Competition Policy as Strategic Trade with Differentiated Products

Martino De Stefano[a], Marc Rysman[b]

[a] Corresponding Author. CRA International, 1201 F Street NW, Washinfton DC, 20004
Email: mdestefano@crai.com. Telephone: 202-662-3842

[b] Department of Economics, Boston University, 270 Bay State Road, Boston, MA, 02215, USA
Email: mrysman@bu.edu, Telephone: 617-353-3086

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Abstract. The paper analyses how countries use competition policy as a tool for strategic trade. In the model, two countries export to a third country. Each exporting country is endowed with a set of differentiated products. Each government chooses the number of exporters for its country and the products that each exporter sells in the first period, and a tax policy in the second period. Firms choose prices or quantities independently in the third period. In the unique Subgame Perfect Equilibrium, both countries group all their products within a single firm - the "national champion policy". We study the implication of different assumptions about the timing of the game.

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1 Introduction

Growth in the share of goods traded in the international market has made domestic competition policy into an international issue. Competition policy is entering the realm of international trade negotiations and, even in the United States, can no longer be seen simply as a matter of intra-national industrial policy. This paper presents a model of competition policy as a tool for strategic trade. The paper looks at competition policy, and competition policy in conjunction with subsidy policy, in order to predict government strategies.

In our model, two countries export to a third consuming country. Each exporting country starts the game endowed with a given set of differentiated products. We represent competition policy by allowing governments to choose the ownership structure of their products. For example, governments can assign all goods to a single firm, or they can assign each good to a separate firm, creating competition between their own goods. They can choose any market structure in between. We study a three-stage game. In the first period, governments choose simultaneously the market structure for their goods. In the second period, each country chooses a production tax system. In the third period, exporters choose their strategies independently. We consider both the case of price-setting exporters and the case of quantity-setting exporters.

We show that in the only Subgame Perfect Equilibrium, each country decides to have one firm controlling all national goods, the *national champion policy*. This happens both when firms compete in price and when they compete in quantity. The result hinges on the fact that competition policy and production taxes can be used interchangeably to achieve desired outcomes. We show that in the absence of foreign country taxation, the home country can choose taxes to achieve any set of prices it desires regardless of its choice of market structure. Therefore, the only impact of market structure can be on how it induces the foreign country to choose taxes. We show that a less competitive home market structure induces the foreign country to choose higher taxes.

We consider whether separate exporters from the same country would themselves choose to merge. We show that a merger among firms from the same country always increases the profit of all firms from that country and reduces the profit of firms from the other country.

We also consider the two-stage game where countries choose market structure in the first period and exporters pick strategies in the second period. We show that each country would like to pick a market structure that mimics committing to desired second stage results. For instance, in a price setting game, each country would like to commit to higher prices than would result in a simultaneous game, so they choose to have a national champion in the first period. In a quantity setting game, each country would like to commit to higher quantities than would result from a simultaneous game. Therefore, they choose a competitive market structure, using competition between their domestic exporters as a method to commit to high quantities.

Finally, we consider the implications of a different assumption about the timing of the game. We study a two-stage game where governments choose taxes and market structure simultaneously in the first period, and firms compete in price or quantity in the following period. We show that there is a multiplicity of equilibria. Given any market structure for the two exporting countries, there is a system of taxes that, together with the given market structures, represents the first stage part of a Subgame Perfect Equilibrium of the game.

Our work follows in the tradition of the Brander and Spencer (1985) model of export subsidization. As is well known, the results of the Brander-Spencer model depend crucially on the assumed market structure, in particular on the number of firms in each country. In our model, market structure is endogenised.

Policy analysts and legal researchers have long recognized a possible relation between trade policy and antitrust policy. Recently, there has been some work by economists as well. An important early contribution is Dixit (1984). He studies strategic trade policy in a two-country model. Each country hosts oligopolistic firms that compete in both markets. He performs comparative analysis and studies how domestic welfare is related to the number of home and foreign firms, to export tariffs and import subsidies. Cowan (1989) develops a model with one importing country and one exporting country. The producing country seeks to maximize the profit of its firms by choosing its competition policy (number of exporters) and its export subsidy, while the importing country chooses its import tariff.

