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Article

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Passive Unilateral Cross-ownership and Strategic Trade Policy

Luciano Fanti and Domenico Buccella

Abstract

In a Cournot duopoly model in which exporters compete in a third market, this paper revisits the classical issue (dating back to the pioneering work of Brander and Spencer, *Export Subsidies and International Market Share Rivalry*, 1985) of the strategic trade policy choice in the presence of the passive participation of one firm in the rival. Passive cross-ownership dramatically alters the participating and participated firms' governments' choice to apply the strategic trade policy instrument, the equilibria typology and their efficiency properties. In fact, if the share of cross-ownership is sufficiently large, the participated firm's government finds optimal to tax export. Moreover, beyond an adequately high threshold, cross-ownership modifies the equilibrium from the activist regime for both countries to an asymmetric regime in which only the participating firm's government intervenes. In addition, in the case of the traditional common activist regime equilibrium, the classical prisoner's dilemma game structure may disappear.

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Keywords Export subsidy; prisoner's dilemma; unilateral cross-ownership; Cournot duopoly

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1 Introduction

The subsidy policy for exporting firms is a cornerstone of the public intervention in the productive sectors. While its effectiveness to gain an advantage is undeniable when rival countries do nothing, if the other countries use a subsidy policy as well, the well-known outcome is that both exporter countries would be better off if neither used that policy. This finding originates from Brander and Spencer (1985), according to which it is always convenient for countries which export in a third-country market under oligopolistic quantity competition to subsidize exports unilaterally. However, such a policy interventions performed by both countries are welfare inferior when compared to the case of free trade. In terms of the game-theoretic approach, this means that the game played by governments has the structure of the prisoner's dilemma.¹ A key point, beyond pointing out the pro and cons of such a policy, consists of identifying the types and characteristics of industries to be targeted with the subsidy policy instrument.²

An important stylized fact, especially with regard to oligopolistic industries, is the widespread presence of passive participation of one firm in other firms. The simplest and most common ownership structure in a duopoly context is that with only one passive (i.e. non-controlling) participation shareholding in the rival firm. Many papers have investigated the theoretical effects of such a type of passive cross-ownership in terms of several topics within the Industrial Organization literature, such as Cournot oligopoly (Farrell and Shapiro, 1990), tacit collusion (Reitman, 1994), Japanese automobile industry (Ono et al., 2004), asymmetric costs (Gilo et al., 2006, 2013), product differentiation and profitability (Fanti, 2013), welfare effects in the presence of unionization or asymmetric costs (Fanti, 2014, 2015), among others.

¹ The literature originated from the early works by Brander and Spencer (e.g. Brander, 1981; Brander and Spencer, 1984, 1985, 1988; Spencer and Brander, 1983), particularly the “strategic trade policy” approach. The subsequent intense debate is surveyed, e.g., by Krugman (1986), Grossman and Richardson (1986), Helpman and Krugman (1989) and Brander (1995).

² As noted by Spencer (1986, 70–71), “the identification of these characteristics is a preliminary step toward translating theory into practical policy proposals.”

On the other hand, most applications of strategic trade policy have been developed, extending the basic frame of Brander and Spencer (1985).³ The first important extension is due to Eaton and Grossman (1986) which studied the issue of strategic subsidies under Bertrand competition, where outputs are typically strategic complements, showing that an incentive to tax rather than to subsidize exports raises, which in turn implies that, under Bertrand, the strategic policy needed to capture more of the profit is a commitment to a higher price (rather than to a larger quantity).

