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Ohnishi, Kazuhiro

July 2024

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Kazuhiro Ohnishi*

Institute for Economic Sciences, Japan

**Abstract**

This paper explores a price-setting oligopoly game where labor-managed firms have the option to provide lifetime employment as a strategic commitment. The game unfolds in two stages. In the first stage, each firm independently and simultaneously decides whether to provide lifetime employment as a strategic commitment. If a firm provides lifetime employment, then it chooses an output level and establishes a lifetime employment agreement with the required number of employees to reach the output level. In the second stage, each firm independently and simultaneously selects a price level to maximize its objective function value. At the conclusion of the second stage, the market opens, and each firm sells at its own price. The paper delves into the equilibrium of the labor-managed Bertrand oligopoly game. The analysis reveals that the equilibrium aligns with the Bertrand solution when no lifetime employment is offered. Consequently, the paper concludes that using lifetime employment as a strategic commitment device is not advantageous for labor-managed firms in the price-setting competition.

Keywords: Labor-managed firm; Lifetime employment; Price-setting model; Substitute goods

JEL classification: C72; D21; L13

* Email: ohnishi@e.people.or.jp

# 1. Introduction

The following research provides practical examples of the differences between labor-managed and capitalist firms. Jones and Backus (1977) studied British labor-managed firms in the footwear industry and found that compared to capitalist firms, labor-managed firms operate at a relatively low scale of output and size, and they tend to underinvest and use less capital per worker. Furthermore, Bartlett et al. (1992) examined the differences in behavior between capitalist firms and labor-managed firms in a matched sample of the two organizational types in North-Central Italy. They found that labor-managed firms tend to have higher productivity, more labor-intensive production methods, lower income differentials, and a more peaceful industrial relations environment than capitalist firms. Labor-managed firms are currently observed in most countries around the world and have been the subject of empirical examination (see, for example, De Reuver et al., 2021; Fakhfakh, Pérotin, and Gago, 2012; Kotliarov, 2022; Maietta and Sena, 2008; Marshall, 2003; McLeod, 2022; Novkovic and Sena, 2007; Podivinsky and Stewart, 2007).

The groundbreaking theoretical analysis of a labor-managed firm was first introduced by Ward in 1958. Since then, the behavior of labor-managed firms has been a topic of interest for many economists. For instance, Zhang (1993) and Haruna (1996) applied the frameworks of entry deterrence by Dixit (1980) and Bulow, Geanakoplos, and Klemperer (1985) to labor-managed industries and demonstrated that labor-managed incumbents are more inclined to maintain excess capacity to deter entry than their profit-maximizing counterparts. Lambertini and Rossini (1998) studied the behavior of labor-managed firms in a two-stage Cournot duopoly model with strategic capital interaction and found that labor-managed firms make their capital commitments based on the interest rate level, which is a departure from the usual behavior observed when only profit-maximizing firms operate in the market. Goel and Haruna (2007) utilized a two-stage duopoly game model of cost-reducing R&D investment with spillovers to explore the strategic interactions between labor-managed firms. Their findings indicate that the effects of changes in research spillovers on employment

(output) are contingent on the nature of the underlying production technology. Luo (2013) developed a two-stage game model centered on cost-reducing R&D with spillover and absorptive capacity. Luo's examination of the strategic interactions of output, R&D investment, and social welfare in a mixed duopoly involving a labor-managed and a profit-maximizing firm suggests that the labor-managed firm employs fewer workers and produces less output while investing more in R&D than the profit-maximizing firm. Ho, Hoang, and Wilson (2021) investigated the impact of R&D rivalry between a profit-maximizing capitalist firm and a labor-managed firm in an international market. Their study shows that increased investment in R&D activities can benefit the labor-managed firm by boosting its share in the international market and reducing the market share of the profit-maximizing capitalist firm.

