

# **A note on endogenous competition mode with managerial-unionised firms<sup>†</sup>**

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## **Abstract**

We analyse the endogenous choice of the competition mode (price vs. quantity) in a duopoly model with managerial delegation and unionised labour markets. Depending on the unions' relative bargaining power and the degree of product differentiation, the set of possible outcomes proves to be very rich, including alternatively a unique quantity or price equilibrium as well as multiple asymmetric-type equilibria.

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# 1 Introduction

In this note we analyse the strategic (endogenous) choice between quantity or price competition in a two-tier vertical structure where downstream firms' owners delegate strategic decisions to managers and marginal production costs (i.e., wages) are bargained between managers and upstream suppliers (i.e., unions).

The pioneering work by Singh & Vives (1984) has given rise to a vast literature analysing the effects of Bertrand and Cournot competition on profits and welfare. Various extensions deal with the comparison between Bertrand and Cournot outcomes, aiming at assessing if Singh & Vives' (1984) seminal results on profits and welfare rankings (i.e., Bertrand competition leads to higher consumer surplus and overall welfare, while Cournot competition entails higher profits when firms compete in substitutes and lower profits when they compete in complements) still apply in alternative frameworks.<sup>1</sup> Instead, less attention has been originally devoted to Singh and Vives' result that the firms' choice to compete in quantities is the symmetric equilibrium in dominant strategies with substitute goods.<sup>2</sup>

More recently, the analysis of the non-cooperative game on the choice of strategic variable in duopoly has becoming a fruitful research topic and different works tackle this issue in various contexts (e.g., Correa-López, 2007; Matsumura & Ogawa, 2012; Chirco & Scrimatore, 2013; Scrimatore, 2013; Tremblay *et al.*, 2013; Bhattacharjee & Pal, 2013; Pal 2015; Basak & Wang, 2016). This paper aims at contributing to this literature by considering the interplay between the separation of ownership from management in modern corporations and the role of labour unions in determining workers' wages.<sup>3</sup>

Our main findings can be summarised as follows: i) the choice to compete in quantities, originally pointed out by Singh & Vives (1984) in a standard duopoly framework, is generally reversed; and ii) a wider set of possible (equilibrium) outcomes also applies with respect to the received literature on endogenous competition in oligopoly, which extends Singh & Vives' (1984) original model. The intuition behind those results can be understood by considering that, together with the standard "competition effect" highlighted by the received literature on managerial

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<sup>1</sup> Just to mention some relatively recent examples, see Correa-López & Naylor (2004), Zanchettin (2006), Mukerjee *et al.* (2012) and Alipranti *et al.* (2014).

<sup>2</sup> Under complement goods, instead, the symmetric equilibrium is competing in prices.

<sup>3</sup> In Industrial Organization, the managerial delegation literature started with the pioneering works by Vickers (1985), Fershtman (1985), Fershtman & Judd (1987) and Sklivas (1987). Horn & Wolinsky (1988), Davidson (1988) and Dowrick (1989) originated instead the literature on unionised oligopolies.

delegation with exogenous costs, according to which owners provide incentives on sales to managers, another important effect plays a role when labour markets are unionised, determining the equilibrium owners' choice of the bonus weight in managerial contracts. This effect, that can be labelled "wage effect" (Fanti & Meccheri, 2013, 2015), refers to the fact that by providing incentives on sales, owners drive managers to increase output and therefore employment. In turn, this also reduces labour demand elasticity and, as a consequence, leads unions to increase their wage claims. Hence, according to this (novel) effect, owners have a rationale to penalise their managers on sales in order to dampen the unions' wage claim.

