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Price vs. Quantity Competition in a Vertically Related Market

Maria Alipranti Chrysovalantou Milliou Emmanuel Petrakis*

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Abstract

This paper demonstrates that the standard conclusions regarding the comparison of Cournot and Bertrand competition are reversed in a vertically related market with upstream monopoly and trading via two-part tariffs. In such a market, downstream Cournot competition yields higher output, lower wholesale prices, lower final prices, higher consumers' surplus, and higher total welfare than Bertrand competition.

Keywords: Cournot; Bertrand; vertical relations; two-part tariffs
JEL classification: D43; L13; L14

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1 Introduction

The vast majority of products reach the hands of the consumers after going through the various stages of the so-called vertical production chain. Clearly, this implies that a firm which operates in one stage of the vertical chain needs to trade with firms that are active at previous and/or later production stages. According to a number of empirical studies (see e.g., Berto Villa-Boas, 2007; Bonnet and Dubois, 2010), a common way of trading among vertically related firms, i.e., among input producers, final product manufacturers, and retailers, is through non-linear two-part tariff contracts. This paper compares Cournot and Bertrand competition in a vertically related market in which an upstream monopolist trades with two competing downstream firms through two-part tariffs.

A well-known result in oligopoly theory is that a one-tier market is more competitive and efficient when it is characterized by Bertrand competition rather than by Cournot competition. In particular, Bertrand competition results into lower prices and profits and higher output and consumer and total welfare than Cournot competition. Singh and Vives (1984) were the first to establish formally these results. A substantial body of the literature (see e.g., Cheng 1985; Vives, 1985; Okuguchi, 1987; Dastidar, 1997; Lambertini, 1997; Häckner, 2000, Amir and Jin, 2001) has been developed thereafter extending the Singh and Vives results. For instance, Cheng (1985) and Vives (1985) generalized these results respectively by means of a geographic approach and by considering the n-firm oligopoly case with general demand functions. Dastidar (1997) and Häckner (2000), instead, pointed out the sensitivity of the results in Singh and Vives to the sharing rules governing oligopoly and to the type of product differentiation.[1]

We demonstrate that the standard conclusions about price and quantity competition can be altered in the context of a vertically related market. In particular, we show that downstream Cournot competition yields more competitive market outcomes than downstream Bertrand competition- it yields higher output and lower prices. The reversal from the standard results is driven by the fact that the upstream monopolist has stronger incentives to increase the aggressiveness of the downstream firms when they compete in quantities than when they compete in prices. Because of this, its incentives to behave opportunistically are more pronounced in the former case. The latter leads, in turn, to lower wholesale prices under Cournot competition that translate into lower marginal costs for the downstream firms, and thus, into higher output and lower prices. Despite the fact that downstream competition is fiercer when it takes place in quantities, still the downstream firms are better off than than when they compete in prices. This reveals that the effect of the lower input prices, and thus, of the higher efficiency, dominates the effect of the increased competition intensity.

[1] Another branch of the literature has addressed the Cournot-Bertrand comparison in the presence of investments in R&D (see e.g., Delbono and Denicolo, 1990; Qiu, 1997).

Interestingly, in light of the above results, and in contrast to conventional wisdom, we find that Cournot competition is preferable to Bertrand competition from both the consumers' and the total welfare point of view.

Our analysis extends the above-mentioned extensive literature that compares Cournot and Bertrand outcomes in standard one-tier oligopoly markets by considering a vertically related setting. As such our analysis also complements the literature on contracting in vertically related markets (e.g., O'Brien and Shaffer, 1992; McAfee and Schwartz, 1994 and 1995; Rey and Vergé, 2004) by analyzing the role of the mode of downstream competition.

Correa-López and Naylor (2004), Correa-López (2007), Arya et al. (2008), Mukherjee et al. (2012), Manasakis and Vlassis (2013), and Chirco-Scrimitore (2013) have also addressed the Cournot-Bertrand debate in the context of a vertically related market. Most of their results are in line with the results of Singh and Vives (1984), and thus, they are different from ours.[2] This occurs mainly because all of these papers, in contrast to ours, share a common feature: they compare Cournot and Bertrand downstream competition in markets where trading occurs through linear wholesale prices contracts, and not through the extensively used in practise, as well as in the theoretical literature on vertical contracting, non-linear two-part tariff contracts.