Ohnishi's (2007) study uses a model where two labor-managed firms can strategically commit to wage-increase contracts in a market with substitute goods. In the first stage, each firm independently decides whether to adopt the wage-rise contract policy (WRCP) as a strategic commitment device. If a firm adopts WRCP, it decides an output level and a wage premium rate. The firm agrees to pay each employee a wage premium uniformly, provided that it actually produces more than the chosen output. In the second stage, each firm independently chooses and sells its actual output. The study shows that there is an equilibrium where at least one labor-managed firm adopts WRCP. Ohnishi (2019) considers a two-stage Cournot oligopoly model with complementary goods. Here, labor-managed firms can offer WRCP as a strategic commitment device. The study shows that at equilibrium, none of the labor-managed firms offers this commitment device. Ohnishi (2012) examines a duopoly model where two labor-managed firms compete against each other. Each firm must choose output either in the first or second period. If the firms decide to choose output in the same period, a simultaneous move game occurs. If the firms decide to choose output in different periods, a sequential move game arises. The study shows that there is no equilibrium where the firms choose output in the same period. Ohnishi (2022)

examines a three-stage oligopoly game model with a concave demand function. Here, labor-managed firms compete in quantities with each other. In the first stage, each firm simultaneously and independently chooses the corporate social responsibility (CSR) level. In the second stage, each firm simultaneously and independently chooses whether to offer lifetime employment as a strategic commitment device. In the third stage, quantity competition takes place. The study shows that the reaction functions of labor-managed firms can be both upward and downward sloping. Ohnishi (2024) investigates a duopoly game model where two labor-managed firms compete in quantities. In the first stage, each firm independently and simultaneously chooses the CSR level. In the second stage, each firm independently and simultaneously chooses whether to offer WRCP as a strategic commitment device. At the end of the game, each firm independently and simultaneously chooses an actual output. The study shows that there is an equilibrium where each labor-managed firm does not use CSR as a business strategy.

Lambertini (2001) conducted an analysis of a spatial differentiation duopoly model, demonstrating that if both firms are labor-managed, a symmetric subgame perfect equilibrium in pure strategies exists. Cellini and Lambertini (2006) adopted a differential game approach to explore the dynamic behavior of labor-managed firms in the context of price stickiness. Their findings indicate that, assuming the membership of labor-managed firms is predetermined, the steady-state equilibrium allocation achieved by an oligopoly of labor-managed firms mirrors that of an oligopoly of profit-maximizing firms. This outcome is consistent under both open-loop and memoryless closed-loop information structures. Kalashnikov et al. (2015) introduced a mixed duopoly model consisting of a labor-managed firm and a profit-maximizing capitalist firm. They investigated the existence and uniqueness of the consistent conjectural variations equilibrium in this model, concluding that under certain conditions, this equilibrium is both existent and unique. Kalashnykova et al. (2022) proposed an oligopoly model within the consistent conjectural variations framework, where a labor-managed firm competes with profit-maximizing capitalist firms. In this model,

production costs are represented as quadratic functions, and consumer demand is depicted as a discontinuous function. They demonstrated the existence and uniqueness of the consistent conjectural variations equilibrium in this model.

Okuguchi (1986) conducted a comparison of the Bertrand and Cournot equilibrium prices for labor-managed oligopolies under product differentiation. The study revealed that Cournot equilibrium prices are not lower than those of Bertrand. In a separate study, Okuguchi (1993) examined two models of duopoly with product differentiation, both involving only labor-managed firms. In one model, the firms' strategies were based on outputs (labor-managed Cournot duopoly), while in the other, prices became the strategic variables (labor-managed Bertrand duopoly). The study found that under general conditions, reaction functions are upward-sloping in both labor-managed Bertrand and Cournot duopolies with product differentiation. Ireland (2003) compared the behavior of profit-maximizing firms with that of labor-managed firms in Bertrand oligopoly competition. The findings indicated that labor-managed firms tend to price lower than profit-maximizing firms. Ohnishi (2010) introduced a price-setting oligopoly model where labor-managed firms could offer retroactive most-favored-customer policies as a strategic tool. The study demonstrated the effects of the retroactive most-favored-customer policy, concluding that this policy helps sellers cooperate because it enables both firms to offer higher prices and to enjoy higher objective function values.

In this paper, we explore the effectiveness of offering lifetime employment as a strategic commitment. Ohnishi (2013) proposed a three-stage Cournot duopoly model involving two identical labor-managed firms. If a firm provides lifetime employment, then it chooses an output level and establishes a lifetime employment agreement with the required number of employees to reach the output level. In the first stage, one of the labor-managed firms is permitted to offer lifetime employment. In the second stage, the other labor-managed firm is given the same opportunity. In the third and final stage, both firms independently and simultaneously decide their actual outputs. The findings suggest that incorporating lifetime

employment as a strategic commitment into the analysis of the quantity-setting labor-managed duopoly model proves beneficial for both firms.