However, while under Cournot the wage effect is in conflict with the (standard) competition effect and generally the former prevails on the latter so that, in equilibrium (and in contrast with the standard literature), owners choose to penalise sales, under Bertrand the competition effect and the wage effect strengthen each other, determining a larger negative bonus weight. In turn, stronger sales penalisation under Bertrand also implies lower wages (further than lower output), leading to a reversal of the standard outcome that profits are higher under Cournot. Furthermore, this makes price contracts the only (subgame perfect) Nash equilibrium for a wide range of structural parameters' values. In particular, only when unions' relative bargaining power is low and product substitutability is high, the standard competition effect outweighs the wage effect (which is negligible when unions' power is very low) and standard outcomes are restored: profits are higher under Cournot and quantity contracts are the only subgame perfect Nash equilibrium. Moreover, as it will be clarified, this line of reasoning also explains why, for some combinations of unions' relative bargaining power and product differentiation, there is room for profitable unilateral deviations from symmetric strategies, also making the presence of two *asymmetric* Nash equilibria a possible event.

It is worth discussing here also the main differences between this work and the companion paper (Fanti & Meccheri, 2015), where the same issue of the endogenous competition mode is analysed in an alternative framework. In particular, the relevant change with respect to our previous work is twofold. First, while in Fanti & Meccheri (2015) it is assumed that unions have all the bargaining power (i.e., a monopoly union model is adopted), we consider now wage bargaining between unions and firms. Since the unions' relative bargaining power captures in this context the weight assigned to the wage effect, this can permit to clarify in greater detail the role of this effect in determining the final outcomes. Secondly, and most importantly, in this paper the firms' owners, instead of managers, take the choice of the competition mode. As we will show, this modification is crucial in determining the main results; while the standard quantity choice equilibrium always applies when the competition mode is chosen by managers (Fanti & Meccheri, 2015), we obtain

herein, as above discussed, a much richer set of possible (endogenous) equilibria, so significantly modifying the standard results inherited by Singh & Vives (1984). This is because, from the one hand, owners and managers have their own objective functions, which differ one another and, from the other (and more interestingly), they choose the competition mode at different stages. Crucially, in Fanti & Meccheri (2015) managers choose the competition mode just prior to the market stage (when wages have already been set). In this paper, instead, we consider a situation in which owners can choose the competition regime before wage bargaining. Hence, while, in the former case, there is no room for managers to strategically choose the competition mode in order to influence wage determination (even when managers' payoff is linked to profits/sales by means of an incentive contract), in the latter, owners have two different tools to affect wages: managerial incentive contracts and competition mode. This makes the situation more complex, leading to a much more elaborated (and completely different) result in relation to the endogenous choice of the competition mode.

The remaining part of the work is organised as follows: the basic framework is presented in Section 2; Section 3, which is the core of this note, analyses and discusses the endogenous choice by firms' owners of the competition mode; finally, Section 4 concludes.

## 2 Basic framework

The model set-up builds on Fanti & Meccheri (2015) that considers a duopoly market where two identical firms produce differentiated products. The inverse demand for firm producing variety  $i$  is given by:

$$p_i(q_i, q_j) = 1 - q_i - \gamma q_j \quad (1)$$

where  $p_i$  denotes the price of variety  $i$ ,  $q_i$  and  $q_j$  the outputs by the two firms (with  $i, j = 1, 2$  and  $i \neq j$ ), and  $\gamma \in (0, 1)$  the degree of product differentiation.<sup>4</sup>

The cost function of the firm  $i$  is given by  $C_i(q_i) = w_i l_i = w_i q_i$ , where  $l_i$  represents the number of workers employed by the firm and  $w_i < 1$  the wage per unit of labour. Hence, profits are  $\pi_i = (p_i - w_i)q_i$ , which, taking (1) into account, become:

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<sup>4</sup> The (inverse) demand structure represented by (1) is a normalised version of that originally introduced by Dixit (1979) and adopted by Singh & Vives (1984).