Among the subsequent extensions, several studies have dealt either with trade policy in the presence of unions (Brander and Spencer, 1988; Bandyopadhyay and Bandyopadhyay, 2001; Fanti and Buccella, 2016) or incentive schemes with the delegation of different types of choices (i.a. Collie, 1997; Colonques, 1997; Das, 1997; Wang et al. 2008, 2009). To the best of our knowledge, despite this vast collection of theoretical and empirical literature, little attention has been paid so far to the effects of a passive participation of one firm in the rival on the trade policy choices in an export-rivalry context, although the theme of the ownership is acknowledged as crucial in the “strategic trade policy approach”.⁴

Among the few exceptions, two papers have provided some analysis on the strategic trade policies in the framework of international cross-ownership, i.e. Lee (1990) and Long and Soubeyran (2001). However, Lee (1990) assumes that only one firm (in a duopoly) faces tax and subsidy, while Long and Souberayn (2001) differs from Lee because there are many firms in each country with asymmetric costs between them, both governments are active and can subsidise (but cannot tax) also foreign firms, the government cannot impose lump-sum tax on consumers, so that they introduce a parameter in the social welfare function to represent the cost of public funds. Therefore they, in contrast with our paper, substantially depart from the standard frame of Brander and Spencer and thus their results are not comparable with our results.

³ In the words of Spencer and Brander (2008), “strategic trade policy has been analyzed in a wide range of contexts and is robust to a range of generalizations. These extensions include consideration of the effects of unionization of the industry, dynamic effects on investment and R&D, vertical integration and trade in intermediate and final goods, and extension to general equilibrium.”

⁴ Again, in the words of Spencer and Brander (2008), “Most applications of strategic trade policy assume that firms differ by *ownership* as well as country of location.”

Therefore, it is natural to ask if an industry characterised by the presence of such a type of cross-ownership could be a good (or a bad) candidate to be targeted with subsidy policies. To produce an answer, we investigate whether and how the presence of cross-ownership alters the outcomes of the standard game in which governments set subsidies for their own exporter firms.

In doing so, we propose a three-stage game with the following timing. At the pre-play stage, governments decide whether to intervene. In the first stage, the exporting countries decide on the optimal subsidy (tax) to maximize their own welfare, which is given by the profits of the exporter firm minus (plus) the subsidy spending (tax revenue).

Finally, in the second stage, the firms simultaneously and independently choose their output. This is determined according to the assumption that the firms choose output levels following the policy decisions that are made by their respective governments. We solve the game by applying the backward induction method to obtain a Sub-game Perfect Nash Equilibrium (SPNE).

It is shown that the presence of passive cross-ownership brings dramatic changes with respect to, on the one hand, the choice of the policy instrument, and on the other hand, the typology of equilibrium as well as its efficiency properties. In particular, with regard to the emergence of the endogenous equilibrium, we show that the presence of cross-ownership may be responsible for a shift from the activist regime for both countries (as in the traditional model) to a mixed regime in which only the government of the participating firm intervenes, while that of the participated firm abstains from intervention.

It is worth observing that the “game-theoretic” context of this paper is the necessary methodological approach for disclosing in depth the effects that are not straightforward of an apparently small change in the ownership structure in the industry, because the “application of basic game theory is a feature of strategic trade policy that distinguishes it from much of the previous work in international economics” (Spencer and Brander, 2008).

There are many cases in which firms acquire their rivals’ stock as passive investments that give them a share in the rivals’ profits but not in the rivals’ decision making. Studies on specific industries characterized by the presence of cross-ownership have been conducted by Alley (1997) (automobile industry), Parker and Roller (1997) (telecommunications), Trivieri (2007) and Bank of Italy (2008) (banking sector) and Morck and Nakamura (1999) on Japanese firms

(which seem to be significantly “cross-ownership oriented” in most industries). Here, we only mention a few examples of case studies (see for more details Gilo, 2000; Gilo and Spiegel, 2003, Fanti, 2016a).

The first case regards the wet shaving razor blade market where Gillette, the international and U.S. leader, in the nineties acquired 22.9% of the nonvoting stock of Wilkinson Sword, one of its largest rivals. Other two examples are in the automobile industry and in the steel industry. As regards the first industry, 1) in 1990, Renault acquired a 45% stake in Volvo Trucks, a 25% stake in Volvo Car, and a 8.2% stake in Volvo A.B., Volvo’s holding company, while Volvo acquired 20% of Renault S.A. and 45% of Renault’s truck-making operations; 2) Subsequently, Renault in 1999 initially acquired a 36.8% stake in Nissan, while Nissan in turn took a 15% non-voting stake in Renault.

