Domestic ownership of foreign firms and strategic privatization policy

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Abstract. In this paper, we consider how the domestic ownership of foreign firms affects the privatization of a public firm competing with foreign firms in the international market. We show that the domestic ownership of foreign firms can impede privatization under Cournot competition, whereas under Bertrand competition it can in fact promote privatization. Furthermore, we demonstrate that for both types of competition, the domestic ownership of foreign firms can render neither complete privatization nor complete nationalization optimal under moderate conditions.

Keywords Foreign ownership · Privatization · Mixed enterprises · State ownership

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1 Introduction

The past few decades have witnessed a global wave of privatization, with the total value of privatization worldwide exceeding US$200 billion in recent years, even in the aftermath of the post-2007 financial crisis.[1] During the privatization process, the ownership of privatized state-owned enterprises is transferred from the state to private investors, with share issue privatizations (SIPs) and mergers and acquisitions (M&As) being among the most important methods of privatization (Brada 1996; Megginson and Netter 2001). However, from the perspective of the private sector, acquiring the shares of privatized firms is only one of many alternatives available for equity investment. Investing in shares issued by private foreign firms, for example, is also common in the age of globalization.

More specifically, consider the possible privatization of the largely state-owned Airbus. If those European governments owning Airbus contemplate an SIP as a means of privatization, they must consider carefully about how they will sell the shares of a privatized Airbus to a private sector that may have already invested heavily in stocks issued by its most important rival, Boeing, a private U.S. firm. How then will the possibility of the domestic ownership of foreign firms affect privatization policy? Our aim here is to examine this important question using a simple model of international mixed oligopoly where the domestic firm is a partially state-owned firm operating in the same market as privately owned foreign firms.[2]

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[1] See Gill Plimmer, "Privatisation fever takes grip," *Financial Times*, June 26, 2011.

[2] Despite ongoing privatization programs around the world, mixed firms, i.e., partially state-owned firms, are still numerous and governmental influence through state ownership remains relatively strong (OECD

Using our simple model, we show that the domestic ownership structure emerges as a critical determinant of privatization policy. Indeed, under Cournot competition, an increase in the extent of domestic ownership of foreign firms can impede the privatization of a public firm competing mainly in the international market. This arises primarily because the government has to balance two conflicting incentives, i.e., to increase the profit of the privatized public firm and to increase the profit of the foreign firm, which is partly owned by domestic investors. An increase in the intensity of privatization shifts production from the foreign firm to the domestic firm, and thus increases the profits of the latter. However, this increase in profit is at the expense of the domestic investors owning shares in the foreign firms. Hence, when there is an increase in the domestic ownership of foreign firms, the home government is motivated to protect the interests of domestic private investors by decreasing the output of the public firm, thus shifting profits to the foreign firm.

In contrast, under Bertrand competition, an increase in the domestic ownership of foreign firms can drive additional privatization. This is because, unlike the Cournot case, there is a convergence of interests between both firms under Bertrand competition, as each firm benefits from the increase in the price of its rival. These findings suggest that, depending on the type of competition under consideration, the effects of the domestic ownership of foreign firms on the privatization process can lie in opposite directions.

These predictions are generally in accordance with real-world evidence. For example, in China, opposing trends in privatization have accompanied the increase in the domestic

2005). Typical industry examples include airlines, automobiles, steel, banking, and electric power suppliers in the E.U., banking, housing loans, life insurance, broadcasting, education, medical care, and overnight delivery in Japan, and banking, airlines, automobiles, and steel in China.

ownership of foreign firms in various industries in recent years. For instance, alongside the increasingly noticeable trend of “renationalization” (the so-called “*guo-jin-min-tui*” or “state advancing, private sector retreating” policy) in industries such as petroleum and coal that largely compete on quantity, Chinese investors have actively searched global markets for the promising acquisition of foreign resource management companies.[3] Conversely, in industries such as home appliances, textiles, and apparel that compete primarily on price, the intensification of privatization has accompanied an increase in international M&A activity, as exemplified by Haier’s recent acquisition of Panasonic’s Sanyo subsidiary.[4]

Furthermore, we also demonstrate that under both Cournot and Bertrand competition, the domestic ownership of foreign firms renders neither complete privatization nor complete nationalization optimal under moderate conditions. Put otherwise, our results suggest that the domestic ownership of foreign firms may prevent governments from adopting policies aimed at either the complete privatization or complete nationalization of their industries. Our analysis thus offers a novel explanation, at least in part, for the observation that governments worldwide appear to refrain from applying complete privatization or complete nationalization in the globalization era.

[3] “The long arm of the state: The government is flexing its muscles in business,” *The Economist*, June 23, 2011; “Privatization with Chinese characteristics: The hidden costs of state capitalism,” *The Economist*, September 3, 2011; “China International Fund: The Queensway syndicate and the Africa trade,” *The Economist*, August 13, 2011.

[4] Soble, J. “Corporate Japan warms to Chinese investors,” *Financial Times*, July 31, 2011.

In terms of background, our analysis mostly relates to the extensive literature on mixed oligopolies.[5] In early work, Matsumura (1998) considers partial privatization and examines optimal state ownership in a domestic context.[6] Since then, a number of studies have considered competition between partially privatized domestic firms and private foreign firms.[7] Recently, the argument has emerged of a strong interdependence between privatization policies and strategic trade policies.[8] For instance, using a mixed oligopoly model for two countries, in each of which there is a public firm and a private firm, Han and Ogawa (2008) show that integration in the product market can in fact limit privatization. Alternatively, Long and Stähler (2009) demonstrate that when a partially privatized domestic firm and a foreign firm compete à la Cournot in a third market, the optimal export subsidy increases with state ownership, whereas in the case of Bertrand rivalry with differentiated goods, the optimal export tax increases with state ownership. In an important recent contribution, Lin and Matsumura (2012) consider the setting in which a partially privatized domestic firm competes with a number of domestic and foreign private firms. Under this setting, Lin and Matsumura (2012) examine how the foreign ownership of privatized domestic firms affects privatization policy. They show that a higher ratio of foreign investor stockholding in a privatized firm can promote

[5] De Fraja and Delbono (1990) provide an excellent survey of the early literature on mixed oligopoly models in a domestic context. See Lin and Matsumura (2012) for an extensive review of the literature on partial ownership in privatized public firms.

[6] Matsumura (1998) shows that for a Cournot duopoly involving a private firm and a privatized firm that values both profits and social welfare, neither full privatization nor full nationalization is optimal under moderate conditions.

[7] Among others, see Chang (2005), Chao and Yu (2006), Fujiwara (2006), and Han and Ogawa (2008).

[8] Long and Stähler (2009) provide an excellent survey of privatization and trade policies.

privatization, whereas the increased penetration of foreign firms in the product market can retard privatization. Nonetheless, the domestic ownership of private foreign firms, being a widely observed phenomenon in the age of globalization, has not been explicitly considered in the literature.[9] In fact, to our best knowledge, this is the first analysis concerning the interdependence of the domestic ownership of foreign firms and privatization policy.[10]

Our paper also relates to the vast empirical literature on privatization, which shows that the magnitudes of privatization vary substantially across the industries studied.[11] Our results also contribute to this stream of literature by generating some testable predictions concerning the direction of privatization policy. Namely, given the domestic ownership of foreign firms, (i) depending on the characteristics of the market under consideration, the direction of privatization policy can be opposite, and (ii) neither complete privatization nor complete nationalization may hold.