$$\pi_i = (1 - q_i - \gamma q_j - w_i)q_i.$$

We also assume that each firm's owner hires a manager and delegates the strategic decisions in the products market game about quantity or price to this manager. The compensation perceived by each manager includes two components, a fixed salary plus a bonus element. The latter is related to a weighted combination between firm profits and sales/output (e.g., Vickers, 1985; Lambertini, 2000; van Witteloostuijn *et al.*, 2007). Formally manager  $i$  receives a bonus that is proportional to:

$$u_i = \pi_i + b_i q_i = (1 - q_i - \gamma q_j - w_i + b_i)q_i \quad (2)$$

where  $b_i$  is the incentive parameter that is chosen by the firm  $i$ 's owner. The owner may provide either incentives or disincentives to the manager's choice of output (sales), so that the parameter  $b_i$  may be either positive or negative. Particularly, the firm  $i$ 's manager partially abandons the rule of the strict profit-maximisation for taking also into account sales when  $b_i \neq 0$ . As a consequence, he/she may become a more (when  $b_i > 0$ ) or less (when  $b_i < 0$ ) aggressive seller in the market.<sup>5</sup> Moreover, managers are also delegated to bargain wages with labour unions, which are interested to their workers' total wage bill.

In the sequel we analyse the choice of the strategic variable taken this market environment. In particular, we consider a four-stage game, where the type of market contract (quantity or price) is selected at the first (pre-play) stage by the firms' owners; at the second stage, owners decide bonus weights in managerial contracts; at the third stage, wages are bargained between unions and managers; at the final stage (the market game), managers compete according to the market contract choosing the strategic variable. As usual, the game is solved by backward induction.

## 2.1 Symmetric choice

In this section, we consider first the cases in which owners make symmetric choices about the market contract. When both firms (managers) compete *à la Cournot*, in the market game, the firm  $i$ 's manager maximises (2) with respect to  $q_i$ . Since firms' managers behave symmetrically, the firm  $i$ 's output, for given wages and bonuses, is given by:

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<sup>5</sup> Extensions to other types of managerial delegation schemes, such as "relative performance delegation" (e.g., Miller & Pazgal, 2002; Chirco *et al.*, 2011), are left to the future research.

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

Instead, when in the market game both firms compete *à la* Bertrand, taking (the inverse of) (1) into account, the firm  $i$ 's manager maximises his/her utility with respect to  $p_i$ . Then, taking into account that  $j$  behaves symmetrically (and considering (1)), the firm  $i$ 's output, for given wages and bonuses, is:

$$q_i(w_i, w_j, b_i, b_j) = \frac{2 - \gamma - \gamma^2 - (2 - \gamma^2)w_i + \gamma w_j + (2 - \gamma^2)b_i - \gamma b_j}{(1 - \gamma^2)(4 - \gamma^2)}. \quad (4)$$

At the third stage, unions and managers bargain over wages. In particular, it is assumed that each manager-union pair bargains according to the Right-to-Manage (RTM) model. Since unions are interested to their workers' total wage bill  $V_i = w_i q_i$ , a wage  $w_i$  is determined through bargaining to maximise the following generalized Nash product:<sup>6</sup>

$$\max_{\{w_i\}} = N_i = V_i^\beta u_i^{1-\beta} = (w_i q_i)^\beta [(1 - w_i - q_i - \gamma q_j + b_i) q_i]^{1-\beta}$$

where  $\beta \in (0,1)$  represents the unions' relative bargaining power *vis-à-vis* managers which, for simplicity, is assumed to be the same for both unions. Accordingly, taking (3) or (4) into account, sub-game perfect symmetric equilibrium wages under Cournot and Bertrand competition at the final stage are, respectively:

$$w_i(b_i, b_j) = \frac{\beta [(\beta\gamma^2 - 8)b_i - 2\gamma(\beta - 2)b_j + (\gamma - 2)(\beta\gamma + 4)]}{(\beta\gamma + 4)(\beta\gamma - 4)}$$

$$w_i(b_i, b_j) = \frac{\beta [(\beta\gamma^2 - 2\gamma^4 + 8\gamma^2 - 8)b_i + \gamma(\gamma^2 - 2)(\beta - 2)b_j + (\gamma + 2)(\gamma - 1)(\beta\gamma - 2\gamma^2 + 4)]}{(\beta\gamma + 2\gamma^2 - 4)(\beta\gamma - 2\gamma^2 + 4)}.$$

At the second stage, by substituting back wages and output in the profit equation, owners simultaneously choose the bonus weights in managerial contracts that maximise profits:

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<sup>6</sup> The pioneering work that provides a rationale for the adoption of the Nash bargaining solution in strategic contexts is Binmore *et al.* (1986).