We examine a two-stage Bertrand oligopoly game involving labor-managed firms that aim to maximize profit per worker. The game unfolds as follows: In the first stage, each firm independently and simultaneously decides whether to offer lifetime employment as a strategic commitment device. In the second stage, each firm independently and simultaneously decides a price level to maximize its objective function value. At the conclusion of the second stage, the market opens, and each firm sells at its own price. We delve into the equilibrium of the labor-managed Bertrand oligopoly game.

The rest of this paper is structured as follows: In Section 2, we introduce a model. Section 3 presents the equilibrium of the model. Finally, Section 4 provides the conclusion of the paper.

# 2. Model

We consider a price-setting oligopoly model where there are $n(\geq 2)$ labor-managed profit-per-worker-maximizing firms. The timing of the model runs as follows. In the first stage, each firm decides simultaneously and independently whether to enter into a lifetime employment contract with its employees. If firm $i$ $(i = 1, 2, ..., n)$ provides lifetime employment, then it chooses output $q_i^*$. Firm $i$ also employs the number of employees necessary to achieve $q_i^*$ and legally enters into a lifetime employment contract with all of the employees.[1] In the second stage, each firm chooses $p_i$ simultaneously and independently to maximize its objective function value. At the end of the second stage, the market opens and firm *i* sells its output at $p_i$. Therefore, firm *i*'s objective function is given by

[1] For details, see Ohnishi (2001, 2006).

$$\omega_i = \begin{cases} \dfrac{p_i q_i(p_1, p_2, ..., p_n) - v_i q_i(p_1, p_2, ..., p_n) - f_i}{l_i(q_i(p_1, p_2, ..., p_n))} & \text{if } q_i(p_1, p_2, ..., p_n) > q_i^*, \\ \dfrac{p_i q_i(p_1, p_2, ..., p_n) - (v_i - r_i) q_i(p_1, p_2, ..., p_n) - r_i q_i^* - f_i}{l_i(q_i(p_1, p_2, ..., p_n))} & \text{if } q_i(p_1, p_2, ..., p_n) \le q_i^*, \end{cases} \quad (1)$$

where $q_i$ denotes firm $i$'s demand function, $v_i \in (0, \infty)$ is firm $i$'s marginal production cost, $r_i \in (0, \infty)$ is firm $i$'s wage cost per unit of output, $f_i \in (0, \infty)$ is firm $i$'s fixed cost, and $l_i$ is the amount of labor in firm $i$.

Throughout this paper, we adopt subgame perfection as our equilibrium concept. We assume that there is a unique equilibrium and that each firm's price, output and profit per worker are positive in the equilibrium. The following assumptions are made.

Assumption 1: $\partial q_i / \partial p_i < 0$.

Assumption 2: $\partial q_i / \partial p_j > 0$. $(i, j = 1, 2, ..., n; i \neq j)$.

Assumption 3: $\partial^2 q_i / \partial p_i \partial p_j = 0$.

Assumption 4: $\left|\partial q_i / \partial p_i\right| > \sum_{j \neq i} \left|\partial q_i / \partial p_j\right|$.

Assumption 5: $dl_i / dq_i > 0$ and $d^2 l_i / dq_i^2 \ge 0$.

Assumption 1 states that demand is downward-sloping. Assumption 2 states that goods are substitutes. Assumptions 1-3 mean that $q_i$ is smooth. Assumption 4 means that firm $i$'s own effects of price on demand exceed firm $j$'s cross effects. Assumption 5 means that the marginal quantity of labor used is positive and non-decreasing. These assumptions are fairly standard in price-setting oligopoly games.

Given $p_{-1} = (p_1, p_2, ..., p_{i-1}, p_{i+1}, ..., p_n)$, firm $i$ maximizes its objective function value with respect to $p_i$. If $q_i > q_i^*$, then its Bertrand reaction function is defined by

$$R_i^N(p_{-i}) = \arg\max_{\{p_i \ge 0\}} \left[ \frac{p_i q_i(p_1, p_2, ..., p_n) - v_i q_i(p_1, p_2, ..., p_n) - f_i}{l_i(q_i(p_1, p_2, ..., p_n))} \right], \quad (2)$$

and if $q_i \le q_i^*$, then its Bertrand reaction function is defined by

$$R_i^L(p_{-i}) = \arg\max_{\{p_i \ge 0\}} \left[ \frac{p_i q_i(p_1, p_2, ..., p_n) - (v_i - r_i) q_i(p_1, p_2, ..., p_n) + r_i q_i^* - f_i}{l_i(q_i(p_1, p_2, ..., p_n))} \right]. \quad (3)$$