The remainder of the paper is structured as follows. Section 2 presents the basic model and the main results. We then consider both Cournot and Bertrand competition and

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[9] Lin and Matsumura (2012) consider the case where privatized state-owned enterprises are sold not only to domestic private investors, but also to foreign investors. However, in their model, the domestic private investors are not permitted to own shares issued by foreign private firms.

[10] Feeney and Hillman (2001) consider the interdependence between international financial markets, privatization, and strategic trade policy and provide a useful summary of earlier work on developments in asset markets and policy outcomes.

[11] See Megginson and Netter (2001) for a thorough survey of the early privatization literature. Recently, Boubakri et al. (2013) used data from 55 developing countries to show that foreign direct investment and foreign portfolio investment can foster privatization in that by making the market environment more prone to competition, they provide an incentive for governments to privatize inefficient firms.

briefly compare their outcomes. Section 3 examines the robustness of the main results using a simple example. In this section, we also examine the welfare effects from a cost reduction in the foreign firm and an increase in the extent of domestic ownership in the foreign firm. We then consider the case in which the two firms compete in the home market, as well as the case where the shares of the privatized firm are sold not only to domestic private investors, but also to foreign investors. We conclude the paper in Section 4.

2 The basic model

2.1 The case of Cournot competition

2.1.1 The model

There are two firms, denoted 1 and 2, located respectively in the home country and the foreign country. Both firms engage in quantity competition à la Cournot, with their outputs denoted q_1 and q_2, respectively. We assume that the goods are perfect substitutes. Both firms export all of their output, $q = q_1 + q_2$, to a third market, the inverse demand function for which is given by $p(q): \mathbb{R}_+ \to \mathbb{R}_+$ (where price is a function of quantity), where $p'(q) < 0$.

The two firms differ in their ownership structures and hence their objective functions. Firm 1 is a partially privatized domestic firm à la Matsumura (1998), whose objective function is a weighted average of its profit and social welfare "modified" to take into account the domestic private ownership of the foreign firm. In contrast, firm 2 is a foreign private firm assumed to maximize only its profits. We assume that the shares of firm 1 can only be owned by the home government and domestic private investors, such that the home government owns a proportion $\theta\left(\in[0,1]\right)$ of the outstanding shares in firm 1 and domestic private investors hold the remainder $1-\theta$. Clearly, firm 1 is completely privatized when $\theta=0$ and completely nationalized when $\theta=1$. Conversely, we assume the shares of firm 2 are owned jointly by private investors in both countries, such that domestic investors own some proportion $\beta\left(\in[0,1]\right)$ while investors in the foreign country hold the remainder $1-\beta$. We assume that β is an exogenous variable given before the start of the game. The assumption that only domestic private investors can acquire the shares of the privatized firm and the third-market assumption greatly simplifies the analysis. More importantly, these assumptions allow us to judge the effects of the domestic ownership of foreign firms in their purest form.

Reflecting the possible technology gap between the firms (e.g., lower efficiency in firm 1 owing to partial state ownership), we assume that the firms do not necessarily share their cost functions.[12] Firm i's cost function ($i=1,2$) is given by $c_i\left(q_i\right):\mathbb{R}_+\to\mathbb{R}_+$, with $c_i'>0$ and $c_i''\geq 0$ and profit denoted by:

$$\pi^i \equiv p(q)q_i - c_i(q_i). \tag{1}$$

The social welfare of the home country is the sum of the profit of firm 1 and the home country's share of firm 2's profit, and is given by:

$$w^1 \equiv \pi^1(q_1,q_2)+\beta\pi^2(q_1,q_2), \tag{2}$$

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[12] Many empirical studies suggest that state-owned firms are less efficient than comparable private firms. See, e.g., Boardman and Vining (1989), D'Souza and Megginson (1999), and Boardman et al. (2002).

whereas that of the foreign country is given by:

$$w^2 \equiv (1-\beta)\pi^2(q_1, q_2). \tag{3}$$

Furthermore, as the World Trade Organization continues to prohibit explicit subsidies, we assume that neither country subsidizes their firms.

As in De Fraja and Delbono (1990), we assume there are no complications associated with the principal–agent relationship (e.g., because managers are perfectly monitored). Accordingly, we assume that the manager of firm 1 maximizes the weighted average of profit π^1 and social welfare w^1, i.e.:

$$v^1 \equiv (1-\theta)\pi^1(q_1, q_2) + \theta w^1 = \pi^1(q_1, q_2) + \theta\beta\pi^2(q_1, q_2). \tag{4}$$

Clearly, the manager of firm 1 values the profits of both firms, although at different weights, with firm 1's profits receiving a heavier de facto weight of one and those of the foreign firm receiving a smaller de facto weight of $\theta\beta$ (≤ 1). Alternatively, the manager of firm 2 maximizes (1). Of course, it is important to note that in our model, the manager of firm 1 *unilaterally* values the profits of both firms, not because the two firms form a de facto joint venture, but as a direct result of the domestic private ownership of the foreign firm. This differs fundamentally from the joint venture case in which both firms would *mutually* value any joint profits.

We also assume that the outputs are strategic substitutes, in the sense that an increase in the output of one firm reduces the marginal profit of the other firm.

Assumption 1. Outputs are strategic substitutes: $\pi_{ij}^{\ i} \equiv \frac{\partial^2 \pi^i}{\partial q_i \partial q_j} = q_i p''(q) + p'(q) < 0$, for all $q_i \in [0, q]$ and for all $q > 0$.

We consider a two-stage game. In stage 1, the home government selects the extent of state ownership θ to maximize (2), given the extent of domestic ownership in the foreign firm β. In stage 2, the firms simultaneously choose their output levels with firm 1 maximizing (4) and firm 2 maximizing (1). We apply backward induction to solve the game.

2.1.2 Equilibrium outcome

Given Assumption 1, we immediately derive the following proposition.

Proposition 1. In the case of international Cournot rivalry in a third market, the output of the home country is a decreasing function of the extent of state ownership θ, whereas that of the foreign country is an increasing function of θ.

Proof. See Appendix A.1.

Proposition 1 suggests that an intensification in privatization (a fall in θ) leads the public firm to increase output. This is in sharp contrast with the well-known result in the literature on mixed oligopoly, that greater privatization leads the public firm to reduce its output (see, e.g., Matsumura 1998; Matsumura and Kanda 2005; Han and Ogawa 2008; Lin and Matsumura 2012). In the literature, intensified privatization leads the public firm to reduce its output because it intends to increase its *own* profit. This action nonetheless indirectly increases the output of its rivals. In the present model, however, intensified privatization increases the output of the public firm because it intends to extract profit from the foreign firm. As shown by (4), a decline in the extent of state ownership reduces the de facto weight attached to the profit of firm 2, thus motivating the manager of firm 1 to reduce the profit of firm 2. Because the outputs are strategic substitutes, the manager achieves this by increasing firm 1's own output.