$$b_i = b_j = b^Q = -\frac{(\gamma^4 - 8\gamma^2)\beta^2 + (8\gamma^2 + 32)\beta - 16\gamma^2}{2[(\gamma^4 + \gamma^3 - 4\gamma^2)\beta^2 + (16 - 2\gamma^3 - 4\gamma^2 - 8\gamma)\beta - 8\gamma^2 + 16\gamma + 32]}$$

$$b_i = b_j = b^P = -\frac{(\gamma - 1)[(3\gamma^4 - 8\gamma^2)\beta^2 + (32 - 4\gamma^6 + 20\gamma^4 - 40\gamma^2)\beta + 4\gamma^2(\gamma^2 - 2)^2]}{(3\gamma^5 - 2\gamma^4 - 10\gamma^3 + 8\gamma^2)\beta^2 - 2(\gamma^2 - 2)(2\gamma^5 - \gamma^4 - 9\gamma^3 + 6\gamma^2 + 12\gamma - 8)\beta + \Psi}$$

where  $\Psi \equiv 4(\gamma^2 + 2\gamma - 4)(\gamma^2 - 2)^2$  and the indexes  $Q$  and  $P$  recall that the bonus weights refer to the case with quantity and price competition, respectively, in the product market.<sup>7</sup> Finally, by substituting back, we obtain the (sub-game perfect) equilibrium output, wage and profit of each firm, the latter being reported below relative to the two competition modes:

$$\pi_i = \pi_j = \pi^Q = \frac{(\beta - 2)(\beta\gamma^2 - 8)[(\gamma^4 - 6\gamma^2)\beta^2 + (4\gamma^2 + 16)\beta - 16\gamma^2 + 32]}{2[(\gamma^4 + \gamma^3 - 4\gamma^2)\beta^2 + (16 - 2\gamma^3 - 4\gamma^2 - 8\gamma)\beta - 8\gamma^2 + 16\gamma + 32]^2}$$

$$\pi_i = \pi_j = \pi^P = \frac{2(\beta - 2)(2 - \gamma^2 + \beta)(\gamma - 1)(\gamma^2 - 2)(-2\gamma^4 + \beta\gamma^2 + 8\gamma^2 - 8)(\beta\gamma^4 - 3\beta\gamma^2 - 4\gamma^2 + 8)}{(1 + \gamma)[(3\gamma^5 - 2\gamma^4 - 10\gamma^3 + 8\gamma^2)\beta^2 - 2(\gamma^2 - 2)(2\gamma^5 - \gamma^4 - 9\gamma^3 + 6\gamma^2 + 12\gamma - 8)\beta + \Psi]^2}.$$

## 2.2 Asymmetric (price/quantity) choice

Let us now assume that firm (manager) 1 competes in price (as a Bertrand-type firm), while firm (manager) 2 in quantity (as a Cournot-type firm). Again, managers take their strategic choices simultaneously under complete information. Firms face symmetric inverse demand and cost functions and differ only in their choice of strategic variable. The Nash equilibrium of the market stage can be described in terms of the best-reply functions for each firm's manager, respectively:

$$p_1(q_2, w_1, b_1) = \frac{1 - \gamma^2 + w_1 - \gamma q_2(1 - \gamma^2) - b_1}{2 - \gamma^2}; \quad q_2(p_1, w_2, b_2) = \frac{1 - \gamma - w_2 + \gamma p_1 + b_2}{2 - \gamma^2}$$

<sup>7</sup> Notice that, while the standard outcome under price competition that owners always penalise managers on sales is confirmed, owners penalise sales also under quantity competition provided that  $\beta$  is sufficiently high. This reverses the received outcome that, when competition is in quantities, owners provide their managers with incentives on sales. We defer to Fanti & Meccheri (2013, 2015) and Meccheri & Fanti (2014) for greater details.

