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Strategic policies with foreign non-tradable input suppliers

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Strategic policies with foreign non-tradable input suppliers

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Abstract: We consider strategic government policies on the exports of final goods and on the input production when the inputs are non-tradable and produced by the foreign firms. If the policies consist of only per-unit tax/subsidies either on the final goods or on the inputs, it is optimal for the governments to impose taxes. However, if the governments can impose profit taxes on input production and per-unit tax/subsidies either on the final goods or on the inputs, it is optimal to impose per-unit subsidies along with a positive profit tax on the inputs. We find that the per-unit tax/subsidies on the final goods are perfect substitutes to per-unit tax/subsidies on the inputs. These results hold whether the input suppliers are the same firms or different firms.

Key Words: Foreign input supplier; Non-tradable input; Per-unit tax/subsidy; Profit tax; Strategic policy

JEL Classifications: F12; F13

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1. Introduction

The seminal work by Brander and Spencer (1985) shows that the implications of trade policies in imperfectly competitive markets are significantly different from those under perfect competition. The main contribution of this paper is to show the consequences of strategic trade policies in extracting rents from foreign final goods producers. While the earlier works in the so called "strategic trade policy" implicitly assumed that the factor markets are perfectly competitive and the factor prices are not affected by the trade policies, the latter works have extended the literature to show the effects of imperfectly competitive factor markets on trade policies.

There are two strands of literature showing the effects of imperfectly competitive factor markets on strategic trade policies. Brander and Spencer (1988), Mezzetti and Dinopoulos (1991), Bandyopadhyay et al. (2000) show how trade policies are affected when the labor markets are unionized, while Bernhofen (1997), Ishikawa and Spencer (1999), Hwang et al. (2003) and Chang and Sugeta (2004) determine optimal trade policies when the final goods producers require a critical input which is produced by domestic and foreign input suppliers.[1] So, while the former set of papers can be

[1] See Spencer and Jones (1991 and 1992) Rodrik and Yoon (1989) and Chang and Chen (1994) for other works on strategic trade policy with intermediate inputs.

appropriate for the situations with *non-tradable inputs* produced by the domestic firms, the latter papers show the implications of imperfectly competitive input markets with *tradable* inputs. Hence, neither of these sets of papers is appropriate for the situation with non-tradable inputs produced by the foreign firms. However, given the wave of globalization, it is often be the case that the foreign firms are investing in non-tradable inputs, such as in telecommunications and electricity industries (Kirkpatrick et al., 2006). This paper fills this gap in the literature.

We consider an economy where the final goods producers compete and like Cournot oligopolists and require a critical non-tradable input, which is produced by the foreign firms. To focus on the rent-shifting effects, we follow the so called "there country framework", where the entire final goods are exported to a third country, called rest of the world (ROW). That is, we consider an economy with two final goods producing countries, ROW where all the final goods are exported, and the input suppliers from ROW.

Section 2 considers the situation where the governments of the final goods producing countries impose per-unit tax/subsidies on the final goods and/or inputs. While subsection 2.1 considers the case of a monopolist input supplier, subsection 2.2 considers two different input suppliers. We show that whether the policies are either on the final goods or on the inputs, the optimal polices are to impose taxes. These tax rates

are the same and generate the same welfare for the final goods producing countries.[2]

Section 3 extends the analysis of section 2 by introducing profit taxes on the foreign input suppliers. Hence, section 2 may be appropriate for the situation when it is either difficult to verify profits of the input suppliers[3] or the input suppliers' opportunity costs are unknown to the governments[4]. We consider the case of single input supplier in subsection 3.1 and different input suppliers in subsection 3.2. In both these cases, it is optimal to use per-unit subsidies if the polices are either on the final goods or on the inputs. However, the governments always impose positive profit taxes on the input suppliers. We show that the welfare effects of the policies either on the final goods or on the inputs are the same. Hence, for the comparable situations of Cournot oligopoly with price discrimination by the input suppliers, our results with profit taxes are in contrast to the previous works with tradable foreign inputs, which suggest that the optimal policy is to impose per-unit tax (see, Bernhofen, 1997, Hwang et al., 2003 and Chang and Sugeta, 2004). If the final goods producing countries can use their policies effectively (i.e., can impose profit taxes on the input suppliers), we show that the suggestion of Brander and Spencer (1985) about per-unit subsidies under

[2] See Dixit (1984) for works on strategic export-import policies along with strategic production subsidies with perfectly competitive factor markets.