In stage 1, the home social planner chooses the extent of state ownership that maximizes social welfare. This yields the optimal extent of state ownership as follows:

$$\theta^* = 1 - \frac{q_1}{\beta q_2}\left(\frac{\pi_{21}^2}{\pi_{22}^2}\right) \text{ and } \left.\frac{\partial w^1}{\partial \theta}\right|_{\theta=1} = p' q_1 \frac{dq_2}{d\theta} < 0\,. \tag{5}$$

We immediately have the following proposition.

Proposition 2. In the case of international Cournot rivalry in a third market:

(i) *The home government increases the extent of state ownership when there is an increase in the extent of the domestic ownership of foreign firms;*

(ii) *It is not optimal for the home government to completely nationalize the public firm; and*

(iii) *It is also not optimal for the home government to completely privatize* the public firm when the extent of domestic ownership of the foreign firm is sufficiently large, i.e., when $\beta > \bar{\beta} \equiv \frac{q_1}{q_2}\left(\frac{\pi_{21}^2}{\pi_{22}^2}\right)$.

Proof. See Appendix A.2.

The underlying intuition of Proposition 2(i) is straightforward. Because firm outputs are strategic substitutes, a firm can only achieve a higher profit level by reducing the profit of its rivals. Privatization, however, reduces the weight attached to the profit of the foreign firm and thus effectively shifts profits from the foreign firm to the domestic firm. In contrast, intensified nationalization (an increase in state ownership) motivates the domestic social planner to shift profit to the foreign firm. Consequently, when the home country's stake in the foreign firm increases, the home government is motivated to protect the interests of domestic investors by decreasing the level of privatization. Proposition 2(i) thus predicts that the foreign ownership structure can in fact impede privatization under international Cournot rivalry. This is a novel finding in the literature.

On the other hand, as long as both firms are producing strictly positive outputs, there will not be complete nationalization, as predicted by Proposition 2(ii).[13] Furthermore, as suggested by Proposition 2(iii), when the home country's stake in the foreign firm is sufficiently large, the home government is motivated to respect the interests of domestic investors by refraining from complete privatization (under which the weight attached by the manager of firm 1 to the foreign firm's profit would become zero).[14] Put differently, complete privatization is not optimal, not because of the "procompetitive effect" of public ownership, but as a direct consequence of the domestic ownership of the foreign firm.[15] Proposition 2(ii) and (iii) together extend the well-known result in Matsumura (1998) that given the domestic ownership of foreign firms, neither complete welfare maximizing or

[13] The underlying mechanism differs from that in Matsumura (1998) in that consumer surplus is not a part of social welfare in our model. Matsumura (1998) suggests that complete nationalization is not optimal if the public firm is not a monopolist. This is because a slight reduction in the output of the public firm does not reduce social welfare, whereas an increase in the output of the profit-maximizing private firm improves social welfare (as the price is strictly higher than the private firm's marginal cost).

[14] Matsumura (1998) shows that complete privatization is not optimal if the public firm is least as efficient as the private firm.

[15] See Harris and Wiens (1980) for a discussion of the "procompetitive effect" of the public firm.

complete profit maximizing would be optimal for the public firm under moderate conditions.

2.2 The case of Bertrand competition

Imperfectly competitive models of international trade have shown that the impact of trade policies can differ substantially between Cournot and Bertrand competition (Eaton and Grossman 1986). Accordingly, we next consider price competition à la Bertrand. We use uppercase letters to distinguish the variables and functions from those introduced in the Cournot case. Let X^1 and X^2 denote the demands for the outputs of firm 1 and firm 2, respectively. The demand functions are $X^i = X^i\left(P_1, P_2\right)$, where P_i is the price of good i. We assume the following.

Assumption 2. Demand for good i decreases with $P_i : X_i^i \equiv \dfrac{\partial X^i}{\partial P_i} < 0$. As the goods are substitutes, an increase in P_j will then decrease the demand for good i, where $i \neq j : X_j^i \equiv \dfrac{\partial X^i}{\partial P_j} > 0$.

Firm i's cost function ($i = 1,2$) is given by $C_i\left(X^i\right) : \mathbb{R}_+ \to \mathbb{R}_+$, with $C_i' > 0$ and $C_i'' \geq 0$. We denote firm i's gross revenue minus production costs with Π^i:

$$\Pi^i\left(P_1, P_2\right) \equiv P_i X^i\left(P_1, P_2\right) - C_i\left[X^i\left(P_1, P_2\right)\right]. \tag{6}$$

Once again, the two firms compete in a third market and the social welfare of the home country is given by:

$$W^1(P_1,P_2) \equiv \Pi^1(P_1,P_2) + \mathrm{B}\Pi^2(P_1,P_2), \tag{7}$$

where $\mathrm{B}\left(\in[0,1]\right)$ is the exogenously determined domestic ownership of the foreign firm.

We assume that the manager of firm 1 maximizes V^1, which is the weighted average of Π^1 and W^1 as follows:

$$V^1 \equiv (1-\Theta)\Pi^1(P_1,P_2) + \Theta W^1(P_1,P_2) = \Pi^1(P_1,P_2) + \Theta\mathrm{B}\Pi^2(P_1,P_2), \tag{8}$$

where $\Theta\left(\in[0,1]\right)$ is the proportion of shares of firm 1 held by the home government. Conversely, firm 2 is completely privately owned and maximizes its own profit.

We consider a two-stage game. In stage 1, the home government sets Θ, given B. In stage 2, the firms simultaneously choose P_1 and P_2, given Θ. Yet again, we use backward induction to solve the game.

We further assume that prices are strategic complements in the sense that an increase in the price of good j will increase the marginal contribution of P_i to the profit of firm i.

Assumption 3. Prices are strategic complements: $\Pi^i_{ij}(P_1,P_2) > 0$ for $j \neq i$.

Given Assumptions 2 and 3, we now derive the following proposition.

Proposition 3. In the case of international Bertrand rivalry in a third market:

(i) *The prices of both firms are increasing functions of the extent of state ownership* Θ*;*

(ii) *The home government decreases the extent of state ownership when there is an increase in the extent of the domestic ownership of the foreign firm;*

(iii) *It is not optimal for the home government to completely nationalize the public firm; and*

(iv) *It is also not optimal for the home government to completely privatize the public firm when the domestic ownership of the foreign firm is sufficiently large, i.e., when* $\mathrm{B} > \frac{\left(P_1(\Theta) - C_X^1\right) X_2^1}{\left(P_2(\Theta) - C_X^2\right) X_1^2} \left(\frac{\Pi_{21}^2}{\Pi_{22}^2}\right)$.

Proof. See Appendices B.1 and B.2.

Proposition 3(i) is a new result and lies in sharp contrast to that in Proposition 1. It suggests that the outcomes of privatization can be of opposing directions, depending on whether the market operates under Cournot or Bertrand competition. The underlying intuition is as follows. Unlike the Cournot case, because prices are strategic complements, there is a convergence of interests between the two firms: that is, each firm benefits from an increase in the price of its rival. Consequently, when the home government reduces the extent of state ownership, the weight attached to the profit of the foreign firm becomes smaller. This motivates the domestic firm to focus more on maximizing its own profit. However, this also benefits the foreign firm because the prices are strategic complements. Hence, in contrast with the Cournot case, a higher level of foreign ownership can further intensify privatization under Bertrand competition, as predicted by Proposition 3(ii). Moreover, Propositions 3(iii) and (iv) are similar to Propositions 2(ii) and (iii), and the underlying intuitions are also similar.