and standard calculations lead to the firm  $i$ 's output, for given wages and bonuses:

$$q_1(w_1, w_2, b_1, b_2) = \frac{2 - \gamma - 2w_1 + \gamma w_2 - \gamma b_2 + 2b_1}{4 - 3\gamma^2} \quad (7)$$

$$q_2(w_1, w_2, b_1, b_2) = \frac{2 - \gamma - \gamma^2 + \gamma w_1 - (2 - \gamma)w_2 + (2 - \gamma^2)b_2 - \gamma b_1}{4 - 3\gamma^2}. \quad (8)$$

By using (7) and (8), maximising the Nash product with respect to  $w_i$  and solving the system, we get the following sub-game perfect equilibrium wages, as a function of the bonus weights:

$$w_1(b_1, b_2) = \frac{\beta[(\beta\gamma^2 + 4\gamma^3 - 8)b_1 + \gamma(\gamma^2 - 2)(\beta - 2)b_2 + \beta\gamma^3 + \beta\gamma^2 - 2\gamma^3 - 2\beta\gamma + 4\gamma^2 + 4\gamma - 8]}{\beta^2\gamma^2 + 8\gamma^2 - 16};$$

$$w_2(b_1, b_2) = \frac{\beta[(4\gamma - 2\beta\gamma)b_1 + (\beta\gamma^2 + 4\gamma^2 - 8)b_2 + \beta\gamma^2 - 2\beta\gamma + 4\gamma^2 + 4\gamma - 8]}{\beta^2\gamma^2 + 8\gamma^2 - 16}.$$

Hence, by substituting wages back, we get profits as a function of the weights on sales only. By maximising with respect to  $b_i$  and solving the system of reaction functions in bonus weights space, we obtain the equilibrium weights on sales  $b_1 = b^{P/Q}$  and  $b_2 = b^{Q/P}$ , where the superscript  $P/Q$  ( $Q/P$ ) recalls that it is obtained when the firm competes in price (quantity) while the rival competes in quantity (price). Finally, by substituting back, we get the corresponding equilibrium profits  $\pi_1 = \pi^{P/Q}$  and  $\pi_2 = \pi^{Q/P}$ .<sup>8</sup>

### 3 Strategic choice of the competition mode

Given the solutions of the above sub-games, we can now turn to the choice of quantity vs. price at the first (pre-play) stage of the game. In particular, we assume that at the pre-play stage firms' owners simultaneously and independently decide the type of contract (price or quantity) offered to customers. The payoff matrix at the pre-play stage is as follows:

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<sup>8</sup> Since equilibrium bonus weights and profits of this case are very cumbersome and not manageable, we omit them for economy of space. [They have been submitted in a separate appendix, as additional material for referees.]

owner $i \setminus$ owner $j$	Quantity	Price
Quantity	$\pi^Q, \pi^Q$	$\pi^{Q/P}, \pi^{P/Q}$
Price	$\pi^{P/Q}, \pi^{Q/P}$	$\pi^P, \pi^P$

**Table 1: Endogenous competition choice: strategic form**

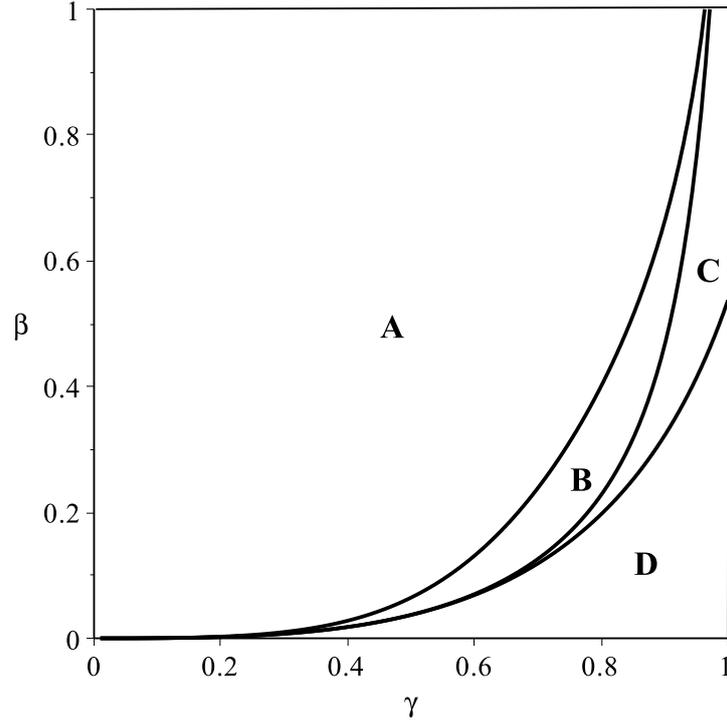
**Proposition.** *In the presence of managerial delegation contracts and unionised labour markets, the following applies:*

