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Unilateral decisions to hire managers in a mixed duopoly with a foreign labour-managed competitor

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Abstract

Numerous studies examine the strategic decisions regarding managerial incentive contracts within private oligopoly markets. Several studies also delve into managerial incentives within mixed oligopoly markets, where state-owned public firms with economic welfare objectives compete against capitalist private firms focused on profit objectives. Additionally, several recent studies consider international mixed oligopoly markets with foreign capitalist firms. For example, one study examines the decisions of firms to hire managers when a state-owned public firm competes with a foreign capitalist firm, indicating that in equilibrium, both firms hire managers, leading to higher domestic economic welfare compared to a scenario where neither firm hires a manager. However, these studies typically focus on mixed oligopoly markets where state-owned firms compete with capitalist firms and do not consider the presence of labour-managed firms. In this paper, we investigate the firms' decisions to hire managers when a state-owned firm competes with a foreign labour-managed firm. We reveal that our equilibrium outcomes coincide with the equilibrium where neither firm hires a manager.

Keywords: State-owned public firm; Foreign labour-managed firm; Managerial delegation; International mixed duopoly; Cournot model
JEL classification: C72, D21, L30

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1. Introduction

Numerous studies investigate the strategic decisions regarding managerial incentive contracts in private oligopoly markets. For instance, The analyses by Fershtman and Judd (1987), Sklivas (1987), Fumas (1992), Basu (1995), Miller and Pazgal (2002), and Kräkel (2002) investigate two-stage delegation games wherein, during the initial stage, profit-maximising owners determine the incentive schemes for their managers. In the subsequent stage, each manager selects the strategy that maximises his utility based on his incentive scheme and his rival's behaviour. Each study demonstrates that owners employ incentive schemes to influence their managers' behaviour, thereby altering the equilibrium outcome. Miller and Pazgal (2001) explore a two-stage duopoly model where, in the second stage, managers compete either both in prices, both in quantities, or one in price and the other in quantity. They show that if owners have sufficient control over their managers' behaviour, the equilibrium solutions remain the same regardless of how firms compete in the second stage. Xu and Lee (2023) investigate the impact of consumers' willingness to pay for environmentally friendly products on dual managerial delegation contracts, which include both sales and environmental incentives. Their findings indicate that Cournot firms aiming to maximise profit establish higher sales incentives and lower environmental incentives compared to profit-maximising Bertrand firms. There are also numerous other noteworthy papers (for example, see Park, 2002; Miller and Pazgal, 2005; Mujumdar and Pal, 2007; Pal, 2012; Poyago-Theotoky and Yong, 2019; Xu, Yin and Lee, 2024). These studies investigate the strategic decisions concerning managerial incentive contracts in private oligopoly markets.

Several papers have been published on the study of mixed oligopoly models that include both state-owned and capitalist firms. For example, White (2001) explores managerial incentives in a mixed oligopoly market where a state-owned firm with economic welfare objectives competes against capitalist firms with profit objectives. It is shown that in equilibrium, only capitalist firms employ managers. Bárcena-Ruiz (2010) examines a mixed duopoly model in which a capitalist firm competes against a firm that is owned jointly by both the public and private sectors. The following three-stage situation is considered. In stage one, each owner decides whether or not to hire a manager. In stage two, the owners who hired managers select incentive parameters. In stage three, the managers or, in their absence, the owners simultaneously and independently choose the firms' output levels. He shows that

if the firms are equally efficient, then at equilibrium, both firms hire managers. Bárcena-Ruiz (2009) investigates firms' decisions as to whether or not to hire managers when there is a state-owned firm competing with a capitalist firm. It is shown that both firms hire managers under Bertrand competition with heterogeneous goods. However, economic welfare is lower if both firms hire managers than if neither firm does. Ohnishi (2021) examines a price-setting mixed duopoly model in which a state-owned firm and a capitalist firm produce complementary goods and shows that there exist two equilibrium outcomes: only the state-owned firm hires a manager, and neither firm hires a manager.

