the equilibrium wholesale prices are below U 's marginal cost, i.e., $w_i^B < c$. That is, U subsidizes downstream production. This is due to the well-known commitment problem that U faces when contracts are not fully observable (see, e.g, McAfee and Schwartz, 1995; Rey and Vergé, 2004; de Fontenay and Gans, 2005). In particular, when U makes an offer (w_i, f_i) to D_i that is accepted, it has incentives to offer a lower wholesale price w_j to make D_j a more aggressive competitor in the final market. Due to strategic substitutability of outputs, this decreases D_i 's output resulting in higher gross profits for D_j . Then U

⁸It is easy to verify that in our setup, w_1 is chosen to maximize (U, D_1) 's joint gross profits; while w_2 is chosen to maximize a weighted average of U 's and D_2 's gross profits in which the latter's profits count $1 - k$.

can more than offset its losses from the lower w_j by charging a higher fixed fee f_j to D_j . Downstream firms, being fully aware of U 's incentives to behave opportunistically, will never agree to pay a wholesale price that exceeds U 's marginal cost.

Notably, U offers a larger subsidization to D_1 than to D_2 , i.e., $w_1^B < w_2^B < c$. As mentioned above, D_1 essentially bears a share of U 's marginal cost, kc , which makes it a less efficient competitor in the final market. Anticipating that, U has incentives to subsidize D_1 even more by charging a lower wholesale price to outweigh the effect of D_1 's higher effective marginal cost and restore its competitiveness in the final market.

Moreover, it is easy to verify that $\frac{\partial w_i^B}{\partial k} < 0, i = 1, 2$. Hence U 's downstream subsidization increases with k . Clearly, the higher the share D_1 owns in U , the lower is the wholesale price that U offers to D_1 to ameliorate the effect of D_1 's higher effective marginal cost and ensure that D_1 competes effectively in the final market. U 's subsidization of D_2 is also increasing in k . This is because U , by offering a lower wholesale price to D_1 , makes D_1 more aggressive, intensifying final market competition. Then U , being subject to its commitment problem, is "forced" to offer a lower wholesale price to D_2 too. Substituting (4) into (3) we get the equilibrium outputs:

$$\begin{aligned} q_1^B &= \frac{(a-c)(2-\gamma)}{2(2-\gamma^2)} \\ q_2^B &= \frac{(a-c)[2(2-\gamma) - 2\gamma^2 + \gamma^3 - k(4-2\gamma-\gamma^2)]}{(2-\gamma^2)(4-\gamma^2(2-k) - 4k)} \end{aligned} \quad (5)$$

Note that q_1^B is independent of k , while q_2^B is increasing in k .

Finally, by setting $(1-k)f_1^B = \pi_{D_1}(w_1^B, w_2^B) - O_{D_1}(w_2^B)$ and $f_2^B = \pi_{D_2}(w_1^B, w_2^B)$, we get the equilibrium net upstream and downstream profits. The expressions for $\Pi_{D_1}^B$ and Π_U^B are too long to be reported here and are delegated to the Appendix. Obviously, $\Pi_{D_2}^B = 0$.

4 Competitive effects of PPBO

We turn now to explore the effects of PPBO on market outcomes and welfare. To do so, we compare the equilibrium outcome of a two-tier industry with passive partial backward ownership with the respective outcome in the benchmark case with no partial ownership. It is easy to see that the latter is obtained by simply setting $k = 0$ in the equilibrium expressions derived above. In particular, the equilibrium outcome of the benchmark case is:

$$w_1^N = w_2^N = c - \frac{(a-c)\gamma^2}{2(2-\gamma^2)}; \quad q_1^N = q_2^N = \frac{(a-c)(2-\gamma)}{2(2-\gamma^2)}$$

$$\Pi_{D_1}^N = \Pi_{D_2}^N = 0; \quad \Pi_U^N = \frac{(a-c)^2(1-\gamma)(4-\gamma^2)}{2(2-\gamma^2)^2}$$

The following Lemma compares the equilibrium outcomes in the presence and absence of PPBO.

Lemma 1. *i) The equilibrium wholesale prices satisfy: $w_1^N = w_2^N > w_2^B > w_1^B$*

ii) The equilibrium outputs and the industry output satisfy: $q_1^N = q_2^N = q_1^B < q_2^B$ and $Q^B > Q^N$

iii) The equilibrium upstream and downstream profits satisfy: $\Pi_U^N > \Pi_U^B$, $\Pi_{D_1}^B > \Pi_{D_1}^N$ and $\Pi_{D_1}^B = \Pi_{D_1}^N = 0$.