As regards the second industry, 1) in the early 90’s, Japanese Nippon Steel and Korean Pohang Iron, two of the worlds’ largest steelmakers, held 0.5% ownership stakes in each other subsequently increased to 1% in the late 90’s and recently planned to increase them to 3%; 2) Japan’s second largest producer, Kawasaki Steel Company, purchased a minority stake in Korean Dongkuk Steel Company, while holding (at the time) a 40% stake in American steelmaker Armco; 3) similar multilateral investments exist among American and Canadian steelmakers as well as among European steelmakers.

Finally, another example of the potential interest of our results can be found in the national electricity markets of North-Europe (Amundsen and Bergman, 2002) where trade policies have been drastically changed at the end of nineties, with the elimination of border tariffs in Norway, Sweden, Finland and Denmark. However also important variations in the ownership structure of the power generating Swedish companies occurred, for example the Norwegian company Statkraft and the German company EON acquired sizable shares of the Swedish company Skydraft, the Finnish company Fortum acquired 50 per cent of the shares of the Swedish company Birka Energy and the French company EDF a minority owner of the Swedish company Grange.

Therefore, our results would indicate that trade policies could not be invariant to such changes in the foreign cross-ownership of power generating (as well as razor blades, automobile, steel) firms exporting in other countries. As a consequence, the paper’s results may be useful also for econometricians and economic policy historians in order to test whether and how trade policies of countries

whose exporting firms have been involved in passive cross-ownership acquisitions with foreign rivals are changed.

The remainder of the paper is organized as follows. Section 2 develops the model of strategic trade policy in the presence of cross-ownership. Section 3 analyses the governments' policy selection. Finally, Section 4 provides a conclusion.

2 The model with strategic trade policy

Following the approach of the Brander–Spencer (1985) model, we consider two exporting countries, each with a firm. Both firms (1 and 2) produce homogeneous goods, which are sold to a third country (i.e. an importing country) and compete between them on quantity (i.e. a duopolistic Cournot market). Moreover, there are two shareholders, *A* and *B* (which belong to countries 1 and 2, respectively), with shareholder *A* entirely owning firm 1 and having the minority of (or, at the limit, equal) shares of firm 2, and thus shareholder *B* has control of firm 2. We denote by b ($0 \leq b \leq 0.5$) the fraction of shares that shareholder *A* has in firm 2.⁵ Shareholders are assumed to maximise their total profit, which means that the objective function of shareholder *A* is

$$\pi_A = \pi_1 + b\pi_2 \quad (1)$$

while the objective function of shareholder *B* is

$$\pi_B = (1 - b)\pi_2. \quad (2)$$

The two firms face the same constant marginal cost, c . The governments of countries 1 and 2 provide specific export subsidies, s_i , to their producers. Therefore, firm i 's cost function is linear and described by:

⁵ The usual assumption that the one who owns the majority of the shares acquires the right to “manage” the firm's choices implies that, in the present model, $b \leq 0.5$. However, in principle, it would be possible even to postulate that the major shareholder “delegates” the firm's choices to the minor shareholder if this were more convenient for both shareholders. This case is left for further research.

$$C_i(q_i) = (c - s_i)q_i \quad (3)$$

We assume the standard linear inverse demand function

$$p = a - q_i - q_j \quad (4)$$

where p_i denotes price, q_i and q_j are the output levels of the two firms. Therefore, profits of firm i can be written as

$$\pi_i = pq_i - (c - s_i)q_i, \quad i=1, 2 \quad (5)$$

From (1), (2) and (5), under profit-maximization, firms' best-reply functions are given by

$$q_1(q_2) = \frac{a - c - q_2(1 + b) + s_1}{2}, \quad (6)$$

$$q_2(q_1) = \frac{a - c - q_1 + s_2}{2} \quad (7)$$

The best-reply functions are downward sloping; that is, under the Cournot assumption, the product market game is played in strategic substitutes. By solving the system (6)–(7), we obtain output and profits as a function of subsidy policies for firms 1 and 2, respectively:

$$q_1(s_1, s_2) = \frac{[(a - c)(1 - b) - s_2(1 + b) + 2s_1]}{(3 - b)} \quad (8)$$