[3] Often the foreign firms use transfer pricing to avoid profit taxes. We refer to Svejnar and Smith (1984) and Falvey and Fried (1986) for seminal works on transfer pricing.

[4] If the opportunity costs of the input suppliers are unknown, excessive profit taxes may discourage the input suppliers to produce in a country.

international Cournot oligopoly with perfectly competitive input markets remains even if the foreign firms with market power supply non-tradable inputs. We conclude the paper in section 4.

It is worth mentioning that, whatever efforts have been devoted so far to find out the implications of imperfectly competitive input markets, to the best of our knowledge, all the papers except Ishikawa and Spencer (1999) and Hwang et al. (2003) have focused only on the trade policies on the final goods and have ignored policies on the input sector. With tradable inputs, and assuming that the input price in the competing country is exogenously given, Ishikawa and Spencer (1999) show that it is better for a country to impose policies on both the final goods and the inputs compared to the situation when the government policies are designed for the final goods only. In contrast, we find that the policies on the final goods only and the policies on the inputs only are perfect substitutes.

With tradable inputs, Hwang et al. (2003) show that the export policy on the final goods and the import policy on the imported inputs are perfect substitute if a monopolist final goods producer imports inputs from a foreign monopolist input supplier. However, unlike them, we consider non-tradable inputs and also focus on competition in both the final goods market and the inputs market. Further, while our results with linear government policies are in line with them, our results with non-linear

polices (i.e., with profit tax and per-unit tax/subsidy) differ from them.

In today's world, the export policies often come under criticisms from the world trade organizations, while the domestic industrial policies are not so much criticized. Our results show that in case of non-tradable inputs with foreign input suppliers, the domestic countries can achieve the same level of welfare by substituting export policies with that of industrial policies that tax the foreign input suppliers.

2. Per-unit tax/subsidies only

2.1. Monopoly input supplier

Consider two countries, 1 and 2, each with a final goods producer, called firm 1 and firm 2 respectively, who sell their entire outputs to a third country, called ROW. Assume that each final goods producer requires only a critical input to produce its outputs. Also, assume that both final goods producers require one unit of input to produce one unit of output.

Assume that the input is produced by a monopolist from ROW, i.e., it is neither from country 1 nor from country 2. Given that the inputs are non-tradable, we assume that the input supplier opens one plant in each country. However, while determining the input prices, w_1 and w_2, in countries 1 and 2 respectively, the input supplier maximizes its total profits from these countries.

We consider the following game. At stage 1, the governments of countries 1 and 2 simultaneously set their respective welfare maximizing policies by determining export subsidies (taxes, if negative) on the final goods, s_1 and s_2, and taxes (subsidies, if negative) on the inputs, t_1 and t_2. At stage 2, the input supplier sets the respective input prices, w_1 and w_2. At stage 3, the final goods producers choose their outputs like Cournot duopolists and the profits are realized. We solve the game in backward induction.

Given the government policies and the input prices, the equilibrium outputs and profits of firms 1 and 2 are respectively

$$q_1 = \frac{a - 2w_1 + 2s_1 + w_2 - s_2}{3} \quad \text{and} \quad \pi_1 = \frac{(a - 2w_1 + 2s_1 + w_2 - s_2)^2}{9} \tag{1}$$

$$q_2 = \frac{a - 2w_2 + 2s_2 + w_1 - s_1}{3} \quad \text{and} \quad \pi_2 = \frac{(a - 2w_2 + 2s_2 + w_1 - s_1)^2}{9}. \tag{2}$$

The input supplier maximizes the following expression to determine the input prices:

$$\underset{w_1, w_2}{Max} \frac{(w_1 - t_1)(a - 2w_1 + 2s_1 + w_2 - s_2)}{3} + \frac{(w_2 - t_2)(a - 2w_2 + 2s_2 + w_1 - s_1)}{3}. \tag{3}$$