2 The Model

An upstream firm, U, produces, at zero marginal cost, an input which two downstream firms, D_1 and D_2, use, in one-to-one-proportion, in the production of their final goods. Downstream firms face no other cost than the cost of obtaining the input from U.[3]

Consumers' inverse and direct demands for D_i's final good are:

$$p_i = a - q_i - \gamma q_j \;\text{ and }\; q_i = \frac{(a-p_i) - \gamma(a-p_j)}{1-\gamma^2},\; i,j = 1,2,\;\; i \neq j,$$

where p_i and q_i are respectively D_i's price and quantity, and γ, with $\gamma \in (0,1)$, is a measure of the substitutability among the products of the downstream firms.[4]

The timing of moves is as follows. First, U bargains with each D_i over the terms of a two-part tariff contract, i.e., over a wholesale price, w_i, and a fixed fee, F_i. And second, D_1 and D_2 choose their prices (Bertrand competition) or their quantities (Cournot competition) after observing each other's contract terms.[5]

[2] An exception is Arya et al. (2008) which similar to us find that Cournot competition results into more competitive and efficient outcomes than Bertrand competition. However, the driving forces behind their results, as well as the model that they use are thoroughly different from ours: they consider a market consisting of a vertically integrated firm and a non-integrated downstream rival.

[3] Assuming zero marginal production costs upstream and downstream is without loss of generality.

[4] See Singh and Vives (1984) for details regarding the derivation of the demand functions from the representative consumer's utility maximization problem.

[5] According to Rey and Vergé's (2004) terminology, we assume that contracts are interim observable. A

We model bargaining by invoking the Nash equilibrium of simultaneous generalized Nash bargaining problems, in which the bargaining power of U and D_i is given respectively by β and $1-\beta$, with $\beta \in (0,1]$. This implies that during the negotiations between U and D_i each of them takes as given the outcome of the simultaneously-run negotiations of U and D_j. A key assumption that underlies this modeling approach is that U bargains with the downstream firms simultaneously and separately.[6] As has been noted by the literature, multiple equilibria can arise in such settings due to the multiplicity of the beliefs that the downstream firms can form when they receive out-of-equilibrium offers. Following Horn and Wolinsky (1988), Cremer and Riordan (1987), O'Brien and Shaffer (1992) and Milliou and Petrakis (2007), we obtain a unique equilibrium by imposing *pairwise proofness* on the equilibrium contracts, i.e., we require that a contract between U and D_i is immune to a bilateral deviation of U with D_j. The following assumption guarantees the existence of a pure strategy pairwise proof equilibrium:[7]

Assumption 1. $\beta \geqslant \overline{\beta}(\gamma) \equiv \frac{\gamma^3}{(2-\gamma)(2-\gamma^2)}$.

For notational reasons, we use superscripts C and B to denote respectively the equilibrium values under Cournot and Bertrand competition in the downstream market.

3 Equilibrium Analysis

We start by solving the last stage of the game, first, under Cournot competition, and then, under Bertrand competition.

(i) Cournot competition: Each D_i chooses q_i in order to maximize its profits:

$$\max_{q_i} \pi_i(w_i, w_j, q_i, q_j) = (a - q_i - \gamma q_j)q_i - w_i q_i - F_i. \tag{1}$$

The resulting reaction functions are:

$$q_i(q_j) = \frac{a - w_i - \gamma q_j}{2}. \tag{2}$$

Note that a reduction in the wholesale price charged to D_i shifts out its reaction function and turns it into a more aggressive downstream competitor.

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

similar assumption can be found in Horn and Wolinsky (1988), Gal-Or (1991), McAfee and Schwartz (1995), Milliou and Petrakis (2007), and in many others.