Therefore, if firm $i$ chooses $q_i^*$, then its best response is as follows:

$$R_i(p_{-i}) = \begin{cases} R_i^L(p_{-i}) & \text{if } q_i(p_1, p_2, ..., p_n) < q_i^*, \\ q_i^* & \text{if } q_i(p_1, p_2, ..., p_n) = q_i^*, \\ R_i^N(p_{-i}) & \text{if } q_i(p_1, p_2, ..., p_n) > q_i^*. \end{cases} \quad (4)$$

The adoption of lifetime employment by firm $i$ creates kinks in its best response at the level of $p_i^*$.

# 3. Equilibrium

We begin by proving the following lemmas.

Lemma 1: If firm $i$ establishes a lifetime employment contract with all the necessary employees to reach $q_i^*$, then its optimal quantity is equal to $q_i^*$.

Proof: First, consider the possibility that firm $i$'s optimal quantity is lower than $q_i^*$. In this case, firm $i$'s objective function is $\omega_i^L = \left[ p_i q_i - (v_i - r_i) q_i - r_i q_i^* - f_i \right] / l_i$. This equation can be rewritten as follows: $\omega_i^L = \left[ p_i q_i - v_i q_i - r_i (q_i^* - q_i) - f_i \right] / l_i$. Here, firm $i$ employs the extra employees necessary to produce $q_i^* - q_i$. That is, firm $i$ can improve its objective function value by reducing $q_i^*$, and the equilibrium solution does not change in $q_i \le q_i^*$. Hence, this case does not result in an equilibrium.

Next, consider the possibility that firm $i$'s optimal quantity exceeds $q_i^*$. Firm $i$'s objective function is $\omega_i^N = \left[ p_i q_i - v_i q_i - f_i \right] / l_i$. It is impossible for firm $i$ to change its output level in equilibrium because such a strategy is not credible. Hence, the lifetime employment contract does not function as a strategic commitment device. Q.E.D.

Lemma 2: Firm $i$'s optimal price is lower when it offers lifetime employment than when it does not.

Proof: Suppose that firm $i$ offers lifetime employment. In the first equation of (1), the first order condition for firm $i$ is

$$\left( q_i + p_i \frac{\partial q_i}{\partial p_i} - v_i \frac{\partial q_i}{\partial p_i} \right) l_i - \left( p_i q_i - v_i q_i - f_i \right) \frac{dl_i}{dq_i} \frac{\partial q_i}{\partial p_i} = 0 , \tag{5}$$

and in the second equation of (1), the first order condition for firm $i$ is

$$\left( q_i + p_i \frac{\partial q_i}{\partial p_i} - v_i \frac{\partial q_i}{\partial p_i} + r_i \frac{\partial q_i}{\partial p_i} \right) l_i - \left( p_i q_i - v_i q_i + r_i q_i - r_i q_i^* - f_i \right) \frac{dl_i}{dq_i} \frac{\partial q_i}{\partial p_i} = 0 . \tag{6}$$

Lemma 1 shows that if firm $i$ offers lifetime employment, its optimal quantity is equal to $q_i^*$. Hence, in (6), $q_i$ is equal to $q_i^*$. Furthermore, $r_i$ is positive, and $\partial q_i / \partial p_i$ is negative (Assumption 1). Thus, this lemma is proved. Q.E.D.

These lemmas provide characterizations of lifetime employment as a strategic commitment device.

We now discuss the equilibrium of the model formulated in the previous section.

We present the following proposition.

Proposition 1: In the labor-managed Bertrand oligopoly game, if one firm unilaterally offers lifetime employment, then each firm's objective function value becomes lower than in the Bertrand solution with no lifetime employment.

Proof: From Assumptions 2 and 3, $\partial^2 \omega_i^N / \partial p_i \partial p_j = \partial^2 \omega_i^L / \partial p_i \partial p_j = l_i \, \partial q_i / \partial p_j > 0$. Hence, both $R_i^N(p_{-i})$ and $R_i^L(p_{-i})$ are upward sloping. Lemma 2 states that firm $i$'s optimal price is lower when it offers lifetime employment than when it does not. Hence, decreasing $p_i$ decreases $p_j$, and decreasing $p_j$ decreases $p_i$. Thus, Proposition 1 is derived. Q.E.D.