$$q_2(s_1, s_2) = \frac{[a - c - s_1 + 2s_2]}{(3 - b)} \quad (9)$$

$$\pi_1(s_1, s_2) = \frac{[(a - c)(1 - b) - s_2(1 + b) + 2s_1](c - a + (1 - b)s_2 - (2 - b)s_1)}{(3 - b)^2} \quad (10)$$

$$\pi_2(s_1, s_2) = \frac{[a - c - s_1 + 2s_2]^2}{(3 - b)^2} \quad (11)$$

The social welfare (SW) expressions of the two countries are given by:

$$SW_1 = \pi_A - s_1 q_1, \quad SW_2 = \pi_B - s_2 q_2 \quad (12)$$

Each government maximises social welfare⁶ with respect to its subsidy rate for a given subsidy rate of the other government and the following reaction functions in subsidy rates are obtained:

$$s_1(s_2) = \frac{(a-c)(1-b) + s_2(1+b)}{2(2-b)}. \quad (13)$$

$$s_2(s_1) = \frac{(a-c-s_1)(1-3b)}{4(1+b)} \quad (14)$$

Solving the system (13)–(14), the subsidy rates at equilibrium are given by

$$s_1 = \frac{(a-c)}{5} \quad (15)$$

$$s_2 = \frac{(a-c)(1-3b)}{5(1+b)} \quad (16)$$

By exploiting (15) and (16) and recalling (8)–(12), after the usual algebra, the equilibrium values of output, profit and social welfare can be derived. Such equilibrium outcomes under trade policy (upper script S) are resumed, together with those of the case of free trade (FT)⁷, in Table 1.

3 The strategic game played by national governments

Now, at the pre-play stage, we develop the game between the two governments. Each of them may decide whether to subsidize production. To determine the subperfect Nash equilibrium (SPNE) of this game, we have to evaluate the

⁶ The expressions for $SW_i(s_i, s_j)$ are too long and are omitted here for brevity.

⁷ The equilibrium outcomes under free trade are easily obtained by setting $s_1=s_2=0$ in (8)–(12).

governments' pay-offs in the mixed case, in which one subsidizes while the other one allows free trade.

We develop the cases in which Government 1 (resp. Government 2) subsidises, while Government 2 (resp. Government 1) does not intervene; that is $s_2=0$ (resp. $s_1=0$). Standard calculations based on the conveniently modified Eqs. (8)–(12) and the maximization by Government 1 (resp. Government 2) of its social welfare leads to the following subsidy rate for firm 1 (resp. firm 2):

$$s_{1|s_2=0} = \frac{(1-b)(a-c)}{2(2-b)} \quad (17)$$

$$s_{2|s_1=0} = \frac{(1-3b)(a-c)}{4(1+b)}. \quad (18)$$

By substituting backwards (17) (and $s_2=0$) (resp. (18) and $s_1=0$) in (12)–(15), we obtain quantities and social welfares of countries 1 and 2 and report the data in Table 1.

An analytical inspection of the values related to the subsidies under the different trade configurations leads to the following Lemma.

Lemma 1. While Government 1 always sets a subsidy, Government 2 sets a subsidy (resp. a tax) when the share of cross-ownership is lower (resp. larger) than one-third in both cases of common or unilateral trade policy.

Proof: by simple observation of Eqs. (15)–(18).

The intuition behind Lemma 1 is straightforward. Since the Cournot competition on the product market is in strategic substitutes, the effect of firm 1's "internalization" that the two firms compete in the product market is such that firm 1 is less aggressive in terms of quantity. Thus, the effect of the increase of the participation of firm 1 in firm 2 results in an increase of the production of the latter and in a reduction of that of the former. Therefore, from the point of view of country 2's social welfare, firm 2 is relatively "overproducing" because of cross-ownership (with the corresponding larger fiscal burden for financing subsidies) so that, when the share of cross-ownership is sufficiently high – implying that also

firm 2's output is relatively large – it becomes optimal to tax (as opposed to subsidized) output.