Several recent studies consider international mixed oligopoly markets with foreign capitalist firms. For instance, Fernández-Ruiz (2009) examines the decisions of firms to hire managers when a state-owned public firm competes against a foreign capitalist firm. He demonstrates that in equilibrium, both firms hire managers, resulting in a higher level of domestic economic welfare compared to the scenario where neither firm hires a manager. Ouattara (2016) examines the endogenous choice of managerial incentives in a mixed duopoly where a state-owned firm competes against a foreign capitalist firm. Domestic investors partly own the foreign capitalist firm. It is shown that when the weight attached to the foreign capitalist firm's profits in domestic economic welfare is high enough, only the state-owned firm hires a manager. Ohnishi (2014) analyses firms' decisions to hire managers when a state-owned firm competes with a foreign capitalist firm and shows that there exists an equilibrium in which neither firm hires a manager. It is found that the state-owned firm aggressively acting against the foreign capitalist firm does not lead to domestic welfare maximisation. Ohnishi (2018a) investigates an international mixed duopoly market in which a state-owned firm competes on price against a foreign capitalist firm and demonstrates that there exists an equilibrium solution in which only the foreign capitalist firm hires a manager. These studies typically focus on mixed oligopoly markets where state-owned firms compete with capitalist firms and do not consider the presence of labour-managed firms.

Several studies introduce labour-managed firms into the picture. For example, Stewart (1992) examines a Cournot mixed duopoly model where a capitalist firm competes with a labour-managed firm and shows that managerial discretion may lead to a greater reduction in the capitalist firm's profits compared to the profit-maximising duopoly. Ohnishi (2018b) examines the equilibrium outcomes of firms' decision games to hire managers when there is a capitalist firm competing against a labour-managed firm and shows that if only the capitalist firm hires a manager, then the equilibrium coincides with the solution when neither

firm hires a manager. In addition, it is shown that if only the labour-managed firm hires a manager, then at equilibrium, the capitalist firm's output and the market price are lower than when neither firm hires a manager. Ohnishi (2020) examines the managerial incentive contract when a state-owned firm competes with a labour-managed firm and demonstrates that the managerial incentive contract is not profitable for the firms.

In this paper, we examine an international mixed duopoly model in which a foreign labour-managed firm competes against a state-owned public firm. We consider three games: neither firm hires a manager, only the state-owned firm hires a manager, and only the labour-managed firm hires a manager. Our primary purpose is to show the equilibrium outcomes of these three games.

The rest of this paper is organised as follows. In Section 2, we describe the basic model. Section 3 examines the three games and presents the equilibrium of each game. Finally, Section 4 concludes the paper.

2. Basic model

Consider a model comprising a state-owned public firm (firm S) and a foreign labour-managed firm (firm FL). Throughout this paper, subscripts 'S' and 'FL' denote firm S and firm FL, respectively. Each firm can hire one manager to make its production decisions. We consider no possibility of entry or exit. The firms produce perfectly substitutable commodities. The market price is determined by the following equation: $P = 10 - Q$, where $Q = q_{\mathrm{S}} + q_{\mathrm{FL}}$ denotes the aggregate quantity.

Firm i's profit is given by

$$\pi_i(q_i, q_j) = P(q_i, q_j)q_i - \frac{1}{2}q_i^2 - f_i, \qquad (i, j = \mathrm{S}, \mathrm{FL}; i \neq j), \tag{1}$$

where f denotes the fixed cost.

Domestic economic welfare (W) is given by

$$W(q_{\mathrm{S}}, q_{\mathrm{FL}}) = \frac{(q_{\mathrm{S}} + q_{\mathrm{FL}})^2}{2} + P(q_{\mathrm{S}}, q_{\mathrm{FL}})q_{\mathrm{S}} - \frac{1}{2}q_{\mathrm{S}}^2 - f_{\mathrm{S}}. \tag{2}$$

Firm S aims to maximise equation (2).

Firm FL seeks to maximise profit per worker:

$$\varphi_{\mathrm{FL}}(q_{\mathrm{S}}, q_{\mathrm{FL}}) = \frac{P(q_{\mathrm{S}}, q_{\mathrm{FL}})q_{\mathrm{FL}} - q_{\mathrm{FL}}^2/2 - f_{\mathrm{FL}}}{l_{\mathrm{FL}}}, \tag{3}$$

where l_{FL} denotes the amount of labour employed by firm FL. We assume $l_{\mathrm{FL}} = q_{\mathrm{FL}}$. Therefore, equation (3) can be rewritten as follows:

$$\varphi_{\mathrm{FL}}(q_{\mathrm{S}}, q_{\mathrm{FL}}) = \frac{P(q_{\mathrm{S}}, q_{\mathrm{FL}})q_{\mathrm{FL}} - q_{\mathrm{FL}}^2/2 - f_{\mathrm{FL}}}{q_{\mathrm{FL}}}. \tag{4}$$

Without loss of generality, we assume $f_i = 1$ $(i = \mathrm{S}, \mathrm{FL})$.