Proposition 1 states that the unilateral lifetime employment commitment generates a lower objective function value for each firm than in the Bertrand solution with no lifetime employment.

The equilibrium of the price-setting game is shown in the following proposition.

Proposition 2: In the labor-managed Bertrand oligopoly game, the equilibrium coincides with the Bertrand solution with no lifetime employment.

Proof: If one firm unilaterally offers lifetime employment, each firm's objective function value decreases compared to the Bertrand solution without lifetime employment (Proposition 1). In the following, we show that if more than one firm offers lifetime employment, each firm's objective function value decreases compared to the Bertrand solution without lifetime employment. From Assumptions 2 and 3, $\partial^2 \omega_i^N / \partial p_i \partial p_j = \partial^2 \omega_i^L / \partial p_i \partial p_j = l_i \, \partial q_i / \partial p_j > 0$, and $\partial^2 \omega_j^N / \partial p_j \partial p_i = \partial^2 \omega_j^L / \partial p_j \partial p_i = l_j \, \partial q_j / \partial p_i > 0$. In the price-setting game with substitute goods, firm $i$'s demand decreases at its own price (Assumption 1) and increases at firm $j$'s price (Assumption 2), and the effect of firm $i$'s own price on demand is greater than the effect of firm $j$'s price (Assumption 4). Both $R_i^N(p_{-i})$ and $R_i^L(p_{-i})$ are upward sloping. In the case where firm $j$ provides lifetime employment, if firm $i$ also provides lifetime employment and lowers its price (Lemma 2), then firm $j$'s amount demanded and its objective function value decrease because of substitute goods, and firm $j$'s price goes down. A drop in firm $j$'s price decreases firm $i$'s objective function value. Thus, Proposition 2 follows. Q.E.D.

Proposition 2 means that neither firm offers lifetime employment in the equilibrium of the labor-managed Bertrand oligopoly game.

# 4. Conclusion

We have examined a price-setting oligopoly game in which labor-managed firms can offer lifetime employment as a strategic commitment device and have shown that the equilibrium coincides with the Bertrand solution with no lifetime employment. As a result, we have found that lifetime employment as a strategic commitment device is not beneficial for labor-managed firms in the price-setting oligopoly game.

# References


Bartlett, W., Cable, J., Estrin, S., Jones, D. C., Smith, S. C., 1992. Labor-managed cooperatives and private firms in North Central Italy: an empirical comparison. Industrial and Labor Relations Review, 46 (1), 103-118.

Bulow, J., Geanakoplos, J., Klemperer, P., 1985. Holding idle capacity to deter entry. Economic Journal 95 (377), 178-182.

Cellini, R., Lambertini, L., 2006. Differential game-theoretical analysis and industrial policy. In Bianchi, P. and Labory, S. (eds.), International Handbook on Industrial Policy (pp. 415-431). Cheltenham, UK: Edward Elgar Publishing.

De Reuver, R., Kroon, B., Olabarria, D. M., Iñurritegui, U. E., 2021. Employee satisfaction in labor-owned and managed workplaces: helping climate and participation spillover to non-owners. Sustainability 13 (6), 3278.

Dixit, A. K., 1980. The role of investment in entry-deterrence. Economic Journal 90 (357), 95-106.

Fakhfakh, F., Pérotin, V., Gago, M., 2012. Productivity, capital, and labor in labor-managed and conventional firms: an investigation on French data. ILR Review 65 (4), 847-879.

Goel, R. K., Haruna, S., 2007. Cooperative and noncooperative R&D with spillovers: the case of labor-managed firms. Economic Systems 31 (4), 423-440.

Haruna, S., 1996. A note on holding excess capacity to deter entry in a labour-managed industry. Canadian Journal of Economics, 29 (2), 493-499.

Ho, J. C., Hoang, V.-N., Wilson, C., 2021. Government R&D subsidies and international competitiveness of labor-managed firms. Heliyon 7 (2), e06054.

Ireland, N. J., 2003. Random pricing by labor-managed firms in markets with imperfect consumer information. Journal of Comparative Economics 31 (3), 573-583.

Jones, D. C., Backus, D. K., 1977. British producer cooperatives in the footwear industry: an empirical evaluation of the theory of financing. Economic Journal 87 (347), 488-510.