[6] This assumption is standard in situations with multilateral contracting (see e.g., Cremer and Riordan, 1987, Horn and Wolinsky, 1988, Hart and Tirole, 1990, O'Brien and Shaffer, 1992, McAfee and Schwartz, 1994 and 1995, Rey and Vergé, 2004, Milliou and Petrakis, 2007).

[7] See McAfee and Schwartz (1995), Rey and Vergè (2004), and Milliou and Petrakis (2007) for details regarding the possible non-existence of a pure strategy pairwise proof equilibrium.

wholesale prices:

$$q_i^C(w_i, w_j) = \frac{a(2-\gamma) - 2w_i + \gamma w_j}{4-\gamma^2}. \quad (3)$$

It is straightforward to derive the respective equilibrium downstream and upstream profits:

$$\pi_{D_i}^C(w_i, w_j) = [q_i^C(w_i, w_j)]^2 - F_i \quad \text{and} \quad \pi_U^C = \sum_{i=1}^{2}[w_i q_i^C(w_i, w_j) + F_i]. \quad (4)$$

(ii) Bertrand competition: Each D_i chooses p_i in order to maximize its profits:

$$\max_{p_i} \ \pi_i(w_i, w_j, p_i, p_j) = (p_i - w_i)\frac{(a-p_i) - \gamma(a-p_j)}{1-\gamma^2} - F_i. \quad (5)$$

The first-order conditions give rise to the following reaction functions:

$$p_i(p_j) = \frac{a(1-\gamma) + \gamma p_j + w_i}{2}. \quad (6)$$

A reduction in the wholesale price charged to D_i shifts in its reaction function and, as in the case of Cournot competition, turns it into a more aggressive competitor. Solving (6), we obtain the equilibrium prices in terms of the wholesale prices:

$$p_i^B(w_i, w_j) = \frac{a(2-\gamma-\gamma^2) + 2w_i + \gamma w_j}{4-\gamma^2}. \quad (7)$$

The resulting equilibrium quantity and profits are:

$$q_i^B(w_i, w_j) = \frac{a(2-\gamma-\gamma^2) - (2-\gamma^2)w_i + \gamma w_j}{(4-\gamma^2)(1-\gamma^2)}; \quad (8)$$

$$\pi_{D_i}^B(w_i, w_j) = [p_i^B(w_i, w_j) - w_i]q_i^B(w_i, w_j) - F_i; \quad \pi_U = \sum_{i=1}^{2}[w_i q_i^B(w_i, w_j) + F_i]. \quad (9)$$

Next, we determine the equilibrium contract terms - we solve the first stage of the game. In stage one, U bargains with D_i over $(w_i,\ F_i)$, taking as given the equilibrium contract terms with D_j, $(w_j^{M*},\ F_j^{M*})$, where M, with $M = C, B$, denotes the mode of downstream competition. In particular, w_i and F_i are chosen to solve the following generalized Nash product:

$$\max_{w_i, F_i} \ [\pi_U^M(w_i, w_j^{M*}) + F_i + F_j^{M*} - d(w_j^{M*}, F_j^{M*})]^{\beta}[\pi_{D_i}^M(w_i, w_j^{M*}) - F_i]^{1-\beta}, \quad (10)$$

where $d(w_j^{M*}, F_j^{M*}) = w_j^{M*}q_j^{mon}(w_j^{M*}) + F_j^{M*}$ is U's disagreement payoff. That is, it is U's profits when its negotiations with D_i break down and D_j acts as a monopolist in the downstream market facing w_j^{M*}, i.e., it produces the monopoly quantity, $q_j^{mon}(w_j^{M*}) = (a -$

$w_j^{M*})/2$.[8]

Maximizing (10) with respect to F_i, we obtain:

$$F_i = \beta \pi_{D_i}^M (w_i, w_j^{M*}) - (1-\beta)[\pi_U^M (w_i, w_j^{M*}) - w_j^{M*} q_j^{mon}]. \quad (11)$$

Substituting (11) into (10), it follows that w_i is chosen in order to solve:

$$\max_{w_i} \ [\pi_U^M (w_i, w_j^{M*}) + \pi_{D_i}^M (w_i, w_j^{M*}) - w_j^{M*} q_j^{mon}]. \quad (12)$$