Lemma (1.i) informs us that both downstream firms obtain the input at a lower wholesale price in a market with PPBO. This finding implies that the upstream monopolist faces a more severe commitment problem in the presence than in the absence of PPBO, and as a consequence, it offers larger subsidization to its downstream partners in the former case.

Lemma (1.ii) informs us that D_1 produces the same amount of output regardless of whether it holds or not a share on its upstream supplier. Intuitively, U anticipating that D_1 faces now a larger effective marginal cost it charges D_1 a lower wholesale price so that to neutralize the effect of PPBO on D_1 's effective marginal cost. As a consequence, D_1 's output decision does not depend on k . However, U 's more severe commitment problem under PPBO benefits D_2 that now faces a lower wholesale price and produces, thus, higher output in the final market. An immediate consequence is that industry output is higher in the presence than in the absence of PPBO; or else, that a market characterized by PPBO is more competitive than a market without PPBO.

Finally, it is not surprising that, as Lemma (1.iii) informs us, the upstream monopolist attains higher net profits in the absence than in the presence of PPBO. This is because, as explained above, the upstream monopolist suffers less from its commitment problem in a market without PPBO. On the other hand, D_1 is better off when it has stakes on U .

Next, we explore whether the presence of PPBO is preferable from both the consumers' and the society's viewpoint. Consumer surplus in our setup is given by $CS = \frac{1}{2}(q_1^2 + q_2^2 + 2\gamma q_1 q_2)$, while social welfare is $TW = CS + \Pi_U + \Pi_{D_1} + \Pi_{D_2}$. The following Proposition summarizes:

Proposition 1. *Consumers surplus and social welfare are higher in the presence of PPBO.*

Notably, in contrast to the bulk of the literature that highlights the potential anticompetitive effects of PPBO, we show that a market with PPBO is preferable to a market without PPBO, in the sense that both consumer surplus and social welfare are higher in the presence

of PPBO. Consumers are better off in the presence of PPBO since the industry output is higher than in its absence (Lemma 1.ii).

Further, social welfare is higher in the presence than in the absence of PPBO. This is because the higher consumer surplus plus the positive profits of the downstream firm that has silent financial interests on U outweigh the lower upstream profits under PPBO.

In sum, we show that in a two-tier industry with an upstream monopoly supplier and interim observable two-part tariff contracts, PPBO can be pro-competitive and socially desirable.

5 Foreclosure Incentives

A natural question that arises in our setup is whether the upstream monopolist supplier has incentives to foreclose one of the downstream competitors. This is based on the well-known antitrust concerns that PPBO may exacerbate vertical foreclosure.

Assume for the moment that the upstream monopolist can commit to foreclose D_i . This could be materialized by offering a *legally binding* exclusive contract to D_j , creating a bilateral monopoly. As we will see below, the distribution of profits crucially depends on whether U forecloses D_1 or D_2 .

Suppose that U forecloses D_1 . U chooses w_2 to maximize $\pi_U + \pi_{D_2}$, resulting to marginal cost pricing $w_2^{F_1} = c$. It then uses $f_2^{F_1}$ to transfer all downstream profits upstream. The equilibrium outcome is: $q_2^{F_1} = \frac{a-c}{2}$, $\Pi_{D_2}^{F_1} = 0$, $\Pi_U^{F_1} = \frac{(1-k)(a-c)^2}{4}$ and $\Pi_{D_1}^{F_1} = \frac{k(a-c)^2}{4}$. The latter two expressions stem from the fact that D_1 has still silent financial interests on U 's net profits.

Suppose next that U forecloses D_2 . U chooses w_1 to maximize $\pi_U + \pi_{D_1}$. Hence $w_1^{F_2} = c$, $q_1^{F_2} = \frac{a-c}{2}$ and $\pi_{D_1}^{F_2} = \frac{(a-c)^2}{4}$. As D_1 has now a zero outside option, U sets $(1-k)f_1^{F_2} = \pi_{D_1}^{F_2}$ to transfer downstream profits upstream. As a result, $\Pi_U^{F_2} = \frac{(a-c)^2}{4}$ and $\Pi_{D_1}^{F_2} = 0$. Even though D_1 has a silent financial interest on U , it will make zero net profits in equilibrium. Intuitively, U can set $f_1^{F_2}$ in such a way that nullifies the effect of PPBO on its net profits. An immediate consequence is that D_1 will never accept an exclusive contract offered by U , because its net profits will be higher in both the case in which U offers an exclusive contract to D_2 and the case in which U sells input to both downstream firms. Therefore, U foreclosing D_2 will never arise in equilibrium.