With linear demand the optimal number of firms from the point of view of the producing country is shown to be infinity, while it is one if the demand is isoelastic. Horn and Levinsohn (2001) study the interaction between trade liberalization and merger policy using partial equilibrium models similar to ours. They develop a two-country model with home consumption and intra-industry trade (there is no third country). As in Horn and Levinsohn (2001), Richardson (1999) develops a model in which countries strategically choose both merger and trade policy. He focuses exclusively on tariffs and studies the case of custom unions as well.

All previous papers assume that firms compete in quantities of homogenous goods. However, it is well known that the predictions of strategic trade models are highly sensitive to assumptions about the type of competition (Eaton and Grossman (1986)). An important contribution of our paper is to consider the arguably more realistic case of differentiated products and price-setting games. A natural extension of models such as Horn and Levinsohn (2001) to differentiated products might be to allow countries to choose their number of products. However, changing the number of products in a differentiated products framework affects demand as well as strategic incentives. Our approach of taking the products as given and allowing countries to choose only ownership structure allows us to focus on strategic issues.

A related paper is Miller and Pazgal (2003). They combine the strategic trade literature and the strategic delegation literature in a three-stage game in which governments choose subsidies, firms' owners choose incentive schemes for their managers, and then the managers compete in the product market. They show that the optimal trade policy does not depend on whether firms compete by setting prices or quantities, but only depends on factors such as the firms' cost and demand functions. Although in our paper the optimal trade policy is sensitive to the nature of product-market competition, the optimal competition policy is not. In our three-stage game, the national champion policy is the only Subgame Perfect Equilibrium, whether firms compete in quantity or price.

A related industrial organization literature uses similar models to analyze games in which firms pick their number of franchises or independent divisions, and then choose two-part tariffs. Saggi and Vettas (2002) and Rysman (2001b) study a linear Cournot duopoly model and show that in the unique Subgame Perfect equilibrium both firms choose to have only one franchise. Rysman (2001b) considers the homogeneous product case, while Vettas and Saggi (2002) study a duopoly with differentiated products, where, however, divisions of the same firm sell an homogeneous good. Their results are in sharp contrast to previous literature which did not model contracts and concluded that competitors benefit by creating a large number of independent divisions (for example Baye et. al (1996), Corchon (1991) and Polasky (1992)). Most of the papers on this topic adopt an homogeneous good assumption and assume Cournot competition. Gonzalez-Maestre (2001) is the first to study heterogeneous goods and price competition.[1]

Finally, our paper is related to the literature analyzing the incentive of oligopolistic firms to merge. Deneckere and Davidson (1985) and Salant et al. (1983) study this issue in an industrial organization context, Horn and Persson (2001) in a trade context. A striking result of Salant et al. (1983) is that in a standard Cournot oligopoly with linear demand and constant marginal costs, horizontal mergers tend to be not profitable for the merging firms, while they always increase the profit of non merging firms. In our model, both under Bertrand and Cournot competition, any merger among home firms increases profit from any home good and decreases profit from any foreign good.

The rest of the paper proceeds as follows. In section 2 we introduce the model and study the case where countries use competition policy but not subsidy policy. Section 3 introduces subsidy policy and shows that in the only equilibrium firms choose a national champion policy. Section 4 studies the implication of a different timing assumption. The last section concludes. Most proofs are omitted; they are available from the authors upon request.