- *when unions bargaining power is not too much low and product substitutability is not too much high, the only subgame perfect Nash equilibrium (SPNE) entails that both owners choose to offer a price contract at the first stage. Furthermore, for a large set of parameters for which this applies, this equilibrium is Pareto-efficient from the firms' owners viewpoint;*
- *when unions are sufficiently strong in bargaining vis-à-vis managers and product substitutability is sufficiently high (but not too high when bargaining power is roughly equally distributed), there are two asymmetric SPNE at the first stage, with one owner offering a price contract and the other owner a quantity contract;*
- *when unions' bargaining power is sufficiently low and product substitutability is sufficiently high, the only (Pareto-efficient) SPNE entails that both owners choose to offer a quantity contract at the first stage.*

*Proof:* Let define the following profits differentials:  $\Delta_1 \equiv \pi^{Q/P} - \pi^P$ ,  $\Delta_2 \equiv \pi^{P/Q} - \pi^Q$  and  $\Delta_3 \equiv \pi^P - \pi^Q$ . Then, the proof of Prop. 1 is provided by Figure 1 considering that:<sup>9</sup>  $\langle \Delta_1 < 0 \cup \Delta_2 > 0 \cup \Delta_3 > 0 \rangle$  applies in region A;  $\langle \Delta_1 < 0 \cup \Delta_2 > 0 \cup \Delta_3 < 0 \rangle$  applies in region B;  $\langle \Delta_1 > 0 \cup \Delta_2 > 0 \cup \Delta_3 < 0 \rangle$  applies in region C; and  $\langle \Delta_1 > 0 \cup \Delta_2 < 0 \cup \Delta_3 < 0 \rangle$  applies in region D.

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<sup>9</sup> Since the profit differentials are only functions of the parameters  $\beta$  and  $\gamma$ , then their 2-D graphical analysis is exhaustive to prove their signs, despite they are polynomials of very high degree (all graphical analyses are derived in MAPLE; details and programs are available from the authors upon request).



**Figure 1: Regions defining endogenous competition modes according to  $\beta$  and  $\gamma$**

Hence, in region A and B the only SPNE is  $(P, P)$  which is, however, Pareto-efficient only in region A; in region C there are two asymmetric SPNE  $(P, Q; Q, P)$ ; in region D  $(Q, Q)$  is the only (Pareto-efficient) SPNE. □

### 3.1 Discussion

The results above obtained, as summarised by our main proposition, and in particular the variety of possible equilibrium outcomes relating to the choice of the competition mode, are novel with respect to the received literature.<sup>10</sup> Hence, it is worth discussing in greater detail the logic, in this framework, behind them. In particular, in order to explain the (endogenous) choice of the competition mode, it is crucial to analyse carefully what applies in the asymmetric configurations when the price setter and the quantity setter are, respectively, on their Cournot and Bertrand reaction functions.

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<sup>10</sup> See, in particular, the works that, by considering (separately) a vertical structure or strategic delegation, are closer to ours (Lambertini, 2000; Correa-López, 2007; Chirco & Scrimitore, 2013; Bhattacharjee & Pal, 2013; Pal, 2015; Basak & Wang, 2016). Also notice that while we have analysed here a framework with decentralised firm-union bargain, we obtain the same rich set of equilibrium outcomes also when unionisation (bargaining) is centralised (results available upon request to authors).