Therefore, we can represent the countries' benefits of the different policy regimes through their pay-offs summarized in the pay-off matrix reported in Table 2. Each government has two strategies: to be interventionist (subsidize, S) or to adopt a non-interventionist stance (free trade, FT). As usual, the first element in each entry represents the payoff to country 1, while the second element represent the payoff to country 2. Along the top, Government 2's strategies are listed, and along the left are Government 1's strategies. Along these lines, social welfares are reported in detail in Table 2.

Now we are in a position, first, to solve for the sub-perfect Nash equilibrium (SPNE) of the game represented in Table 2, and second, to investigate the efficiency properties of the emerged SPNE.

Table 1. Outcomes under the different trade configurations

	quantity	subsidy	social welfare
Strategic trade policy	$q_1^{S,S} = \frac{2(a-c)}{5}$, $q_2^{S,S} = \frac{2(a-c)}{5(1+b)}$	$s_1^{S,S} = \frac{(a-c)}{5}$ $s_2^{S,S} = \frac{(a-c)(1-3b)}{5(1+b)}$	$SW_1^{S,S} = \frac{2(a-c)^2(3b^2+6b+1)}{25(1+b)^2}$, $SW_2^{S,S} = \frac{2(a-c)^2}{25(1+b)}$
Free trade	$q_1^{FT,FT} = \frac{(1-b)(a-c)}{3-b}$, $q_2^{FT,FT} = \frac{a-c}{3-b}$	$s_1^{FT,FT} = s_2^{FT,FT} = 0$	$SW_1^{FT,FT} = \frac{(a-c)^2}{(3-b)^2}$, $SW_2^{FT,FT} = \frac{(1-b)(a-c)^2}{(3-b)^2}$
Asymmetric regime 1 (Government 1 strategic trade policy)	$q_1^{S,FT} = \frac{(1-b)(a-c)}{2-b}$, $q_2^{S,FT} = \frac{a-c}{2(2-b)}$	$s_1^{S,FT} = \frac{(1-b)(a-c)}{2(2-b)}$ $s_2^{S,FT} = 0$	$SW_1^{S,FT} = \frac{(a-c)^2}{4(2-b)}$, $SW_2^{S,FT} = \frac{(1-b)(a-c)^2}{4(2-b)^2}$
Asymmetric regime 2 (Government 2 strategic trade policy)	$q_1^{FT,S} = \frac{a-c}{4}$, $q_2^{FT,S} = \frac{a-c}{2(1+b)}$	$s_1^{FT,S} = 0$ $s_2^{FT,S} = \frac{(1-3b)(a-c)}{4(1+b)}$	$SW_1^{FT,S} = \frac{(3b^2+8b+1)(a-c)^2}{16(1+b)^2}$, $SW_2^{FT,S} = \frac{(a-c)^2}{8(1+b)}$

Table 2. Social Welfare matrix

Country 2 \ Country 1	FT	S
FT	$SW_1^{FT,FT} = \frac{(a-c)^2}{(3-b)^2},$ $SW_2^{FT,FT} = \frac{(1-b)(a-c)^2}{(3-b)^2}$	$SW_1^{FT,S} = \frac{(3b^2 + 8b + 1)(a-c)^2}{16(1+b)^2},$ $SW_2^{FT,S} = \frac{(a-c)^2}{8(1+b)}$
S	$SW_1^{S,FT} = \frac{(a-c)^2}{4(2-b)},$ $SW_2^{S,FT} = \frac{(1-b)(a-c)^2}{4(2-b)^2}$	$SW_1^{S,S} = \frac{2(a-c)^2(3b^2 + 6b + 1)}{25(1+b)^2},$ $SW_2^{S,S} = \frac{2(a-c)^2}{25(1+b)}$

Let us define the following six differentials:⁸

$$\Delta_{1,1} = SW_1^{S/FT} - SW_1^{FT/FT}, \Delta_{2,1} = SW_1^{FT/S} - SW_1^{S/S},$$

$$\Delta_{1,2} = SW_2^{FT/S} - SW_2^{FT/FT}, \Delta_{2,2} = SW_2^{S/FT} - SW_2^{S/S},$$

$$\Delta_{3,1} = SW_1^{S/S} - SW_1^{FT/FT}, \Delta_{3,2} = SW_2^{S/S} - SW_2^{FT/FT}$$

Result 1. In an export-rivalry model with an unilateral passive participation, 1) when the share of participation is lower than one third, the choice to subsidy is the dominant strategy for both governments, that is, S/S is the SPNE; 2) when the share of participation is larger than one third, a mixed regime, in which only the government of the participating firm intervenes, while that of the participated firm abstains from intervening, endogenously emerges, that is S/FT is the SPNE.