3 Discussion

This section serves to check the robustness of the preceding results. More importantly, it also analyzes and quantifies the effects of an asymmetric cost structure on the level of privatization and the welfare effects from a cost reduction in the foreign firm, as well as an increase in the extent of the domestic ownership of the foreign firm. The section also considers the case in which the two firms compete in the home market, as well as the case where the shares of the privatized firm are sold not only to domestic private investors, but also to foreign investors. We preserve the basic setup and notation of the preceding sections, save for the cost functions and the inverse demand function. For tractability and without loss of generality, we assume:

$$c_1(q_1) = q_1^2, \ c_2(q_2) = kq_2^2, \tag{9}$$

and

$$p = a - q_1 - q_2, \tag{10}$$

where $k > 0$ denotes the possible technology gap between the two firms and a represents the size of the market. It may be natural to assume that $k < 1$, which indicates that the foreign private firm has more efficient technology than the domestic public firm. However, we do not exclude the possibility of $k \geq 1$.

3.1 Robustness of the main results and the welfare effects

We first consider the robustness of the main results (denoted by superscript e). We also examine the welfare effects from a cost reduction in the foreign firm and an increase in the extent of domestic ownership in the foreign firm. The Cournot–Nash equilibrium outputs, denoted q_1^e and q_2^e, are obtained by simultaneously maximizing equations (1) and (4):

$$q_1^e = \frac{a + 2ak - a\beta\theta}{7 + 8k - \beta\theta}, \quad q_2^e = \frac{3a}{7 + 8k - \beta\theta}. \tag{11}$$

It is easy to verify that Proposition 1 holds because $\frac{dq_1^e}{d\theta} = -\frac{6a\beta(1+k)}{(7+8k-\beta\theta)^2} < 0$ and $\frac{dq_2^e}{d\theta} = \frac{3a\beta}{(7+8k-\beta\theta)^2} > 0$.

Using the equilibrium outcomes in the second stage, the following yields the optimal extent of state ownership that maximizes social welfare:

$$\theta^e = 1 - \frac{q_1}{\beta q_2}\left(\frac{\pi_{21}^2}{\pi_{22}^2}\right) = \frac{6\beta + 6\beta k - 1 - 2k}{\beta(5+6k)}. \tag{12}$$

Clearly, $\frac{d\theta^e}{d\beta} = \frac{1+2k}{\beta^2(5+6k)} > 0$ (Proposition 2(i)). Moreover, because $\theta^e\big|_{\beta=1} = \frac{5+4k}{5+6k}$, we see that $\theta^e \neq 1$ as long as $k \neq 0$ (Proposition 2(ii)). This result suggests that a sufficient condition for complete nationalization under the present model setting is that the private foreign firm is sufficiently efficient.[16] Finally, $\theta^e > 0$ as long as $\beta > \overline{\beta} = \frac{1+2k}{6+6k}$ (Proposition 2(iii)).

[16] Using a model that considers the effect of open policies in product markets and privatization policies, Han and Ogawa (2008) find that governments choose complete privatization when the public firm is sufficiently inefficient compared with the private firm.

We now proceed to consider the effects of a cost reduction in the foreign firm. Because $\frac{d\overline{\beta}}{dk} = \frac{1}{6(1+k)^2} > 0$, the less efficient the foreign firm, the higher the critical share $\overline{\beta}$. Our simulation suggests that if the foreign firm is more efficient compared with the domestic firm, the critical share $\overline{\beta}$ is lower than 25%. Table 1 provides the results of the numerical simulations to show how the critical share $\overline{\beta}$ changes for different values of k.

(Table 1 about here)

Moreover, we have $\frac{d\theta^e}{dk} = -\frac{2(2+3\beta)}{\beta(5+6k)^2} < 0$, suggesting that technology improvement in the foreign firm can impede privatization as it motivates the home government to increase the extent of state ownership. This is because a technology improvement in the foreign firm increases its profitability, motivating the manager of firm 1 to increase the weight attached to the foreign firm's profit. It can achieve this by increasing the extent of state ownership, as shown by (4). Figure 1 depicts how θ^e varies across different values of β and k.

Finally, substituting θ^e back into (2), we can see that social welfare is given by

$$w^{1e} = \frac{a^2\left(4\beta(1+k)+(1+2k)^2\right)}{4(1+k)(6-\beta+8k)}. \tag{13}$$

Clearly, $\frac{dw^{1e}}{d\beta} = \frac{a^2(5+6k)^2}{4(1+k)(6-\beta+8k)^2} > 0$ and $\frac{dw^{1e}}{dk} = \frac{a^2(5+6k)(2+4k-\beta(7+6k))}{4(1+k)^2(6-\beta+8k)^2}$,

with $\frac{dw^{1e}}{dk} < 0$ when $\frac{2+4k}{7+6k} < \beta < 1$ and $\frac{dw^{1e}}{dk} \geq 0$ when $\beta \leq \frac{2+4k}{7+6k}$; i.e., when β is sufficiently large (small), an improvement in the foreign firm's efficiency improves (worsens) the home country's social welfare. The intuition is straightforward. A technology improvement in the foreign firm shifts profit from the home firm to the foreign firm, and thus decreases the home country's producer surplus. However, when domestic ownership in the foreign firm is sufficiently large, the profit gain from the more efficient foreign firm is able to dominate the loss, and this improves the home county's social welfare. In Figure 2, we summarize how the home country's social welfare w^{1e} changes with different values of β and k for the case where $a = 10$. Note that the home country's social welfare approaches its maximum when β approaches one (when the foreign firm is completely owned by domestic investors) and when k approaches zero (the foreign firm is extremely efficient).

(Figures 1 and 2 about here)

3.2 The two firms compete in the home market

In the preceding analyses, we assumed that the two firms compete in a third market. Next, we consider the case in which the firms engage in Cournot competition in the home market (denoted by superscript d). The basic setup and notations from the preceding section apply, except that we modify social welfare in the home country to include consumer surplus:

$$w^{1d} \equiv \pi^{1d}\left(q_1^d, q_2^d\right) + \beta\pi^{2d}\left(q_1^d, q_2^d\right) + CS^d\ , \tag{14}$$

where $CS^d \equiv \int_0^{q_1^d+q_2^d}\left(a - q_1^d - q_2^d\right)dq - \left(a - q_1^d - q_2^d\right)\left(q_1^d + q_2^d\right) = \left(q_1^d + q_2^d\right)^2/2$. Accordingly, the manager of firm 1 maximizes the weighted average of profit π^1 and social welfare w^1, i.e.:

$$v^{1d} \equiv (1-\theta)\pi^{1d}\left(q_1^d, q_2^d\right) + \theta w^{1d} = \pi^{1d}\left(q_1^d, q_2^d\right) + \theta\beta\pi^{2d}\left(q_1^d, q_2^d\right) + \theta CS^d\ . \tag{15}$$