The equilibrium input prices are

$$w_1^* = \frac{a + s_1 + t_1}{2} \quad \text{and} \quad w_2^* = \frac{a + s_2 + t_2}{2}. \tag{4}$$

The governments of countries 1 and 2 maximize the following expressions to determine the welfare maximizing export subsidies and taxes on the inputs:

$$\underset{s_1, t_1}{Max} \frac{(a + 2s_1 - 2t_1 - s_2 + t_2)^2}{36} - \frac{(s_1 - t_1)(a + 2s_1 - 2t_1 - s_2 + t_2)}{6} \tag{5}$$

$$\underset{s_2, t_2}{Max} \frac{(a + 2s_2 - 2t_2 - s_1 + t_1)^2}{36} - \frac{(s_2 - t_2)(a + 2s_2 - 2t_2 - s_1 + t_1)}{6}. \tag{6}$$

Given the symmetry of the countries, the equilibrium government policies are

$$t_1 - s_1 = t_2 - s_2 = \frac{a}{7}. \tag{7}$$

It is immediate from (7) that if the governments of countries 1 and 2 use policies only on the final goods, they impose export taxes $s_1 = s_2 = -\frac{a}{7}$. On the other hand, if they impose taxes only on the inputs, the optimal tax rates are $t_1 = t_2 = \frac{a}{7}$.

Hence, the following proposition is immediate.

Proposition 1: *If the final goods producers from two countries sell their entire outputs to a third country and the monopolist input supplier is not from the final goods producing countries, then the optimal taxes on the final goods only, those are* $s_1 = s_2 = -\frac{a}{7}$, *or the optimal taxes on the inputs only, those are* $t_1 = t_2 = \frac{a}{7}$, *or a combination of the optimal taxes on the final goods and the inputs such that* $t_1 - s_1 = t_2 - s_2 = \frac{a}{7}$ *generates the same welfare to the final goods producing countries.*

Each government wants to extract rent from both the foreign final goods producer and the foreign input supplier, and design its policies accordingly. However, it should be noted that these motives for rent extraction are inter-related. For example, if a government imposes tax/subsidy on the final goods producer of that country, that policy not only affects the marginal cost of that firm for a given input price, it also affects the

input price by affecting the input demand. Hence, by designing a policy for the final goods only, a government can manipulate the input price of the foreign firm, thus can extract rent from both the final goods market and the input market. Similarly, a policy targeting the foreign input supplier can also extract rent from both the final goods market and the input market. As a result, the governments can get the same welfare by designing a policy that either targets the final goods producer or the input supplier.

Though the welfare effects of taxes on the final goods and on the inputs are the same, it follows immediately from (4) and (7) that the input prices are different for these policies. The input prices are lower for taxes on the final goods producers than for taxes on the input suppliers. Taxes on the final goods reduce the input demands, while taxes on the inputs reduce the profits of the input suppliers. Hence, while the former policy tends to reduce the input price, the latter policy tends to increase the input price.

Even if the input prices differ depending on the policies either on the final goods or on the inputs, we get the same outputs and profits of the firms under these policies.

2.2. Different input suppliers

Let us now assume that the input suppliers in countries 1 and 2 are different, though neither of them is from countries 1 and 2. So, unlike section 2, now the input supplier U_1 (resp. U_2) in country 1 (resp. in country 2) determines the input price w_1 (resp. w_2)

to maximize the utility of U_1 (resp. U_2) .

The structure of the game is as follows. At stage 1, the governments of countries 1 and 2 simultaneously set their respective welfare maximizing policies by determining export subsidies (taxes, if negative) on the final goods, s_1 and s_2, and taxes (subsidies, if negative) on the inputs, t_1 and t_2. At stage 2, the input suppliers simultaneously set the respective input prices, w_1 and w_2. At stage 3, the final goods producers choose their outputs like Cournot duopolists and the profits are realized. We solve the game in backward induction.

Since the inputs are non-tradable, the input suppliers in countries 1 and 2 do not face direct competition between them, and therefore, get the input demands from the respective final goods producers only. However, the input suppliers face indirect competition due to the effects of the input prices on the final goods production and therefore, on the input demands by the final goods producers.