On the other hand, U foreclosing D_1 will arise in equilibrium but only if $\Pi_U^{F_1} > \Pi_U^B$. It is easy to verify that the latter inequality holds for all $k < k_F(\gamma)$, with $\frac{dk_F}{d\gamma} > 0$, $k_F(\gamma)$ positive for all $\gamma < 0.654$, and equal to $\frac{1}{2}$ for all $\gamma \leq 0.802$.⁹ Together with Assumption 1,

⁹The expression for $k_F(\gamma)$ is too long to report it here. It is available from the authors upon request.

this implies that there is a “small” area of parameters where U has incentives to foreclose D_1 . In particular, foreclosure occurs only if $k < 0.47$ and $\gamma_1(k) < \gamma < \gamma_2(k)$, with $\frac{d\gamma_1}{dk} > 0$, $\frac{d\gamma_2}{dk} < 0$, $\gamma_1(0) = 0.654$, $\gamma_2(0) = 0.882$, and $\gamma_1(0.47) = \gamma_2(0.47) = 0.798$. In other words, U has incentives to foreclose D_1 only when the final products are not too differentiated and PPBO is not too high.

Nevertheless, if U does not dispose of a commitment mechanism, e.g. the exclusive contract offered to D_2 is not legally binding, D_2 will not consent to it. After signing a contract with D_2 in which $w_2^F = c$ and $f_2^F = \frac{(a-c)^2}{4}$, U has incentives to offer a contract with a lower wholesale price to D_1 . It will make D_1 an aggressive competitor in the final market, increasing its gross profits. U will then transfer upstream part of D_1 's gross profits such that D_1 has incentive to accept the contract. D_2 , being aware of U 's opportunistic behavior, will never consent to a contract with a high wholesale price and a high fixed fee. Therefore, in equilibrium U will sell to both downstream firms and the equilibrium outcome will be as in our main model.

6 Extensions

We consider a few extensions to examine the robustness of our main results.¹⁰

Secret contracts: Consider next that contracts are secret, instead of interim observable as in our main model. In line with the received literature, we show that market outcomes and welfare remain invariant in the presence of PPBO. This result is driven by the fact that under secret contracts, U supplies D_i s at $w_i^B = c$. Since PPBO does not offer any benefit to D_i s, their output remains invariant to k .

Linear tariffs: Consider now the case in which U trades with D_i s via linear wholesale price contracts, instead of two-part tariffs. Assuming that contracts are interim observable, we find that equilibrium wholesale prices are above upstream marginal cost and, more importantly, that are increasing in k . As a result, PPBO decreases industry output and consumer surplus. Social welfare is also lower in the presence than in the absence of PPBO. Thus, under quantity competition and linear contracts, PPBO is anticompetitive and welfare-decreasing.

Bertrand competition: Finally, consider the case of price, instead of quantity competition, in the final market. Assuming interim observable two-part tariff contracts, we find that $w_i^B > c$, $i = 1, 2$; moreover, that w_i^B increases with k . Again, PPBO decreases industry output, consumer surplus and social welfare. Thus, under downstream price competition, PPBO is both anticompetitive and welfare-decreasing.

¹⁰A detailed analysis is available by the authors upon request.

7 Conclusion

We study the market and welfare effects of non-controlling partial backward ownership (PPBO) in an industry with an upstream monopolist supplier selling an essential input to two downstream Cournot competitors that produce horizontally differentiated goods. We have shown that under interim observable two-part tariff contracts, PPBO may be pro-competitive and welfare-enhancing. This is in contrast with the bulk of the existing literature that classifies PPBO either as neutral for market outcomes and welfare or anti-competitive and welfare-reducing. Under PPBO, the upstream monopolist faces a more severe commitment problem and offers lower wholesale prices to downstream firms, making thus downstream competition more intense and increasing industry output, consumer surplus and social welfare.

Our findings are not necessarily robust to alternative assumptions regarding the vertical contracting framework (e.g., contract type, observability of contract terms) or the mode of downstream competition. This suggests that the competitive effects of PPBO can depend crucially on the specific features of the vertically related markets. As a suggestion for further research, it would be nice to back our theoretical results with empirical data.