Firm i can hire an able manager to make its production decisions. Manager S aims to maximise the following function:

$$M_{\mathrm{S}} = \lambda_{\mathrm{S}} W(q_{\mathrm{S}}, q_{\mathrm{FL}}) + (1 - \lambda_{\mathrm{S}}) P(q_{\mathrm{S}}, q_{\mathrm{FL}}) q_{\mathrm{S}}, \tag{5}$$

and manager FL aims to maximise the following function:

$$M_{\mathrm{FL}} = \lambda_{\mathrm{FL}} W(q_{\mathrm{S}}, q_{\mathrm{FL}}) + (1 - \lambda_{\mathrm{FL}}) P(q_{\mathrm{S}}, q_{\mathrm{FL}}) q_{\mathrm{FL}}, \tag{6}$$

where $\lambda_i \in [0,1]$ denotes the incentive parameter that firm i chooses to maximise its objective.

We consider the following two-stage game. In the first stage, manager i $(i = \mathrm{S}, \mathrm{FL})$ sets the level of λ_i. In the second stage, the firms compete in Cournot fashion. We adopt subgame perfection as an equilibrium concept and solve the game by backward induction.

3. Equilibrium outcomes

In this section, we examine the following three games:

Game 1: Neither firm hires a manager.

Game 2: Only firm S hires a manager.

Game 3: Only firm FL hires a manager.

We discuss these games in order.

Game 1

In the second stage, firm S maximises domestic economic welfare given by (2), while firm FL maximises the objective function value given by (4). The simultaneous solution of these problems yields:

$q_{\mathrm{S}}^n = 5$,

$$q_{\mathrm{FL}}^{n} = \frac{\sqrt{6}}{3},$$

where the superscript '*n*' represents the equilibrium outcome of the game when neither firm hires a manager. These quantity choices imply:

$$\varphi_{\mathrm{FL}}^{n} = 5 - \sqrt{6},$$

$$W^{n} = 24\frac{1}{3}.$$

Game 2

In this subsection, we find the equilibrium of the game when only firm S hires a manager. In the second stage, manager S maximises the objective function value given by (5), while firm FL maximises (4). These lead to:

$$q_{\mathrm{S}}^{s} = \frac{10 - (1 - \lambda_{\mathrm{S}})\sqrt{6}/3}{2}, \tag{7}$$

$$q_{\mathrm{FL}}^{s} = \frac{\sqrt{6}}{3},$$

where the superscript '*s*' represents the equilibrium outcome of the game when only firm S hires a manager.

In the first stage, the manager of firm S chooses the incentive parameter λ_{S} to maximise domestic economic welfare. This results in:

$$\lambda_{\mathrm{S}}^{s} = 1.$$

By replacing this incentive parameter value into (7), we obtain $q_{\mathrm{S}}^{s} = 5$. Therefore, we find that the equilibrium values of this game are the same as those of Game 1.

We can now present the following proposition.

Proposition 1: Suppose that only firm S hires a manager. Then the equilibrium coincides with the outcome when neither firm hires a manager.

Proposition 1 suggests that firm S does not need to hire a manager in order to maximise domestic economic welfare. This is evident from $\lambda_{\mathrm{S}}^{s} = 1$.

Game 3

In the second stage, the manager of firm FL maximises the objective function value given

by (6), and firm S maximises domestic economic welfare.

In the first stage, the manager of firm FL chooses the incentive parameter λ_{FL} to maximise profit per worker. This results in:

$\lambda_{FL}^{f} = 1$,

where the superscript '*f*' represents the equilibrium outcome of the game when only firm FL hires a manager.

Therefore, the equilibrium values of this game are the same as those where neither firm hires a manager. We state the following proposition.

Proposition 2: Suppose that only firm FL hires a manager. Then the equilibrium solution coincides with the outcome when neither firm hires a manager.

This proposition states that firm FL does not need to hire a manager in order to maximise profit per worker. Proposition 2 is also evident from $\lambda_{FL}^{f} = 1$.

4. Conclusion

We have studied firms' decisions to hire managers when a foreign labour-managed firm competes against a state-owned firm. We have considered a game where only the state-owned firm hires a manager. We also have examined a game in which only the foreign labour-managed firm hires a manager. It has been shown that in each game, the equilibrium coincides with the outcome when neither firm hires a manager.

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