It is well-known from the literature on vertical contracting (see e.g., Hart and Tirole, 1990, Rey and Vergé, 2004) that when an upstream monopolist, which supplies multiple competing downstream firms, deals with one of its downstream customers, it has incentives to "free-ride" on its other downstream customers. That is, when U negotiates with D_i, it has incentives to behave opportunistically and offer a lower wholesale price to D_i than to D_j because by doing so it will affect D_j's response in the market competition stage. In this way, it will raise D_i's market share and gross profits that it will then transfer upstream through a higher fixed fee charged to D_i. When the negotiations with the downstream firms, as in our setting, take place separately, and thus, they are secret, there is no guarantee that U will not behave in such an opportunistic way since U is unable to commit to any of the downstream firms regarding the terms offered to others. This is reflected in (12) in which w_i is chosen not in order to maximize the overall industry profits, but instead, in order to maximize the excess joint surplus of U and D_i, that is, the joint surplus of U and D_i minus U's disagreement payoff. This, as explained by McAfee and Schwartz (1994), means that when the input price choice takes place, U ignores the direct profit reduction to D_j from cutting the input price to D_i - it cares only about D_j's response to D_i's change in marginal cost, not the reduction in D_j's profits. As a consequence, even though U is in a monopoly position, its inability to publicly commit to specific contract terms to all downstream customers when negotiations are secret gives room for opportunistic behavior and prevents it from inducing the maximum overall industry profits.[9] This corresponds to the so- called *commitment problem*, due to Hart and Tirole (1990), and further analyzed by O'Brien and Shaffer (1992), McAfee and Schwartz (1994) and (1995), Rey and Vergé (2004) and de Fontenay and Gans (2005), that an upstream monopolist faces when it deals with multiple competing downstream firms and contracts are not public. Clearly, the presence of the *commitment problem* means that each D_i, anticipating

[8]This implies that we have assumed that a breakdown in one pair's negotiations does not trigger new negotiations in the rival pair. We should also stress that our results remain intact, if we assume instead that D_j acts as a duopolist in the downstream market facing w_j^{M*} (as in Horn and Wolinsky, 1988).

[9]If the negotiations between U and the two downstream firms, did not take place separately, i.e., if contracts were public and thus, each downstream firm observed both its own contracts terms and the terms of its rival before deciding to accept them, the maximum overall industry profits would have been induced, because, due to the public commitment, U would not have been able to behave opportunistically.

U's opportunistic behavior, both under Cournot and under Bertrand competition, would turn down an offer that maximizes the industry's overall profits.[10] In particular, solving (12), first under downstream Cournot competition, we obtain the equilibrium wholesale prices:

$$w_1^{C*} = w_2^{C*} = -\frac{a\gamma^2}{2(2-\gamma^2)}. \tag{13}$$

The solution instead of (12) under downstream Bertrand competition results into the following:

$$w_1^{B*} = w_2^{B*} = \frac{a\gamma^2}{4}. \tag{14}$$

Observe that under Cournot competition, the equilibrium wholesale prices (13) are lower than U's marginal cost, i.e., U subsidizes, via the wholesale prices, the downstream production. In contrast, under Bertrand competition, there is no subsidization of the downstream production - the equilibrium wholesale prices (14) exceed the upstream marginal cost. The explanation for this has to do with the fact that while quantities are strategic substitutes, prices are strategic complements. Because of this, the upstream monopolist has stronger incentives to increase the aggressiveness of its downstream customers when the latter compete in quantities than when they compete in prices. More specifically, in the former case, by reducing the input price charged to D_i, it causes an increase in D_i's output and a decrease in D_j's output (due to strategic substitutability) that translates into significantly larger gross profits for D_i that U can extract through a higher F_i. In the latter case though, a reduction of the input price charged to D_i leads to a decrease in both D_i's and D_j's prices (due to strategic complementarity), resulting in a relatively smaller increase in D_i's profits that U can extract through the F_i. In other words, U's incentives to behave opportunistically are more pronounced under Cournot competition than under Bertrand competition. As a consequence, U's commitment problem is also more severe under Cournot than under Bertrand competition.