Given the government policies and the input prices, the equilibrium outputs and profits of firms 1 and 2 are respectively

$$q_1 = \frac{a - 2(w_1 - s_1) + (w_2 - s_2)}{3} \quad \text{and} \quad \pi_1 = \frac{(a - 2(w_1 - s_1) + (w_2 - s_2))^2}{9} \tag{8}$$

$$q_2 = \frac{a - 2(w_2 - s_2) + (w_1 - s_1)}{3} \quad \text{and} \quad \pi_2 = \frac{(a - 2(w_2 - s_2) + (w_1 - s_1))^2}{9}. \tag{9}$$

The input suppliers U_1 and U_2 maximize the following expressions respectively to determine the input prices:

$$\underset{w_1}{Max}\frac{(w_1-t_1)(a-2(w_1-s_1)+(w_2-s_2))}{3} \tag{10}$$

$$\underset{w_2}{Max}\frac{(w_2-t_2)(a-2(w_2-s_2)+(w_1-s_1))}{3}. \tag{11}$$

The equilibrium input prices are

$$w_1^* = \frac{5a+7s_1+8t_1-2s_2+2t_2}{15} \quad \text{and} \quad w_2^* = \frac{5a+7s_2+8t_2-2s_1+2t_1}{15}. \tag{12}$$

The governments of countries 1 and 2 maximize the following expressions to determine the welfare maximizing export subsidies and taxes on the inputs:

$$\underset{s_1,t_1}{Max}\frac{(10a+14s_1-14t_1-4s_2+4t_2)^2}{2025}-\frac{(s_1-t_1)(10a+14s_1-14t_1-4s_2+4t_2)}{45} \tag{13}$$

$$\underset{s_2,t_2}{Max}\frac{(10a+14s_2-14t_2-4s_1+4t_1)^2}{2025}-\frac{(s_2-t_2)(10a+14s_2-14t_2-4s_1+4t_1)}{45}. \tag{14}$$

Given the symmetry of the countries, the equilibrium government policies are

$$t_1-s_1=t_2-s_2=\frac{17a}{80}. \tag{15}$$

It is immediate from (15) that if the governments of countries 1 and 2 use policies only on the final goods, they impose export taxes $s_1=s_2=-\frac{17a}{80}$. On the other hand, if they impose taxes only on the inputs, the optimal tax rates are $t_1=t_2=\frac{17a}{80}$.

Hence, the following proposition is immediate.

Proposition 2: *Assume that there are non-tradable inputs, the input suppliers are different and not from the final goods producing countries, and the final goods producers from two countries sell their entire outputs to a third country. Then, the optimal taxes only on the final goods, those are* $s_1=s_2=-\frac{17a}{80}$*, or the optimal taxes*

only on the inputs, those are $t_1 = t_2 = \frac{17a}{80}$*, or a combination of the optimal taxes on the final goods and the inputs such that* $t_1 - s_1 = t_2 - s_2 = \frac{17a}{80}$ *generates the same welfare to the final goods producing countries.*

The intuition for Proposition 2 is also similar to that of Proposition 1.

It follows from Propositions 1 and 2 that whether the input suppliers in countries 1 and 2 are the same or not, the welfare effects of the government policies either on the final goods or on the inputs are equivalent. However, since $\frac{17a}{80} > \frac{a}{7}$, the optimal tax rates are higher when the input suppliers are different than when they are the same firms. For a given and symmetric per-unit tax subsidy, the input prices are lower when the input suppliers are different than when they are the same firms. Hence, if the input suppliers are different, the competition between them induces the governments to subsidize less aggressively (or to tax more aggressively) compared to the situation when the input suppliers are the same firm, thus internalizing competition between them.

3. Profit tax along with per-unit tax/subsidies

In this section, we assume that governments of the final goods producing countries can use non-linear policies those are consist of per-unit tax/subsidies and profit taxes.

Given that the inputs are non-tradable and the input suppliers are foreign firms, it is immediate that the final goods producing countries can improve their welfare by taxing the profits of the input suppliers. However, since the final goods producers are domestic firms, the profit taxes on the final goods producers will not affect the welfare of the final goods producing countries. Hence, in the following analysis, we will consider that the governments of the final goods producing countries use profit taxes on the input suppliers along with the per-unit tax/subsidies on the final goods and on the inputs.