The Cournot–Nash equilibrium outputs for this case, denoted q_1^d and q_2^d, are given by:

$$q_1^d = \frac{a + 2ak + a\theta - a\beta\theta}{7 + 8k - \theta - \beta\theta - 2k\theta},\ \ q_2^d = \frac{3a - a\theta}{7 + 8k - \theta - \beta\theta - 2k\theta}. \tag{16}$$

Clearly, $\dfrac{dq_1^d}{d\theta} = \dfrac{2a(1+k)(4-3\beta+2k)}{\left(7-2k(\theta-4)-\theta(1+\beta)\right)^2} > 0$, $\dfrac{dq_2^d}{d\theta} = \dfrac{a\left(3\beta-2(2+k)\right)}{\left(7-2k(\theta-4)-\theta(1+\beta)\right)^2} < 0$,

and $\dfrac{d\left(q_1^d + q_2^d\right)}{d\theta} = \dfrac{a(1+2k)(4-3\beta+2k)}{\left(7-2k(\theta-4)-\theta(1+\beta)\right)^2} > 0$, indicating that Proposition 1 no longer holds.

The optimal extent of state ownership that maximizes social welfare is then given by:

$$\theta^d = 1 + \frac{2}{6\beta(1+k) - 7 - 4k(3+k)}. \tag{17}$$

Figure 3 plots how θ^d changes across different values of β and k.

Clearly, we have $\frac{d\theta^d}{d\beta} = \frac{-12(1+k)}{\left(7-6\beta(1+k)+4k(3+k)\right)^2} < 0$; i.e., the home government decreases the extent of state ownership when there is an increase in the domestic ownership of the foreign firm. This indicates that Proposition 2(i) also does not hold. Intuitively, this is mainly because besides the two conflicting incentives as in the third-market case, i.e., to increase the profit of the privatized public firm and to increase the profit of the foreign firm, the home government now has one additional incentive to balance, namely, to increase domestic consumption. Moreover, we also note that $\frac{d\theta^d}{dk} = \frac{4(6-3\beta+4k)}{\left(7-6\beta(1+k)+4k(3+k)\right)^2} > 0$. This result also sharply contrasts with the result obtained under the third-market case, once again because the home government now has to bear in mind domestic consumption.

It is easy to verify that θ^d cannot attain a value of one as long as $\beta \in [0,1]$. On the other hand, θ^d remains positive either (i) when $0 < k \le 0.1514$ and $0 < \beta \le \bar{\bar{\beta}} \equiv \frac{5+12k+4k^2}{6+6k}$, or (ii) when $k > 0.1514$ and $\beta \in [0,1]$. Moreover, $\frac{d\bar{\bar{\beta}}}{dk} \equiv \frac{2}{3} + \frac{1}{2(1+k)^2} > 0$. As depicted in Figure 3, we can see that when the foreign firm is sufficiently efficient and the home country's stake in the foreign firm is sufficiently large, the home government is motivated to privatize the domestic firm completely. This is because complete privatization can shift output from the inefficient domestic firm to the more efficient foreign firm, and thus maximize the profit of the latter. The resultant fall in domestic social welfare, however, can be dominated by the increase in the profits of the foreign firm when the extent of domestic ownership of the foreign firm is sufficient large.

Hence, although Proposition 2(ii) and (iii) and Proposition 3(iii) and (iv) largely hold even when the two firms compete à la Cournot in the home market, the underlying mechanism differs.

Finally, substituting θ^d back into (15), we can see that social welfare is given by:

$$w^{1d} = \frac{a^2\left(5+2\beta(1+k)+4k(2+k)\right)}{22-4\beta(1+k)+24k(2+k)}. \tag{18}$$

Clearly, $\dfrac{dw^{1d}}{d\beta} = \dfrac{16a^2(1+k)^3}{\left(11-2\beta(1+k)+12k(2+k)\right)^2} > 0$ and $\dfrac{dw^{1d}}{dk} = -\dfrac{16a^2(1+k)(1+\beta+\beta k)}{\left(11-2\beta(1+k)+12k(2+k)\right)^2} < 0$. In Figure 4, we summarize how the home country's social welfare w^{1d} changes across different values of β and k for the case where $a = 10$. Note that similar to the case in which firm 1 and firm 2 compete in a third market, the home country's social welfare approaches its maximum when β approaches 1 (when the foreign firm is completely owned by domestic investors) and k approaches 0 (the foreign firm is extremely efficient). Note also that the welfare effect of complete privatization lies in sharp contrast to where the two firms compete in a third market. Although complete privatization ($\theta = 0$) renders the lowest level of welfare possible in the third market case, it can also produce the highest level of social welfare where both firms compete in the home market.

(Figures 3 and 4 about here)

3.3 The privatized firm is partially owned by foreign investors

So far, we have assumed that the privatized public firm is sold exclusively to domestic investors. Next, we consider the effects of the possible foreign ownership of the privatized domestic firm (denoted by superscript f). For simplicity, we assume that the proportion of shares of the privatized public firm acquired by foreign investors is given by $1-\delta$, with $\delta \in [0,1]$. The basic setup and notations for the preceding section continue to apply, except that we modify the home social welfare to take into account the foreign ownership of the domestic firm:

$$w^{1f} \equiv \delta\pi^{1f}\left(q_1^f, q_2^f\right) + \beta\pi^{2f}\left(q_1^f, q_2^f\right). \tag{19}$$

Accordingly, the manager of firm 1 maximizes the weighted average of profit π^1 and social welfare w^1, i.e.:

$$v^{1f} \equiv (1-\theta)\pi^{1f}\left(q_1^f, q_2^f\right) + \theta w^{1f} = (1-\theta+\theta\delta)\pi^{1f}\left(q_1^f, q_2^f\right) + \theta\beta\pi^{2f}\left(q_1^f, q_2^f\right). \tag{20}$$

For tractability and without loss of generality, we let $k = 0.5$. The Cournot–Nash equilibrium outputs, denoted q_1^f and q_2^f, are given by:

$$q_1^f = \frac{a\left((2+\beta-2\delta)\theta-2\right)}{(5+\beta-5\delta)\theta-11},\ q_2^f = \frac{a\left((1-\delta)\theta-3\right)}{(5+\beta-5\delta)\theta-11}. \tag{21}$$

Because $\dfrac{dq_1^f}{d\theta} = -\dfrac{3a(4+3\beta-4\delta)}{\left((5+\beta-5\delta)\theta-11\right)^2} < 0$ and $\dfrac{dq_2^f}{d\theta} = \dfrac{a(4+3\beta-4\delta)}{\left((5+\beta-5\delta)\theta-11\right)^2} > 0$, Proposition 1 holds. Intuitively, as shown by (19) and (20), the foreign ownership of the domestic firm only modifies the relative weights attached to the profits of the two firms by the domestic firm and the social planner; it will not alter the direction of their choices.

The socially optimal extent of state ownership is given by:

$$\theta^f = \frac{14\delta - 12 - 9\beta}{\beta(\delta - 9) - 2(\delta - 6)(\delta - 1)}. \tag{22}$$

Figure 5 demonstrates how θ^d changes for different values of β and δ.