Firstly, recall that in a standard framework with profit-maximising firms and competitive labour markets (i.e., without unions), asymmetric configurations lead to the price setter's quantity to be lower and its price to be higher than those of the rival, with higher profits accruing to the quantity-setter (Singh & Vives, 1984, p. 550). As also pointed out by Chirco & Scrimatore (2013) in a different context, introducing managerial delegation by itself modifies this situation in a relevant way. On the one side, it makes (symmetric) quantity and price competition respectively less profitable and more profitable. On the other side, in the asymmetric configurations, managerial delegation “enhances the aggressiveness of the price setter, while it damps down that of the quantity setter, thus causing the profits of the former to increase and those of the latter to decrease” (Chirco & Scrimatore, 2013, p. 485). However, when labour markets are not unionised (i.e., no “wage effect” is present), Cournot profits keep on dominating Bertrand profits, and no incentive to unilaterally deviation from quantity-quantity to price-quantity applies.<sup>11</sup> Hence, the role of the “wage effect” becomes essential to explain our results. In other words, together with managerial delegation and the choice of incentive contracts, the choice of the competition mode is now a strategic tool for firms' owners to dampen the unions' wage claim.<sup>12</sup>

In particular, from the literature on unionised oligopolies, we know that: i) equilibrium wages are higher under Cournot than under Bertrand because the (sub-game perfect) labour demand schedule in the latter regime is more elastic than in the former, leading unions to mainly moderate their wage claims when firms compete in prices; and ii) a unit increase in wage reduces equilibrium profits more in Cournot than in Bertrand (e.g., Correa-López & Naylor, 2004, pp. 690-692). This opens up to the opportunity for unilateral deviations to price competition, which is reinforced in a context with managerial delegation. This is because, under Bertrand, the competition effect and the wage effect strengthen each other, leading to a larger negative bonus weight for manager and, as a consequence, lower (endogenous) wages. Indeed, as long as  $\beta$  becomes sufficiently high, hence the “wage effect” sufficiently strong, owners first perceive an incentive to unilaterally deviate from the quantity-quantity choice (the asymmetric choice being an equilibrium) and then, if the products are

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<sup>11</sup> This can be verified by considering the sign of the profit differentials in the region D when  $\beta \rightarrow 0$ , as reported in the proof of our proposition.

<sup>12</sup> As already discussed in the Introduction section, this represents the key-difference with respect to Fanti & Meccheri (2015), where managers (instead of owners) choose the competition mode just before the market competition stage, when wages have already been set by unions. In that case, even if in theory managers are interested to affect wages due to the presence of incentive contracts, they must take wages as given when decide the competition mode. As a consequence, the standard result of endogenous quantity competition is never reversed.

not strictly substitutes (i.e.,  $\gamma$  is not too high), they move towards a symmetric price-price equilibrium. However, the advantage for owners to keep on competing in prices reduces as product substitutability increases. Indeed, as  $\gamma$  increases, the standard competition effect becomes stronger and, when  $\gamma \rightarrow 1$ , profits collapse to zero under price competition due to the “Bertrand paradox”. Hence, it is profitable for a firm unilaterally deviate from price-price to quantity-price. This completes the explanation of why also a region with two asymmetric equilibria does exist in this context.

## 4 Conclusion

In this paper we have analysed the endogenous choice of the competition mode (price vs. quantity) in a duopoly model with managerial delegation and unionised labour markets. Depending on the unions’ relative bargaining power and the degree of product differentiation, the set of possible outcomes has proved to be very rich, including alternatively a unique quantity or price equilibrium as well as multiple asymmetric-type equilibria. In particular, these findings crucially depends on the fact that the owner initially decides on the mode of competition, hence having also this strategic tool (in addition to that of the manager’s bonus) to affect union’s wages. Such results are novel, hence they contribute to extend the literature that investigates the endogenous choice of the competition mode in oligopoly markets. In order to extend such results, future research could be carried out by considering other managerial incentive structures, such as “relative performance delegation”, or by introducing incentive contracts bargaining between owners and managers into the analysis.