⁸ As is well known, through the analysis of the first four differentials, we may obtain any possible Nash equilibrium of the game.

Proof: since

$$\Delta_{1,1} = \frac{[(1-b)(a-c)]^2}{4(2-b)(3-b)^2} > 0, \quad \Delta_{2,1} = \frac{(-21b^2 + 8b - 7)(a-c)^2}{400(1+b)^2} < 0,$$

$$\Delta_{1,2} = \frac{(9b^2 - 6b + 1)(a-c)^2}{8(1+b)(3-b)^2} > 0,$$

$$\Delta_{2,2} = \frac{(-33b^2 + 32b - 7)(a-c)^2}{100(1+b)(2-b)^2} < 0 \Leftrightarrow b \begin{matrix} < 1 \\ > 3 \end{matrix},$$

then result 1 follows.

Result 1 shows that Government 1: 1) on the one hand, always benefits from an unilateral subsidization although the subsidy rates is decreasing with the cross-ownership share because, when the latter increases, firm 1's production should reduce for maximizing profits (due to the “internalization effect”), and thus also a lower subsidy to production is needed; and 2) on the other hand, never benefits from an unilateral reversion to the free trade. On the contrary, Government 2, although always benefits from an unilateral trade policy which, however, is transformed from a subsidy to a tax with increasing cross-ownership shares, begins to prefer an unilateral decision to switch to a free-trade regime once its optimal trade policy becomes a tax instead of a subsidy. This is because its production and profits are larger without tax (and the rebated tax revenue would be less than profits loss). Thus, an asymmetric trade policy regime endogenously emerges when the asymmetry in the ownership structure becomes sufficiently large.

Result 2. Country 1 is better off in the S/S equilibrium than under FT/FT, provided that the share of cross-ownership is sufficiently high but not too high, that is when $0.186 < b < 0.333$, and is better off in the mixed S/FT equilibrium than both under S/S and FT/FT. Country 2 is better off in the mixed S/FT equilibrium (that is when $b > 0.333$) than under S/S (but not better than under FT/FT).

Proof: since

$$\Delta_{3,1} = \frac{(6b^4 - 24b^3 - 41b^2 + 46b - 7)(a - c)^2}{25(1 + b)^2(2 - b)^2} < 0 \Leftrightarrow b > 0.186,$$

$$\Delta_{3,2} = \frac{(27b^2 - 12b - 7)(a - c)^2}{25(1 + b)(3 - b)^2} < 0, \quad \Delta_{1,2} > 0$$

and $SW_2^{S/FT} - SW_2^{FT/FT} < 0$, then result 2 follows.

The reason behind the unconventional consequences for country 1 in Result 2 is that the national subsidy policy allows for a mitigation of the firm 1's quantity reduction due the “internalization effect” and the foreign subsidy policy sustains the firm 2's production and thus firm 2's profits which are partially returned as dividends to the firm 1 in a b percent measure: in other words, when b increases, firm 1 tends, on the one hand, to hold relatively its market share thanks to its subsidy and, on the other hand, to gain relatively from the support to the firm 2's quantity of the firm due to the subsidy of the other Government. As a result, provided that $b > 18.6\%$, country 1's welfare is higher when both Governments subsidize. Moreover, when b increases over one third and thus Government 2 switches to a free-trade regime, the country 1's welfare is better off in the new equilibrium regime, because the other Government ceases to tax the firm 2's production and thus the latter's profits increase, and, given the large cross-ownership share, foreign dividends received by firm 1 increase such that country 1's welfare is higher than under trade policy of both Governments.