Clearly, $\frac{d\theta^f}{d\beta} = \frac{4\delta(3+\delta)}{\left(\beta(\delta-9)-2(\delta-6)(\delta-1)\right)^2} > 0$ (Proposition 2(i)). Moreover, we can see that $\frac{d\theta^f}{d\delta} = \frac{(4+3\beta)(3\beta-12\delta)+28\delta^2}{\left(\beta(\delta-9)-2(\delta-6)(\delta-1)\right)^2}$, hence, $\frac{d\theta^f}{d\delta} > 0$ when $0 < \delta < \frac{12+9\beta}{14} - \frac{1}{7}\sqrt{\frac{3\left(24+22\beta+3\beta^2\right)}{2}}$ and $\frac{d\theta^f}{d\delta} < 0$ when $\frac{12+9\beta}{14} - \frac{1}{7}\sqrt{\frac{3\left(24+22\beta+3\beta^2\right)}{2}} < \delta < 1$.

It is easy to verify that θ^f cannot attain a value of one as long as $\delta \in (\beta/2, 1)$. On the other hand, θ^f remains positive either (i) when $0 < \beta < 2/9$ and $0 < \delta \leq \frac{12+9\beta}{14}$, or (ii) $\beta \in (9/2, 1)$ and $\delta \in [0,1]$. As also shown in Figure 5, we can see that when domestic ownership of the foreign firm is sufficiently low and foreign ownership of the domestic firm is sufficiently large, the home government is motivated to privatize the domestic firm completely. Hence, Proposition 2(ii) and (iii) and Proposition 3(iii) and (iv) again largely hold.

Finally, substituting θ^f back into (19), we can see that social welfare is given by:

$$w^{1f} = \frac{a^2\left(3\beta + 2\delta^2\right)}{3\left(4\delta + 6 - \beta\right)}. \tag{23}$$

Clearly, $\frac{dw^{1f}}{d\beta} = \frac{2a^2\left(3+\delta\right)^2}{3\left(4\delta+6-\beta\right)^2} > 0$ and $\frac{dw^{1f}}{d\delta} = \frac{4a^2\left(2\delta-\beta\right)\left(3+\delta\right)}{3\left(4\delta+6-\beta\right)^2}$. Hence, $\frac{dw^{1f}}{d\delta} > 0$ when $\delta > \beta/2$ and $\frac{dw^{1f}}{d\delta} < 0$ when $\delta < \beta/2$. In Figure 6, we summarize how the home country's social welfare w^{1f} changes for different values of β and δ for the case where $a = 10$. Note that the home country's social welfare approaches its maximum when β approaches one (when the foreign firm is completely owned by domestic investors) and δ approaches one (when the domestic firm is completely owned by domestic investors).

(Figures 5 and 6 about here)

4. Concluding remarks

Our findings suggest that the domestic ownership of foreign firms can be an important factor underlying privatization policy. Depending on the type of competition, the domestic ownership of foreign firms can exert completely opposing effects on the privatization policies for industries in which public firms compete with foreign firms in the international market. In sum, under Cournot competition, privatization can be restricted, whereas under Bertrand competition, intensive privatization can be advanced. Moreover, given the domestic ownership of foreign firms under either type of competition, neither complete privatization nor complete nationalization would be optimal under moderate conditions. Our model then explains, at least in part, why we rarely observe complete privatization or complete nationalization in the era of globalization and why the level of privatization can vary across different industries. We believe these new insights are relevant to the ongoing discussion on the relationship between an open capital market policy and privatization policy, suggesting that the characteristics of these markets, in particular the type of competition, appears to demand dissimilar privatization policies.

By necessity, our analysis imposes a number of restrictive assumptions, in light of which we must reflect upon the above results. These assumptions include: (i) government influence on firms is costless; (ii) privatization does not improve the efficiency of the privatized firm; and (iii) the principal–agent problem is absent in both firms. Further research is thus required to understand whether the basic conclusions of this analysis would change in the absence of these assumptions.

Appendices

A Cournot competition in a third market

A.1 Stage 2

We first solve for the output game in stage 2. Given θ, the first-order condition of firm 1 is:

$$\underbrace{p'q_1 + p - c_1'}_{\pi_1^1} = -\theta\beta q_2 p' , \tag{A1}$$

and the second-order condition is $2p' + q_1 p'' - c_1'' + \theta\beta q_2 p'' < 0$. For firm 2, the first-order condition is:

$$\underbrace{p'q_2 + p - c_2'}_{\pi_2^2} = 0 , \tag{A2}$$

and the second-order condition is $2p' + q_2 p'' - c_2'' < 0$.

Next, we consider the effects of an increase in θ on the equilibrium outputs. We totally differentiate the systems of (A1) and (A2):

$$\begin{bmatrix} v_{11}^1 & v_{12}^1 \\ \pi_{21}^2 & \pi_{22}^2 \end{bmatrix} \begin{bmatrix} dq_1/d\theta \\ dq_2/d\theta \end{bmatrix} = \begin{bmatrix} -\beta\pi_1^2 \\ 0 \end{bmatrix} . \tag{A3}$$

The determinant of the matrix is $D \equiv v_{11}^1 \pi_{22}^2 - v_{12}^1 \pi_{21}^2$, for which we assume $D > 0$. Making use of Assumption 1, we derive:

$$\begin{cases} \dfrac{dq_1}{d\theta} = -\dfrac{\beta\pi_1^2}{D}\pi_{22}^2 < 0, \\ \dfrac{dq_2}{d\theta} = \dfrac{\beta\pi_1^2}{D}\pi_{21}^2 > 0, \\ \dfrac{dq_2/d\theta}{dq_1/d\theta} = -\dfrac{\pi_{21}^2}{\pi_{22}^2} < 0. \end{cases} \tag{A4}$$

A.2 Stage 1

In stage 1, the home government chooses the optimal privatization policy that maximizes its own welfare. The welfare of the home country is given by:

$$\begin{aligned} w^1\left(q_1(\theta), q_2(\theta)\right) = &\left[p\left(q_1(\theta), q_2(\theta)\right) q_1(\theta) - c_1\left(q_1(\theta)\right)\right] \\ &+ \beta\left[p\left(q_1(\theta), q_2(\theta)\right) q_2(\theta) - c_2\left(q_2(\theta)\right)\right] \end{aligned}. \tag{A5}$$

Together with (A1) and (A2), the first-order condition is then:

$$\frac{\partial w^1}{\partial \theta} = p'\left[(1-\theta)\beta q_2 \frac{dq_1}{d\theta} + q_1 \frac{dq_2}{d\theta}\right] = 0 . \tag{A6}$$

This gives the optimal level of state ownership:

$$\theta^* = 1 - \frac{q_1}{\beta q_2}\left(\frac{\pi_{21}^2}{\pi_{22}^2}\right). \tag{A7}$$

Clearly, the optimal level of θ^* cannot attain a value of one because $\left.\dfrac{\partial w^1}{\partial \theta}\right|_{\theta=1} = p' q_1 \dfrac{dq_2}{d\theta} < 0$. Moreover, $\theta^* > 0$ as long as $\beta > \dfrac{q_1}{q_2}\left(\dfrac{\pi_{21}^2}{\pi_{22}^2}\right)$.