Substituting (13) into (3) and (4), we obtain the equilibrium output and price, as well as the equilibrium downstream and upstream profits under Cournot competition:

$$q_i^{C*} = \frac{a(2-\gamma)}{2(2-\gamma^2)}; \; p_i^{C*} = \frac{a(1-\gamma)(2+\gamma)}{2(2-\gamma^2)}; \tag{15}$$

$$\pi_{D_i}^{C*} = \frac{a^2(1-\beta)(2-\gamma)^2}{8(2-\gamma^2)}; \; \pi_U^{C*} = \frac{a^2(2-\gamma)[\beta(2-\gamma)(2-\gamma^2)-\gamma^3]}{4(2-\gamma^2)^2}. \tag{16}$$

From (14), (7), (8) and (9), it follows that the respective equilibrium values under

[10] In order to maximize the overall industry profits, both input prices would have to be set above the upstream marginal cost in order to counteract the negative competitive externality existing whenever there is competition in the downstream market (see McAfee and Schwartz, 1994).

Bertrand competition are given by:

$$q_i^{B*} = \frac{a(2+\gamma)}{4(1+\gamma)};\ p_i^{B*} = \frac{a(2-\gamma)}{4}; \tag{17}$$

$$\pi_{D_i}^{B*} = \frac{a^2(1-\beta)(2+\gamma)[4-2\gamma-\gamma^3+\gamma^4]}{32(1+\gamma)};\ \pi_U^{B*} = \frac{a^2(2+\gamma)[2\beta(2-\gamma)+(1-\beta)\gamma^3(1-\gamma)]}{16(1+\gamma)}. \tag{18}$$

4 Cournot vs. Bertrand Downstream Competition

We turn now to the comparison of the equilibrium outcomes under Cournot and Bertrand final market competition.

Proposition 1 *The equilibrium wholesale prices and the final prices are higher under Bertrand than under Cournot competition, while the opposite holds for the equilibrium output.*

Proof. First, $w_i^{C*} < 0 < w_i^{B*}$; second, $p^{C*} - p^{B*} = -\frac{a\gamma^3}{4(2-\gamma^2)} < 0$; finally, $q^{C*} - q^{B*} = \frac{a\gamma^3}{4(1+\gamma)(2-\gamma^2)} > 0$. ■

Proposition 1 informs us that under Cournot competition the downstream firms obtain the input at better terms than under Bertrand competition. This is a straightforward implication of the fact that, as explained above, the upstream monopolist suffers more from the *commitment problem* when downstream firms compete in quantities than in prices. Clearly, this finding implies, in turn, that downstream firms face a lower marginal cost, and thus, they enjoy higher efficiency under Cournot rather than under Bertrand competition. In light of this, it is not surprising that, as Proposition 1 also informs us, Cournot competition is more competitive than Bertrand competition, or else, that Bertrand competition yields higher prices and lower output than Cournot competition. Since the downstream firms are less efficient under Bertrand competition, they charge higher prices and they produce a smaller quantity than under Cournot competition.

Proposition 2 *The equilibrium downstream profits are higher under Cournot than under Bertrand competition, while the opposite holds for the equilibrium upstream profits.*

Proof. We take the difference $\pi_{D_i}^{C*} - \pi_{D_i}^{B*} = \frac{a^2(1-\beta)\gamma^3[8-\gamma(1+\gamma)(4-\gamma^2)]}{32(1+\gamma)(2-\gamma^2)}$, and we note that it is always positive. Similarly, we take the difference $\pi_U^{C*} - \pi_U^{B*} = \frac{-a^2\gamma^3 K}{16(1+\gamma)(2-\gamma^2)^2}$, where $K \equiv 16 - \beta(2-\gamma^2)(8-\gamma(1+\gamma)(4-\gamma^2)) - \gamma^2(16-4\gamma-6\gamma^2+\gamma^3+\gamma^4)$. It can be checked that $K > 0$; hence, $\pi_U^{C*} < \pi_U^{B*}$. ■

According to Proposition 2, downstream firms are better off under quantity competition than under price competition. This result is in line with the respective result of Singh and Vives (1984) in a one-tier market, but the rationale behind it is completely different.