3.1. Monopolist input supplier

Let us now consider a game similar to subsection 2.1 with the exception that now the governments can impose profit taxes along with the per-unit tax/subsidies on the final goods and on the inputs. Hence, it should be clear that our analysis of this section will similar to section 2.1 up to the stage of input price determination. However, the analysis will be changed for the government policies.

Given the input prices in (4), the profit of the input supplier in the i th country is $\pi_i^I = \frac{(a+s_i-t_i)(a+2s_i-2t_i-s_j+t_j)}{12}$, where $i=1,2$ and $i \neq j$. Hence, assuming that the opportunity cost of the input supplier is zero and given the symmetry of the countries, the optimal profit tax imposed by the i th government is

$\pi^I = \dfrac{(a + s_i - t_i)(a + 2s_i - 2t_i - s_j + t_j)}{12}$, where $i = 1,2$ and $i \neq j$.[5]

Therefore, the governments of countries 1 and 2 maximize the following expressions to determine the welfare maximizing per-unit tax/subsidies:

$$\underset{s_1,t_1}{Max} \frac{\begin{array}{l}(a + 2s_1 - 2t_1 - s_2 + t_2)^2 - 6(s_1 - t_1)(a + 2s_1 - 2t_1 - s_2 + t_2) \\ + 3(a + s_1 - t_1)(a + 2s_1 - 2t_1 - s_2 + t_2)\end{array}}{36} \tag{16}$$

$$\underset{s_2,t_2}{Max} \frac{\begin{array}{l}(a + 2s_2 - 2t_2 - s_1 + t_1)^2 - 6(s_2 - t_2)(a + 2s_2 - 2t_2 - s_1 + t_1) \\ + 3(a + s_2 - t_2)(a + 2s_2 - 2t_2 - s_1 + t_1)\end{array}}{36}. \tag{17}$$

The symmetry of the countries gives the equilibrium per-unit tax/subsidies as

$$t_1 - s_1 = t_2 - s_2 = -\frac{7a}{5}. \tag{18}$$

The equilibrium profit tax on the input supplier imposed by each government is $\dfrac{12a^2}{25}$.

It is immediate from (18) that the per-unit tax/subsidies either on the final goods or on the inputs are perfect substitutes. It also follows from (18) that, in contrast to subsection 2.1, it is optimal to impose per-unit subsidy either on the final goods or on the inputs if the governments use profit taxes on the inputs. However, the profit tax on the input supplier is always positive irrespective of the per-unit subsidies on the final goods or on the inputs.

The following proposition summarizes the above discussion.

[5] We assume that the inputs suppliers produce if they are not worse off compared to their opportunity costs.

Proposition 3: *If the final goods producers from two countries sell their entire outputs to a third country and the monopolist input supplier is not from the final goods producing countries, then it is optimal for the governments to impose positive profit taxes on the inputs, and per-unit subsidies either on the final goods or on the inputs if the governments impose profit taxes along with per-unit tax/subsidies on the final goods and on the inputs.*

The reason for the above result is as follows. Since the governments use profit taxes to extract rents from the foreign input suppliers, they use per-unit tax/subsidies for extracting rents from the foreign final goods producers. Given that the final goods producers compete in outputs, if a government imposes per-unit subsidy either on the final goods or on the inputs, it reduces the effective marginal cost of the respective final goods producer and increases its output, thus extracting rent from the competing foreign final goods producer. As a result, it is optimal to impose per-unit subsidies along with positive profit taxes.

3.2. Different input suppliers

Let us now consider the situation similar to subsection 2.2 (i.e., with different foreign input suppliers) with the exception that now the governments can impose profit taxes

along with the per-unit tax/subsidies on the final goods and on the inputs. It is immediate that this modification will affect the first stage analysis of subsection 2.2.

Given the input prices in (12), the profit of the i th input supplier is $\pi_i^I = \frac{(5a + 7s_i - 7t_i - 2s_j + 2t_j)(10a + 14s_i - 14t_i - 4s_j + 4t_j)}{675}$, where $i = 1,2$ and $i \neq j$. Therefore, the optimal profit tax imposed by the i th government is π_i^I.