Furthermore, from (A7), we can see that $\dfrac{d\theta^*}{d\beta} = \dfrac{1}{\beta^2}\left(\dfrac{q_1\pi_{21}^2}{q_2\pi_{22}^2}\right) > 0$. Note that the term inside the brackets does not change when β changes, i.e., $d\left(q_1\pi_{21}^2 / q_2\pi_{22}^2\right)\big/ d\beta = 0$. As in Long and Stähler (2009), it suffices to prove this fact to prove that the optimal level of state ownership always ensures that the stage 2 equilibrium output is identical to that obtainable if firm 1 were the quantity-setting leader and firm 2 were the quantity-setting follower.[17] Rewriting (A7), we have:

$$\theta^* \beta q_2 p' = \beta q_2 p' - q_1 p' \left(\frac{\pi_{21}^2}{\pi_{22}^2} \right) = \beta q_2 p' - \pi_2^1 \left(\frac{\pi_{21}^2}{\pi_{22}^2} \right). \tag{A8}$$

Using firm 1's first-order condition, this gives:

$$\pi_1^1 = \pi_2^1 \left(\frac{\pi_{21}^2}{\pi_{22}^2} \right) + \beta \pi_1^2 . \tag{A9}$$

But this is precisely the condition that determines the pair $\left(q_1^L, q_2^F \right)$, which would be obtained if firm 1 were the quantity-setting leader (whose objective function would be $\pi^1 \left(q_1, q_2 \right) + \beta \pi^2 \left(q_1, q_2 \right)$), and firm 2 is the quantity-setting follower.

B Bertrand competition in a third market

B.1 Stage 2

Given Θ, the first-order condition of firm 1 is:

[17] Note that the level of state ownership we consider in this paper has many of the same analytical attributes as the export subsidy considered in Brander and Spencer (1985) and Long and Stähler (2009). As shown in Brander and Spencer (1985, Proposition 3), "the optimal export subsidy moves the industry equilibrium to what would, in the absence of a subsidy, be the Stackelberg leader–follower position in output space with the domestic firm as leader."

$$\underbrace{X^1 + (P_1 - C_1')X_1^1}_{\Pi_1^1} = -\Theta \mathrm{B}(P_2 - C_2')X_1^2, \tag{A10}$$

and the second-order condition is $\Pi_{11}^1 + \Theta \mathrm{B} X_{11}^2 (P_2 - C_2') < 0$. For firm 2, the first-order condition is:

$$\underbrace{X^2 + (P_2 - C_2')X_2^2}_{\Pi_2^2} = 0, \tag{A11}$$

and the second-order condition is $\Pi_{22}^2 < 0$.

Next, we consider the effects of an increase in Θ on the equilibrium outputs. We totally differentiate the systems of (A10) and (A11):

$$\begin{bmatrix} V_{11}^1 & V_{12}^1 \\ \Pi_{21}^2 & \Pi_{22}^2 \end{bmatrix} \begin{bmatrix} dP_1/d\Theta \\ dP_2/d\Theta \end{bmatrix} = \begin{bmatrix} -\mathrm{B}\Pi_1^2 \\ 0 \end{bmatrix}. \tag{A12}$$

The determinant of the matrix is $J \equiv V_{11}^1 \Pi_{22}^2 - V_{12}^1 \Pi_{21}^2$, for which we assume $J > 0$. Making use of Assumptions 2 and 3, we derive:

$$\begin{cases} \dfrac{dP_1}{d\Theta} = -\dfrac{\mathrm{B}\Pi_1^2}{J}\Pi_{22}^2 > 0, \\ \dfrac{dP_2}{d\Theta} = \dfrac{\mathrm{B}\Pi_1^2}{J}\Pi_{21}^2 > 0, \\ \dfrac{dP_2/d\Theta}{dP_1/d\Theta} = -\dfrac{\Pi_{21}^2}{\Pi_{22}^2} > 0. \end{cases} \tag{A13}$$

B.2 Stage 1

In stage 1, the home government chooses the optimal privatization policy to maximize its own welfare. The welfare of the home country is given by:

$$W^1(\Theta) = \left[P_1(\Theta)\,X^1\left(P_1(\Theta), P_2(\Theta)\right) - C_1\left[X^1(P_1, P_2)\right]\right] \\ + \mathrm{B}\left[P_2(\Theta)\,X^2\left(P_1(\Theta), P_2(\Theta)\right) - C_2\left[X^2(P_1, P_2)\right]\right], \tag{A14}$$

and the first-order condition is given by:

$$\frac{dW^1}{d\Theta} = X^1\frac{dP_1}{d\Theta} + \left(P_1(\Theta) - C_1'\right)\left(X_1^1\frac{dP_1}{d\Theta} + X_2^1\frac{dP_2}{d\Theta}\right) \\ +\mathrm{B}\left(X^2\frac{dP_2}{d\Theta} + \left(P_2(\Theta) - C_2'\right)\left(X_1^2\frac{dP_1}{d\Theta} + X_2^2\frac{dP_2}{d\Theta}\right)\right) = 0. \tag{A15}$$

Rearranging terms yields:

$$\left[X^1 + \left(P_1(\Theta) - C_1'\right)X_1^1 + \Theta\mathrm{B}\left(P_2(\Theta) - C_2'\right)X_1^2\right]\frac{dP_1}{d\Theta} \\ = -\left[\left(P_1(\Theta) - C_1'\right)X_2^1 + \Theta\mathrm{B}\left(X^2 + \left(P_2(\Theta) - C_2'\right)X_2^2\right)\right]\frac{dP_2}{d\Theta}, \tag{A16}$$

and hence:

$$(1-\Theta)\mathrm{B}\left[\left(P_2(\Theta) - C_2'\right)X_1^2\right]\frac{dP_1}{d\Theta} = -\left[\left(P_1(\Theta) - C_1'\right)X_2^1\right]\frac{dP_2}{d\Theta}, \tag{A17}$$

which then yields the optimal level of state ownership:

$$\Theta^* = 1 - \frac{\left(P_1(\Theta) - C_1'\right)X_2^1}{\mathrm{B}\left(P_2(\Theta) - C_2'\right)X_1^2}\left(\frac{\Pi_{21}^2}{\Pi_{22}^2}\right) \text{ and}$$

$$\left.\frac{\partial W^1}{\partial \Theta}\right|_{\Theta=1} = -\left[\left(P_1(\Theta) - C_1'\right)X_2^1\right]\frac{dP_2}{d\Theta} < 0. \tag{A18}$$

Clearly, Θ^* cannot attain a value of one in the case of international Bertrand rivalry. Moreover, $\Theta^* > 0$ when $\mathrm{B} > \frac{\left(P_1(\Theta) - C_1'\right) X_2^1}{\left(P_2(\Theta) - C_2'\right) X_1^2}\left(\frac{\Pi_{21}^2}{\Pi_{22}^2}\right)$.

From (A18), we can see that $\frac{d\Theta^*}{d\mathrm{B}} = \frac{1}{\mathrm{B}^2}\left(\frac{\left(P_1(\Theta) - C_1'\right) X_2^1 \Pi_{21}^2}{\left(P_2(\Theta) - C_2'\right) X_1^2 \Pi_{22}^2}\right) < 0$. Note also that the term inside the brackets does not change with Θ. The argument is similar to that used in the Cournot competition case.