2 A Model of Competition Policy

In this section, we consider a two period model in which two countries choose the structure of their exporting market in the first period and exporters set prices in the second period. We follow with a

[1] Gonzales-Maestre (2001) allows competing firms (principals) to choose their number of products located on a circle, where each product is produced by an independent division. He finds that the principal prefers many divisions where we find the principal preferring only one. We believe that this discrepancy is due to the fact that allowing the principal to choose the number of products has demand-inducing as well as strategic effects.

discussion of the quantity-setting case. In the next section, we study a three-period model in which countries choose market structure in the first period, countries choose a production tax in the second period and exporters set prices or quantities in the third. Note that all results could be easily extended to more than two countries exporting to an importing country.

2.1 Competition Policy

Two countries, h (home) and f (foreign) export to a third consuming country.[2] The two exporting countries are endowed with a set of differentiated products. In the first period, each exporting country chooses its number of exporters and the exporters' products. They can assign all goods to a single firm, or they can assign each good to a separate firm, creating competition between their own goods, or they can choose any market structure in between. In the second period, those exporters choose prices for their products independently. The solution concept is Subgame Perfection. Formally, the home country exports n^h products and the foreign country exports n^f products. The total number of products is $n = n^h + n^f$. Utility for the representative agent in the consuming country is:

$$U = \sum_{i=1}^{n} \alpha_i q_i - \frac{1}{2}\left(\sum_{i=1}^{n} q_i^2 + 2\gamma \sum_{i \neq j} q_i q_j\right) + I - \sum_{i=1}^{n} p_i q_i$$

The parameter $\gamma \in [0, 1)$ captures the degree of substitutability between products: the higher γ, the higher the degree of substitutability[3]. From the first order (sufficient) condition we can derive the following inverse demand functions:

$$p_i = \alpha_i - q_i - \gamma \sum_{j \neq i} q_j$$

[2] This assumption is usual in the strategic trade literature, since Brander and Spencer (1985) contribution. The assumption allows us to ignore consumers' welfare issues and concentrate on the strategic incentives to manipulate market structure. Arguably, this assumption can also be motivated as a representation of laws that allow cartels to form only for the purposes of exporting.

[3] At cost of a more cumbersome notation, we could allow more general substitution patterns. For example, we could assume that goods from the same country are better substitutes than goods from different countries (Armington assumption). The main results of the paper would stay unaltered.

The demand functions are obtained by inverting the previous functions:

$$q_i = a_i - \beta p_i + \sigma \sum_{j \neq i} p_j$$

With a_i, β and σ appropriately defined functions of α_i and γ.[4] Linear demand systems have been extensively used in the industrial organization literature. See for example Singh and Vives (1984) or Hackner (2000).

Let $\mathcal{G}^h$ be the set of all partitions (or groupings) of the n^h home products. Then, in the first period, the home government chooses a partition of products $G^h \in \mathcal{G}^h$ that contains J^h elements. Each element $G_j^h \in G^h$ is a set of products. By the definition of a partition, $\cup_{j=1}^{J^h} G_j^h$ contains the entire set of home products and $G_j^h \cap G_k^h = \emptyset$, $\forall j \neq k$. Country h is interpreted to have J^h firms and firm j sells the n_j^h products contained in the set G_j^h. We say that market structure $G^{h\prime}$ is more competitive than market structure G^h if $G^{h\prime}$ is a finer partition of home products than G^h.[5] The foreign country is characterized in an analogous way. Firm are assumed to have constant marginal cost, which for simplicity is taken to be zero.

In the second period, each exporter chooses prices independently. Let $\mathbf{p}_j^c$ be the vector of prices for products controlled by firm j in country c, and let $\mathbf{p}_{-j}^c$ be the vector of all other prices. Define $\mathbf{q}_j^c(\mathbf{p}_j^c, \mathbf{p}_{-j}^c) : \mathbb{R}^n \to \mathbb{R}^{n_j^c}$ to be the function mapping prices into the vector of quantities for products controlled by firm j in country c. Each firm solves:

$$\max_{\mathbf{p}_j^c} \ \mathbf{p}_j^{c\prime} \mathbf{q}_j^c(\mathbf{p}_j^c, \mathbf{p}_{-j}^c)$$

Here, $\mathbf{x}'$ represents the transpose of the vector $\mathbf{x}$. It is straightforward to show that equilibrium exists and is unique. Let $\mathbf{p}^c(G^h, G^f)$ be the function returning the vector of equilibrium prices that arise for country c when the two countries choose partitions G^h and G^f.