Appendix

Equilibrium Fixed Fees and Net Profits:

$$\begin{aligned}
 f_1 &= \frac{[4(2-\gamma)^2(2-\gamma^2)-2k(16-16\gamma+\gamma^4+2\gamma^5-\gamma^6)-\gamma^3k^2(8-8\gamma+\gamma^3)](a-c)^2}{8(1-k)(2-\gamma^2)^2(4-\gamma^2(2-k)-4k)} \\
 f_2 &= \frac{[2(2-\gamma)-2\gamma^2+\gamma^3-k(4-2\gamma-\gamma^2)]^2(a-c)^2}{(2-\gamma^2)^2(4-\gamma^2(2-k)-4k)^2} \\
 \Pi_{D_1}^B &= \frac{[4(2-\gamma^2)^2(8-8\gamma-2\gamma^2+\gamma^3)-4k(2-\gamma^2)(32(1-\gamma)-16\gamma^2+8\gamma^3+8\gamma^4-\gamma^6)]+}{8(2-\gamma^2)^2(4-\gamma^2(2-k)-4k)^2} \\
 &\quad +k^2(128(1-\gamma)-96\gamma^2+64\gamma^3+56\gamma^4-8\gamma^5-16\gamma^6+\gamma^8)]k(a-c)^2 \\
 \Pi_U^B &= \frac{[16(2-\gamma^2)^2(4(1-\gamma)-\gamma^2+\gamma^3)-4k(2-\gamma^2)(80(1-\gamma)-44\gamma^2+40\gamma^3+10\gamma^4-4\gamma^5-\gamma^6)]}{8(2-\gamma^2)^2(4-\gamma^2(2-k)-4k)^2} \\
 &\quad +2k^2(256(1-\gamma)-224\gamma^2+192\gamma^3+96\gamma^4-40\gamma^5-25\gamma^6+2\gamma^7+2\gamma^8) \\
 &\quad -k^3(128(1-\gamma)-96\gamma^2+64\gamma^3+56\gamma^4-8\gamma^5-16\gamma^6+\gamma^8)](a-c)^2
 \end{aligned}$$

Proof of Lemma 1: *i)* As w_i^B is continuous in $k \in [0, 1/2]$, $\frac{\partial w_1^B}{\partial k} = -\frac{\gamma^2(4-\gamma^2)(a-c)}{(4-\gamma^2(2-k)-4k)^2} < 0$, and $\frac{\partial w_2^B}{\partial k} = -\frac{2\gamma^3(a-c)}{(4-\gamma^2(2-k)-4k)^2} < 0$, $w_i^B < w_i^N$, $i = 1, 2$. Moreover, $\frac{w_2^B - c}{w_1^B - c} = \frac{(4-(2-k)\gamma^2-4k+2\gamma k)}{2(2-\gamma^2)} < 1$ for all k, γ ; hence, $w_1^B < w_2^B$.

ii) Since q_1^B is independent of k , $q_1^N = q_2^N = q_1^B$. As q_2^B is continuous in $k \in [0, 1/2]$ and $\frac{\partial q_2^B}{\partial k} = \frac{\gamma^3(a-c)}{(4-\gamma^2(2-k)-4k)^2} > 0$, $q_2^B > q_2^N$. As a consequence, $Q^B > Q^N$.

iii) It can readily be verified that $\frac{\Pi_U^B}{\Pi_U^N} < 1$ and $\frac{\Pi_{D_1}^B}{\Pi_{D_1}^N} > 1$ for all permissible k and γ .

Proof of Proposition 1: From Lemma 1(ii) we know that $q_1^N = q_2^N = q_1^B < q_2^B$. As a consequence, $CS^B > CS^N$.

Total welfare in the absence of PPBO is $TW^N = CS^N + \Pi_U^N = \frac{(2-\gamma)^2(1+\gamma)(a-c)^2}{2(2-\gamma^2)^2} + \frac{(1-\gamma)(4-\gamma^2)(a-c)^2}{2(2-\gamma^2)^2} = \frac{(2-\gamma)(a-c)^2}{2-\gamma^2}$; while in the presence of PPBO is $TW^B = CS^B + \Pi_U^B + \Pi_{D_1}^B = \frac{[4(4-2\gamma-2\gamma^2+\gamma^3)-k(16-8\gamma-4\gamma^2+\gamma^3)](a-c)^2}{2(2-\gamma^2)(4-\gamma^2(2-k)-4k)}$. It can readily be verified that $TW^B > TW^N$ for all permissible k and γ .