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Table 1 Simulation summary

k	0	0.1	0.2	0.4	0.6	0.8	1	1.2	1.4
$\overline{\beta}$	0.1667	0.1818	0.1944	0.2143	0.2292	0.2407	0.25	0.2576	0.2639

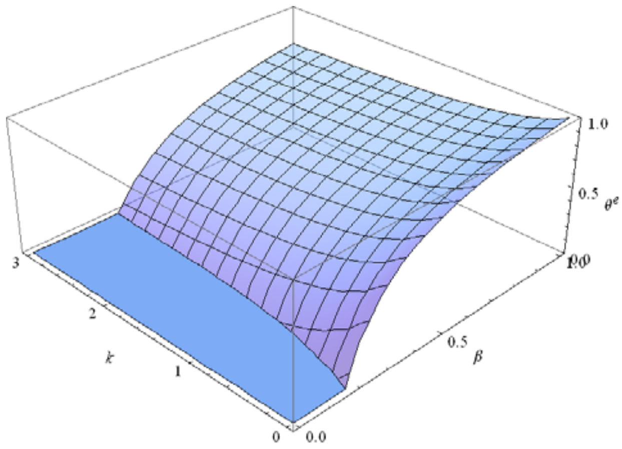

Fig. 1 (The case in which both firms compete in a third market) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the efficiency of the foreign firm (k) on the optimal state share in the public firm (θ^e)

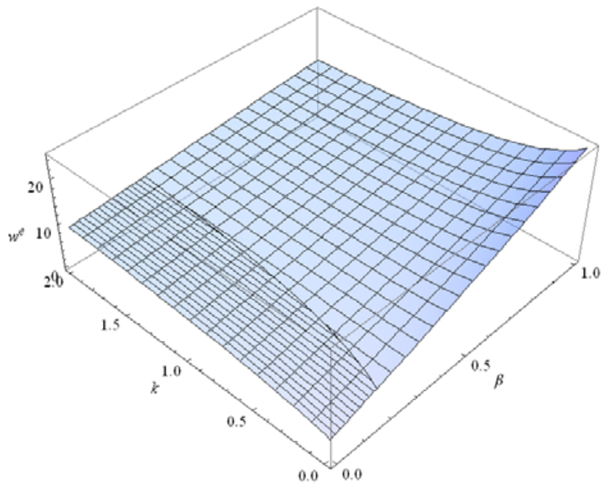

Fig. 2 (The case in which both firms compete in a third market) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the efficiency of the foreign firm (k) on the home country's social welfare (w^e) where $a = 10$

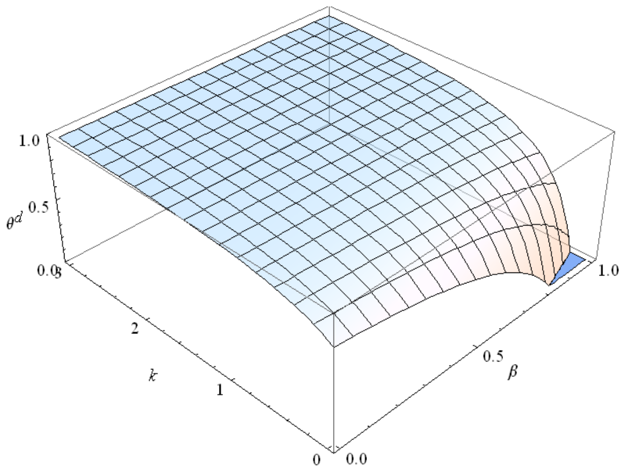

Fig. 3 (The case in which both firms compete in the home market) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the efficiency of the foreign firm (k) on the optimal state share in the public firm (θ^d)

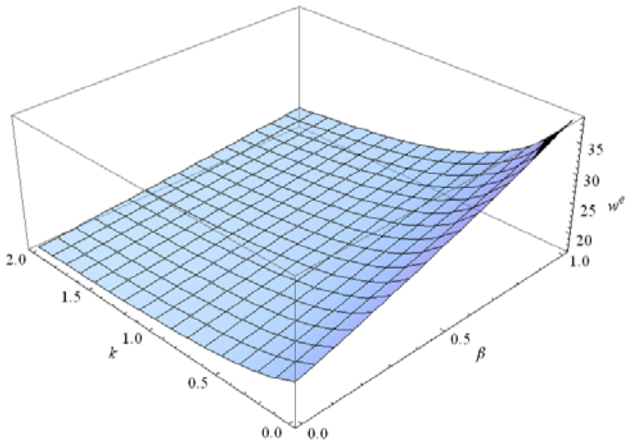

Fig. 4 (The case in which both firms compete in the home market) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the efficiency of the foreign firm (k) on the home country's social welfare (w^d) where $a = 10$

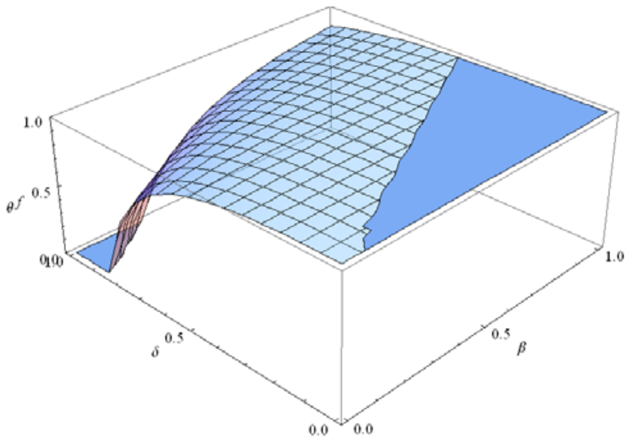

Fig. 5 (The case in which the privatized firm is partially owned by foreign investors) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the extent of foreign ownership of the domestic firm (δ) on the optimal state share in the public firm (θ^f) where $k = 0.5$

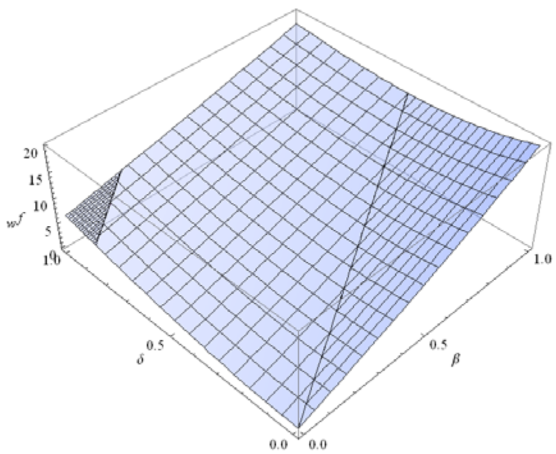

Fig. 6 (The case in which the privatized firm is partially owned by foreign investors) Effects of changes in the extent of domestic ownership of the foreign firm (β) and the extent of foreign ownership of the domestic firm (δ) on the home country's social welfare (w^f) where $a = 10$ and $k = 0.5$