The governments of countries 1 and 2 maximize the following expressions to determine the welfare maximizing per-unit tax/subsidies

$$\underset{s_1,t_1}{Max} \frac{\begin{array}{c}(10a + 14s_1 - 14t_1 - 4s_2 + 4t_2)^2 - 45(s_1 - t_1)(10a + 14s_1 - 14t_1 - 4s_2 + 4t_2) \\ + 3(5a + 7s_1 - 7t_1 - 2s_2 + 2t_2)(10a + 14s_1 - 14t_1 - 4s_2 + 4t_2)\end{array}}{2025} \quad (19)$$

$$\underset{s_2,t_2}{Max} \frac{\begin{array}{c}(10a + 14s_2 - 14t_2 - 4s_1 + 4t_1)^2 - 45(s_2 - t_2)(10a + 14s_2 - 14t_2 - 4s_1 + 4t_1) \\ + 3(5a + 7s_2 - 7t_2 - 2s_1 + 2t_1)(10a + 14s_2 - 14t_2 - 4s_1 + 4t_1)\end{array}}{2025}. \quad (20)$$

The symmetry of the countries gives the equilibrium per-unit tax/subsidies as

$$t_1 - s_1 = t_2 - s_2 = -\frac{25a}{38}. \quad (21)$$

The equilibrium profit tax on the input supplier imposed by each government is $\frac{141a^2}{722}$.

It follows immediately from (21) that the per-unit tax/subsidies either on the final goods or on the inputs are perfect substitutes, and, in contrast to subsection 2.2, it is optimal to impose per-unit subsidy either on the final goods or on the inputs if the governments use profit taxes on the inputs. However, the profit tax on the input supplier is always positive irrespective of the per-unit subsidies on the final goods or on the inputs.

The following proposition summarizes the above discussion.

Proposition 4: *If the final goods producers from two countries sell their entire outputs to a third country, the input suppliers are different and not from any final goods producing countries, then it is optimal for the governments to impose positive profit taxes on the inputs, and per-unit subsidies either on the final goods or on the inputs if the governments impose profit taxes along with per-unit tax/subsidies on the final goods and on the inputs.*

Though Propositions 3 and 4 are qualitatively similar, the comparison of (18) and (21) shows that the per-unit taxes are lower when the input suppliers are different than when they are the same firms. The profit taxes are also lower in the former than in the latter. When the input suppliers are different, the competition between them induces the governments to impose per-unit subsidies less aggressively and also generate lower profits for the input suppliers, which can be taxed by the governments, compared to the situation when monopoly in the input sector internalizes competition between the input suppliers.

4. Conclusion

Though the recent literature has shown the implications of input production by the foreign firms on strategic trade policies, it has not paid attention on non-tradable inputs. We analyze the effects of non-traded inputs produced by the foreign firms and show the implications of profit taxes in this respect.

We show that whether the governments design polices either for the final goods producers or for the input suppliers, the optimal policies are to impose per-unit taxes if the governments can impose only per-unit tax/subsidies. However, if the governments can use profit taxes along with per-unit tax/subsidies, it is optimal for the governments to impose per-unit subsidies either on the final goods or on the inputs, while imposing positive profit taxes on the inputs. We show that whether or not the governments use profit taxes, the per-unit tax/subsidy policies on the final goods and on the inputs are perfect substitute. Our results hold whether the input suppliers are the same firms or different firms.

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AWPE DATA SHEET

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TI: Strategic policies with foreign non-tradable input suppliers

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KE: Foreign input supplier; Non-tradable input; Per-unit tax/subsidy; Profit tax; Strategic policy

AB: We consider strategic government policies on the exports of final goods and on the input production when the inputs are non-tradable and produced by the foreign firms. If the policies consist of only per-unit tax/subsidies either on the final goods or on the inputs, it is optimal for the governments to impose taxes. However, if the governments can impose profit taxes on input production and per-unit tax/subsidies either on the final goods or on the inputs, it is optimal to impose per-unit subsidies along with a positive profit tax on the inputs. We find that the per-unit tax/subsidies on the final goods are perfect substitutes to per-unit tax/subsidies on the inputs. These results hold whether the input suppliers are the same firms or different firms.