Now we briefly provide some discussions of the robustness of the paper's results to modifications of two paper's features, that is the consideration of 1) two-sided instead of one-sided cross-ownership, and 2) a different timing of the game between Governments. As regards the first point, we note that in the real life the cross-ownership of companies may often result in a complex network of interdependent relations between economic agents. In the industrial organization literature the term “cross-ownership” includes all kinds of ownership relations that are distinguished in the finance literature. These include pyramiding structure, one-sided shareholdings, and mutual (reciprocal) shareholdings (which also includes “ring-form” links) (e.g. Dietzenbacher and Temurshoev, 2008). An analysis of the endogenous emergence of equilibrium trade policies under bilateral

cross-ownership is on our research agenda, but it is beyond of the scope of the present work. However a preliminary discussion on comparison of the equilibrium results unilateral cross-ownership and those under bilateral cross-ownership under the *exogenous* assumption of activist and non-activist policies reveals the following observation: while the (sole) country 1 (with unilateral passive investment of its firm) may be better off when the cross-ownership share is larger than 18.6% , in the case of reciprocal cross-ownership both countries are better off under free-trade than under subsidy policies, in accord with the traditional result. Therefore when the cross-ownership is reciprocal the consequent “more collusion” and higher profits does not modify the traditional welfare-superiority of the free-trade regime (that is the prisoner’s dilemma structure of the Brander and Spencer’s game would remain unchanged, while it is drastically changed under one-sided cross ownership).

Finally, as regards the second point, this paper assumes (in the spirit of the Brander and Spencer’ s approach) that Governments when both decide to intervene choose simultaneously and independently the optimal subsidy (tax) to maximize its own welfare in stage 1. However, in line with the recent literature (i.e. Hamilton and Slutski, 1990) according to which whether agents play simultaneously or sequentially the move game should not be exogenously assumed but should result from the agents’ decisions (because alternating the order of moves significantly different results may arise), one should also investigate whether such an assumption is sufficiently robust because otherwise the equilibrium results could be changed. In the Appendix we develop the “observable delay” game proposed by Hamilton and Slutski (1990) and show the robustness of our assumption.

4 Conclusions

This paper has carried out an investigation of the traditional subject of strategic trade policy choices, taking into account the widely observed phenomenon in the real world of firms detaining passive participations in rival companies. We have analyzed how cross-ownership changes the outcomes of the standard game in which governments set subsidies for their exporters. We have shown that passive cross-ownership remarkably alters the choice of the policy instrument, the

typology of equilibrium and its efficiency properties. In fact, although firms compete à la Cournot, the government of the participated firm can find optimal to tax export if the share of cross-ownership is adequately large. Moreover, when the cross-ownership share is sufficiently large (at least one third), the governments' game equilibrium shifts from an activist regime for both countries to a mixed regime in which only the government of the participating firm adopts a strategic trade policy, while that of the participated firm remains neutral. In addition, even in the case of the traditional common activist regime equilibrium, the classical prisoner's dilemma situation disappears, provided that cross-ownership share is at least about one fifth, because subsidization becomes optimal for the government of the participating firm. Finally, in the presence of the mixed equilibrium, subsidization becomes optimal (resp. inefficient) for the government of the participating firm (resp. the government of the participated firm).

Future research is definitely recommended to check the robustness of the present findings under a more extended game framework in which firms compete à la Bertrand in the presence of differentiated products or a framework considering managerial firms, network industries, R&D investments, and the presence of unionized labor force.

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Appendix: The timing game of Governments under trade policy regime

It is assumed that trade policy parameters can be chosen either sequentially or simultaneously, according to the observable delay game early formulated by Hamilton and Slutsky (1990).⁹ Therefore, at the pre-play game, the Governments decide to set parameters either at time $t = 1$ or at time $t = 2$.

As in the main text, in the first stage, the Governments choose the trade policy parameters. If both Governments choose parameters in the same period, they are chosen simultaneously, otherwise they are chosen sequentially.

We denote the leader (follower) Government by superscript L (F). Solving the model as in the main text, assuming that Government 1 is the leader (resp. follower) and the Government 2 is the follower (resp. leader), we obtain the following policy parameters (Table A1) and social welfares (Table A2), where the superscripts C denote the values obtained in the case of trade policy regime (S/S) in the main text.