## References

- Alipranti, M., Milliou, C., & Petrakis, E. (2014). Price vs. quantity competition in a vertically related market. *Economics Letters*, 124, 122-126.
- Basak, D., & Wang, L. F. S. (2016). Endogenous choice of price or quantity contract and the implications of two-part-tariff in a vertical structure. *Economics Letters*, 138, 53-56.
- Binmore, K., Rubinstein, A. & Wolinsky, A. (1986). The Nash bargaining solution in economic modelling. *RAND Journal of Economics*, 17, 176-188.

- Chirco, A., Scrimatore, M., & Colombo, C. (2011). Competition and the strategic choice of managerial incentives: the relative performance case. *Metroeconomica*, 62, 533-547.
- Chirco, A., & Scrimatore, M. (2013). Choosing price or quantity? The role of delegation and network externalities. *Economics Letters*, 121, 482-486.
- Correa-López, M. (2007). Price and quantity competition in a differentiated duopoly with upstream suppliers. *Journal of Economics & Management Strategy*, 169, 469-505.
- 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.
- Davidson, C. (1988). Multiunit bargaining in oligopolistic industries. *Journal of Labor Economics*, 6, 397-422.
- Dixit, A. (1979). A model of duopoly suggesting a theory of entry barriers. *Bell Journal of Economics*, 10, 20-32.
- Dowrick, S. J. (1989). Union-oligopoly bargaining. *Economic Journal*, 99, 1123-1142.
- Fanti, L., & Meccheri, N. (2013). Managerial delegation under alternative unionization structures. *Labour*, 27, 38-57.
- Fanti, L., & Meccheri, N. (2015). On the Cournot-Bertrand profit differential and the structure of unionisation in a managerial duopoly. *Australian Economic Papers*, 54, 266-287.
- Fershtman, C. (1985). Managerial incentives as a strategic variable in duopolistic environment. *International Journal of Industrial Organization*, 3, 245-253.
- Fershtman, C., & Judd, K. (1987). Equilibrium incentives in oligopoly. *American Economic Review*, 77, 927-940.
- Horn, H., & Wolinsky, A. (1988). Bilateral monopolies and incentives for merger. *RAND Journal of Economics*, 19, 408-419.
- Lambertini, L. (2000). Strategic delegation and the shape of market competition. *Scottish Journal of Political Economy*, 47, 550-570.
- Matsumura, T., & Ogawa, A. (2012). Price versus quantity in a mixed duopoly. *Economics Letters*, 116, 174-177.
- Meccheri, N., & Fanti, L. (2014). Managerial delegation contracts under centralized unionization. *Managerial and Decision Economics*, 35, 51-66.
- Miller, N., & Pazgal, A. (2002). Relative performance as a strategic commitment mechanism. *Managerial and Decision Economics*, 23, 51-68.
- Mukherjee, A., Broll, S., & Mukherjee, S. (2012). Bertrand versus Cournot competition in a vertical structure: a note. *The Manchester School*, 80, 545-559.
- Pal, R. (2015). Cournot vs. Bertrand under relative performance delegation: implications of positive and negative network externalities. *Mathematical Social Sciences*, 75, 94-101.

Scrimitore, M. (2013). Price or quantity? The strategic choice of subsidized firms in a mixed duopoly. *Economics Letters*, 118, 337-341.

Singh, N., & Vives, X. (1984). Price and quantity competition in a differentiated duopoly. *RAND Journal of Economics*, 15, 546-554.

Sklivas, S. (1987). The strategic choice of managerial incentives. *RAND Journal of Economics*, 18, 452-458.

Tremblay, V. J., Tremblay, C. H., & Isariyawongse, K. (2013). Endogenous timing and strategic choice: the Cournot-Bertrand model. *Bulletin of Economic Research*, 65, 332-342.

van Witteloostuijn, A., Jansen, T., & van Lier, A. (2007). Bargaining over managerial contracts in delegation games: managerial power, contract disclosure and cartel behavior. *Managerial and Decision Economics*, 28, 897-904.

Vickers, J. (1985). Delegation and the theory of the firm. *Economic Journal*, 95, 138-147.

Zanchettin, P. (2006). Differentiated duopoly with asymmetric costs. *Journal of Economics & Management Strategy*, 15, 999-1015.