In a one-tier market, the explanation for this result is that competition is fiercer under Bertrand competition than under Cournot competition. This is not the explanation though in a vertically related market since, as we saw in Proposition 1, Cournot is more competitive than Bertrand. In a vertically related market, such as the one considered here, the higher downstream profits under Cournot competition are due, instead, to the higher efficiency of the downstream firms resulting from the lower wholesale prices due to the more severe upstream monopolist's *commitment problem*.

According also to Proposition 2, the preferences of the upstream and downstream firms are not aligned. The upstream firm, in contrast to the downstream firms, attains higher profits when downstream competition is in prices rather than in quantities. This is so because, as explained above, under price competition U suffers less from the commitment problem.

Next, we examine whether Bertrand or Cournot competition is preferable from both the consumers' welfare and the total welfare viewpoints.

Proposition 3 *Consumers' surplus as well as total welfare are higher under Cournot than under Bertrand competition.*

Proof. Consumers' surplus is given by $CS^{M*} = (1+\gamma)[q_i^{M*}]^2$. From Proposition 1, we know that $q_i^{C*} > q_i^{B*}$; hence $CS^{C*} > CS^{B*}$. Total welfare is: $TW^{M*} = CS^{M*} + \Pi_U^{M*} + 2\Pi_{Di}^{M*}$. After substituting (15),(16), (17), and (18), total welfare under Cournot and Bertrand competition is given respectively by $TW^{C*} = \frac{a^2(2-\gamma)(6-\gamma-3\gamma^2)}{4(2-\gamma^2)^2}$ and $TW^{B*} = \frac{a^2(2+\gamma)(6-\gamma)}{16(1+\gamma)}$. Taking the difference $TW^{C*} - TW^{B*} = \frac{a^2\gamma^3[8-\gamma(4+(4-\gamma)\gamma)]}{16(1+\gamma)(2-\gamma^2)^2}$, we note that it is always positive. Thus, $TW^{C*} > TW^{B*}$. ■

In contrast to conventional wisdom, we find that a market with Cournot competition is more efficient than a market with Bertrand competition, in the sense that both the consumers' surplus and the total welfare are higher in the former case. For consumers' surplus this is a straightforward implication of the fact that in a Cournot market prices are lower and output is higher than in a Bertrand market (Proposition 1). The higher total welfare under Cournot competition arises because, in contrast to the upstream profits, both the consumers' surplus and the downstream profits are higher under Cournot than under Bertrand competition. In other words, in a vertically related market with upstream monopoly and trading with non-linear contracts, Cournot competition is more socially desirable than Bertrand competition.

5 Conclusion

We have shown that the standard conclusions regarding the comparison of Cournot and Bertrand competition can be reversed in a vertically related market with trading through non-linear contracts. In such a market, the incentives of an upstream monopolist to make its customers more aggressive in the downstream market are stronger when the latter compete in quantities than when they compete in prices. As a result, the upstream monopolist faces a more severe commitment problem under Cournot than under Bertrand downstream competition and charges lower wholesale prices in the former case. The lower wholesale prices translate into higher efficiency for the downstream firms and, in turn, into lower final prices and higher output and consumers' surplus in the case of Cournot competition. Although under Cournot competition the upstream profits are lower than under Bertrand competition, the downstream profits along with the total welfare are higher.

We should stress, however, that our results are not necessarily robust to alternative assumptions regarding the upstream market structure and/or the contracting procedure (e.g., contract type, observability of contract terms). This suggests that the well-known results regarding the comparison of Cournot and Bertrand competition can depend crucially not only on whether or not the markets are vertically related, but also on the specific features of the vertically related markets.

References

[1] Arya, A., Mittendorf, B., Sappington, D., 2008. Outsourcing, vertical integration, and price vs. quantity competition. International Journal of Industrial Organization 26, 1-16.

[2] Amir, R., Jin, J.Y., 2001. Cournot and Bertrand equilibria compared: substitutability, complementarity and concavity. International Journal of Industrial Organization 19, 303-317.