Now we are in position to investigate the SPNE of the timing game.

Let us define:

$$\Delta_{1,1} = SW_1^F - SW_1^C, \Delta_{2,1} = SW_1^L - SW_1^C, \Delta_{1,2} = SW_2^F - SW_2^C, \Delta_{2,2} = SW_2^L - SW_2^C.$$

Standard calculations lead to the following social welfare differentials:

$$\Delta_{1,1} = \frac{(43b - 16b^2 - 22)(a - c)^2}{900(1 + b)^2} \begin{matrix} < \\ > \end{matrix} 0 \Leftrightarrow b \begin{matrix} < \\ > \end{matrix} 0.6875; \Delta_{1,2} = \frac{(-99b^4 + 24b^3 + 78b^2 + 8b - 11)(a - c)^2}{50(8b + 9b^2 + 3)^2(1 + b)} \begin{matrix} < \\ > \end{matrix} 0 \Leftrightarrow b \begin{matrix} < \\ > \end{matrix} \frac{1}{3};$$

$$\Delta_{2,1} = \frac{(9b^4 - 24b^3 + 22b^2 - 8b + 1)(a - c)^2}{100(8b + 9b^2 + 3)(1 + b)^2} \begin{matrix} > \\ < \end{matrix} 0 \Leftrightarrow b \begin{matrix} < \\ > \end{matrix} \frac{1}{3}; \Delta_{2,2} = \frac{(a - c)^2}{300(1 + b)} > 0$$

Result A. We have $\Delta_{1,1} < 0, \Delta_{1,2} < 0, \Delta_{2,1} > 0, \Delta_{2,2} > 0$ (provided that $b < 1/3$, i.e. when the trade policy regime is the equilibrium), which means that the SPNE of

⁹ Observable delay games have been intensively developed in the industrial organization literature (see for example the bibliography in Fanti (2016b)), but only few papers investigated the issue of the endogenous timing of the Government interventions in a third market model (i.e. Arvan, 1991; Okhawa et al., 2002, Hamada, 2009).

Table A1. Subsidy/tax rates matrix for the extended game with observable delay

<i>Firm 2</i>	L	F
<i>Firm 1</i>		
L	s_1^C, s_2^C	$s_1^{L/F} = \frac{(3b^2 + 1)(a - c)}{(9b^2 + 8b + 3)},$ $s_2^{L/F} = \frac{(1 - 3b)(3b + 1)(a - c)}{2(9b^2 + 8b + 3)}$
F	$s_1^{F/L} = \frac{a - c}{6}, s_2^{F/L} = \frac{(1 - 2b)(a - c)}{3(1 + b)}$	s_1^C, s_2^C

Table A2. Profits matrix for the extended game with observable delay.

<i>Firm 2</i>	L	F
<i>Firm 1</i>		
L	SW_1^C, SW_2^C	$SW_1^{L/F} = \frac{(9b^2 + 6b + 1)(a - c)^2}{4(9b^2 + 8b + 3)},$ $SW_2^{L/F} = \frac{(1 + b)(3b + 1)^2(a - c)^2}{2(9b^2 + 8b + 3)}$
F	$SW_1^{F/L} = \frac{(a - c)^2(8b^2 + 19b + 2)}{36(1 + b)^2},$ $SW_2^{F/L} = \frac{(a - c)^2}{12(1 + b)}$	SW_1^C, SW_2^C

the timing game is given by the choice leader/leader and then ultimately the SPNE is given by the simultaneous choice of subsidy/tax policies by Governments.¹⁰

The conclusion is that Result 1 and 2 in the main text are robust to the endogenous determination of the sequence of moves by Governments.

¹⁰ For $1/3 < b < 1/2$, we have $\Delta_{1,1} > 0$, $\Delta_{1,2} > 0$, $\Delta_{2,1} > 0$, $\Delta_{2,2} > 0$ and thus there would be two mixed SPNE in pure strategies, but in such a case the trade policy regime is no longer the equilibrium and thus the timing game would be meaningless.

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