Kalashnikov, V., Kalashnikov-Jr, V., Arévalo Franco, A., Castillo-Pérez, F. J., 2015. Consistent conjectural variations equilibrium in a mixed oligopoly with a labor input function. In Ohnishi, K. (ed.), Firms' Strategic Decisions: Theoretical and Empirical Findings, Volume 1 (pp. 114-138). Sharjah, UAE: Bentham Science Publishers.

Kalashnykova, N., Kalashnikov, V., Watada, J., Flores-Muñiz, J. G., Anwar, T., Lin, P.-C. 2022. Consistent conjectural variations equilibrium in a mixed oligopoly model with a labor-managed company and a discontinuous demand function. IEEE Access 10 (1), 107799-107808.

Kotliarov, I. (2022). A taxonomy of business organizations: transport industry and beyond. Transportation Research Procedia 63, 2165-2171.

Laffont, J. J., Moreaux, M., 1985. Large-market Cournot equilibria in labour-managed economies. Economica 52 (206), 153-165.

Lambertini, L., 2001. Spatial competition with profit-maximising and labour-managed firms. Papers in Regional Science 80 (4), 499-507.

Lambertini, L., Rossini, G., 1998. Capital commitment and Cournot competition with labour-managed and profit-maximising firms. Australian Economic Papers 37 (1), 14-21.

Luo, J., 2013. Absorptive capacity and R&D strategy in mixed duopoly with labor-managed and profit-maximizing firms. Economic Modelling 31 (2), 433-439.

Maietta, O. W., Sena, V., 2008. Shadow price of capital and the Furubotn–Pejovich effect: some empirical evidence for Italian wine cooperatives. Applied Stochastic Models in Business and Industry 24 (5), 495-505.

Marshall, R. C., 2003. The culture of cooperation in three Japanese worker cooperatives. Economic and Industrial Democracy 24 (4), 543-572.

McLead, C. M., 2022. Are athlete-owned leagues a viable alternative for professional sport? Journal of Sport and Social Issues 46 (1), 51-74.

Novkovic, S., Sena, V. (eds.), 2007. Cooperative Firms in Global Markets, Bingley, UK: Emerald Publishing Limited.

Ohnishi, K., 2001. Lifetime employment contract and strategic entry deterrence: Cournot and Bertrand. Australian Economic Papers 40 (1), 30-43.

Ohnishi, K., 2006. Bertrand games with lifetime employment contracts as a strategic commitment. Manchester School 74 (5), 549-557. (ERRATUM, Manchester School 74 (6), 729).

Ohnishi, K., 2007. Wage-rise contract and Cournot competition with labor-managed firms. Rivista di Politica Economica 97 (3), 17-31.

Ohnishi, K., 2010. Most-favoured-customer pricing and labour-managed oligopoly. Journal of Industry, Competition and Trade 10 (1), 33-40.

Ohnishi, K., 2012. Endogenous leadership in a labor-managed duopoly. Journal of Game Theory 1 (4), 25-28.

Ohnishi, K., 2013. A three-stage labour-managed Cournot duopoly with lifetime employment as a strategic commitment. Frontiers in Finance and Economics 10 (1), 87-99.

Ohnishi, K., 2019. Wage-rise contract and labour-managed Cournot oligopoly with complementary goods. East-West Journal of Economics and Business, 22 (1), 29-40.

Ohnishi, K., 2022. Corporate social responsibility and reaction functions of labor-managed firms with lifetime employment as strategic commitment. International Journal of

Management, Accounting and Economics 9 (8), 542-549.

Ohnishi, K., 2024. Corporate social responsibility and labor-managed duopoly with wage rise as strategic commitment. International Journal of Management, Accounting and Economics 11 (5), 599-610.

Okuguchi, K., 1986. Labor-managed Bertrand and Cournot oligopolies. Journal of Economics 46 (2), 115-122.

Okuguchi, K., 1993. Follower's advantage in labor-managed duopoly. Keio Economic Studies 30 (2), 1-5.

Podivinsky, V. K., Stewart, G., 2007. Why is labour-managed firm entry so rare? An analysis of UK manufacturing data. Journal of Economic Behaviour and Organisation 63 (1), 177-192.

Ward, N., 1958. The firm in Illyria: market syndicalism. American Economic Review 48 (4), 566-589.

Zhang, J., 1993. Holding excess capacity to deter entry in a labour-managed industry. Canadian Journal of Economics 26 (1), 222-234.