References

- [1] Baumol, W. J., and Ordover, J. A. 1994. On the perils of vertical control by a partial owner of a downstream enterprise. *Revue d'économie industrielle* 69, 7-20.
- [2] Brito, D., Cabral, L., and Vasconcelos, H., 2016. Competitive Effects of Partial Control in an Input Supplier. *CEPR Discussion Paper* No. DP11397.
- [3] Cremer, J., and Riordan, M., 1987. On governing multilateral transactions with bilateral contracts. *Rand Journal of Economics* 18, 436-451.
- [4] de Fontenay, C. C., and Gans, J. S., 2005. Vertical ownership in the presence of upstream competition. *Rand Journal of Economics* 36, 544-572.
- [5] Flath, D., 1989. Vertical ownership by means of Shareholding Interlocks. *International Journal of Industrial Organization* 7, 369-380.
- [6] Gal-Or, E., 1991. Duopolistic vertical restraints. *European Economic Review* 34, 1237-1253.
- [7] Goncalves, R., 2014. Backward partial vertical integration through private placement. Working Paper. http://www3.eeg.uminho.pt/economia/nipe/PEJ2014/index_ficheiros/Page423.htm
- [8] Greenlee, P., and Raskovich, A., 2006. Partial Vertical Ownership. *European Economic Review* 50, 1017-1041.
- [9] Grossman, S., and Hart, D., 1980. Takeover bids, the free-rider problem, and the theory of the corporation. *Bell Journal of Economics* 11, 42-64.
- [10] Hart, O., and Tirole, J., 1990. Vertical ownership and market foreclosure. *Brookings papers on economic activity: Microeconomics*, 205-276.
- [11] Höffler, F., and Kranz, S., 2011. Legal unbundling can be a golden mean between vertical integration and ownership separation. *International Journal of Industrial Organization* 29, 576-588.
- [12] Horn, H., and Wolinsky, A., 1988. Bilateral monopolies and incentives for merger. *Rand Journal of Economics* 19, 408-419.
- [13] Hunold, M., 2020. Non-discriminatory pricing, partial backward ownership, and entry deterrence. *International Journal of Industrial Organization* 70.

- [14] Hunold, M., and Shekhar, S., 2018. Supply Chain Innovations and Partial Ownership. *DICE Discussion Paper* No. 281.
- [15] Hunold, M., and Stahl, K., 2016. Passive vertical ownership and strategic delegation. *Rand Journal of Economics* 47, 891-913.
- [16] Levy, N., Spiegel, Y., and Gilo, D., 2018. Partial vertical ownership, ownership structure, and foreclosure. *American Economic Journal: Microeconomics* 10, 132-180.
- [17] McAfee, P., and Schwartz, M., 1994. Opportunism in multilateral vertical contracting: nondiscrimination, exclusivity, and uniformity. *American Economic Review* 84, 210-230.
- [18] McAfee, P., and Schwartz, M., 1995. The non-existence of pairwise-proof equilibrium. *Economics Letters* 49, 251-259.
- [19] Milliou, C., and Petrakis, E., 2007. Upstream horizontal mergers, vertical contracts, and bargaining. *International Journal of Industrial Organization* 25, 963-987.
- [20] O'Brien, D. P., and Shaffer, G., 1992. Vertical control with bilateral contracts. *Rand Journal of Economics* 23, 299-308.
- [21] Rey, P., and Vergé, T., 2004. Bilateral control with vertical Contracts. *Rand Journal of Economics* 35, 728-746.
- [22] Salop, S. C., and O'Brien, D. P., 2000. Competitive Effects of Partial Ownership: Financial Interest and Corporate Control. *Antitrust Law Journal* 67, 559-614.
- [23] Shekhar, S., and Thomes, T., 2020. Passive backward acquisitions and downstream collusion. *Economics Letters* 197.
- [24] Singh, N., and Vives, X., 1984. Price and quantity competition in a differentiated duopoly. *Rand Journal of Economics* 15, 546-554.
- [25] Spiegel, Y., 2013. Backward ownership, forward ownership, and vertical foreclosure. *CEPR Discussion Paper* No. DP9617.