[3] Berto Villa-Boas, S., 2007. Vertical relationships between manufacturers and retailers: Inference with limited data. Review of Economic Studies 74, 625-652.

[4] Bonnet, C. and Dubois, P. 2010. Inference on vertical contracts between manufacturers and retailers allowing for non linear pricing and resale price maintenance. Rand Journal of Economics 41, 139-164.

[5] Cheng, L., 1985. Comparing Bertrand and Cournot equilibria: A geometric approach. Rand Journal of Economics 16, 146-152.

[6] Chirco, A., Scrimitore, M., 2013. Choosing price or quantity? The role of delegation and network externalities. Economics Letters 121, 482-486.

[7] Correa-López, M., 2007. Price and Quantity Competition in a differentiated duopoly with upstream suppliers. Journal of Economics and Management Strategy 16, 469-505.

[8] Correa-López, M., Naylor, R.A., 2004. The Cournot-Bertrand profit differential: a reversal result in a differentiated duopoly with wage bargaining. European Economic Review 48, 681-696.

[9] Cremer, J., Riordan, M.H., 1987. On governing multilateral transactions with bilateral contracts. Rand Journal of Economics 18, 436-451.

[10] Dastidar, K.G., 1997. Comparing Cournot and Bertrand in a homogenous product market. Journal of Economic Theory 75, 205-212.

[11] de Fontenay, C.C., Gans J.S., 2005. Vertical Integration in the presence of upstream competition. Rand Journal of Economics 36, 544-572.

[12] Delbono, F., Denicolo, V., 1990. R&D investment in a symmetric and homogeneous oligopoly. International Journal of Industrial Organization 8, 297-313.

[13] Gal-Or, E., 1991. Duopolistic vertical restraints. European Economic Review 34, 1237-1253.

[14] Häckner, J., 2000. A note on price and quantity competition in differentiated oligopolies. Journal of Economic Theory 93, 233-239.

[15] Hart, O., Tirole, J., 1990. Vertical integration and market foreclosure. Brookings papers on economic activity. Microeconomics, 205-276.

[16] Horn, H., Wolinsky, A., 1988. Bilateral monopolies and incentives for merger. Rand Journal of Economics 19, 408–419.

[17] Lambertini, L., 1997. Prisoners' dilemma in duopoly (super) games, Journal of Economic Theory 77, 181-191.

[18] Manasakis, C., Vlassis, M., 2013. Downstream mode of competition with upstream market power. Dice Discussion paper No.118. Düsseldorf Institute for Competition Economics (DICE).

[19] McAfee, P., Schwartz, M., 1994. Opportunism in multilateral vertical contracting: nondiscrimination, exclusivity, and uniformity. American Economic Review 84, 210-230.

[20] McAfee, P., Schwartz, M., 1995. The non-existence of pairwise-proof equilibrium. Economics Letters 49, 251-259.

[21] Milliou, C., Petrakis E., 2007. Upstream horizontal mergers, vertical contracts, and bargaining. International Journal of Industrial Organization 25, 963-987.

[22] Mukherjee, A., Broll, U., Mukherjee, S., 2012. Bertrand versus Cournot competition in a vertical structure: A note. The Manchester School 80, 545-559.

[23] O'Brien, D., Shaffer, G., 1992. Vertical control with bilateral contracts. Rand Journal of Economics 23, 299-308.

[24] Okuguchi, K., 1987. Equilibrium prices in the Bertrand and Cournot oligopolies. Journal of Economic Theory 42, 128-139.

[25] Qiu, L.D., 1997. On the dynamic efficiency of Bertrand and Cournot equilibria. Journal of Economic Theory 75, 213-229.

[26] Rey, P., Vergé T., 2004. Bilateral control with vertical Contracts. Rand Journal of Economics 35, 728-746.

[27] Singh, N., Vives, X., 1984. Price and quantity competition in a differentiated duopoly. Rand Journal of Economics 15, 546-554.

[28] Vives, X., 1985. On the efficiency of Bertrand and Cournot equilibria with product differentiation. Journal of Economic Theory 36, 166-175.

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