[4]In particular, $a_i = \frac{\alpha_i[\gamma(n-2)+1] - \gamma \sum_{j \neq i} \alpha_j}{(1-\gamma)[\gamma(n-1)+1]}$; $\beta = \frac{\gamma(n-2)+1}{(1-\gamma)[\gamma(n-1)+1]}$; $\sigma = \frac{\gamma}{(1-\gamma)[\gamma(n-1)+1]}$. We assume that the α_i are such that $a_i > 0$. This requires the α_i not be very different across products.

[5]Note that this method of ordering market structures is not complete. However, to prove the results of this paper, it will be sufficient to consider changes in market structure in the direction of increasing or decreasing competitiveness.

Lemma 1 *A less competitive home market structure or a less competitive foreign market structure imply higher prices for the products of both the home country and the foreign country.*

In the first period, each country chooses a partition for its products. Country h solves:

$$\max_{G^h \in \mathcal{G}^h} \Pi^h \left(G^h, G^f\right) = \mathbf{p}^h(G^h, G^f)'\mathbf{q}^h \left(\mathbf{p}^h(G^h, G^f), \mathbf{p}^f(G^h, G^f)\right)$$

We show that the optimal strategy for each country is to group all of its products into a single firm - the *national champions strategy.* The intuition is straightforward. Two principals are playing a price-setting game through their agents. In a price-setting game, each of the principals would like to commit to higher prices than would normally occur in a simultaneous-move game. They use the partition of firms to achieve an outcome as close as possible to what they would have chosen if they could just choose prices directly in the first period. Let $\mathbf{p}^h_{ST}(G^f)$ be the function returning the "Stackelberg price vector", the prices that the home government would pick if it could pick prices in the first period knowing that foreign firms would set prices in the second period according to their optimal reaction function $\mathbf{p}^f(\mathbf{p}^h, G^f)$, given foreign market structure G^f. That is:

$$\mathbf{p}^h_{ST}(G^f) = \underset{\mathbf{p}^h}{\text{argmax}} \; \Pi^h \left(\mathbf{p}^h, \mathbf{p}^f(\mathbf{p}^h, G^f)\right) = \mathbf{p}^{h\prime}\mathbf{q}^h \left(\mathbf{p}^h, \mathbf{p}^f(\mathbf{p}^h, G^f)\right) \tag{1}$$

Governments try to use the tools at their disposal, such as competition policy and tax policy (in the next section), to try to achieve these prices. In other terms, the home country chooses G^h such that $\mathbf{p}^h(G^h, G^f)$ is as close as possible to $\mathbf{p}^h_{ST}(G^f)$. To see this, note that prices set by foreign exporters depend on home country's partition only through their effect on home country prices. That is, we can abuse notation and write $\mathbf{p}^f(G^h, G^f)$ as $\mathbf{p}^f\left(\mathbf{p}^h(G^h, G^f), G^f\right)$. Therefore, the home country solves:

$$\max_{G^h \in \mathcal{G}^h} \Pi^h \left(G^h, G^f\right) = \mathbf{p}^h(G^h, G^f)'\mathbf{q}^h \left(\mathbf{p}^h(G^h, G^f), \mathbf{p}^f\left(\mathbf{p}^h(G^h, G^f), G^f\right)\right)$$

The objective function is identical to the objective function of (1). Countries use pre-production strategies to try to mimic a "Stackelberg outcome" in the production stage. This result appears in many principal agent papers, such as Brander and Spencer (1985) and Fershtman and Judd (1987). In our case, choosing a partition of firms may not be enough to do as well as choosing prices directly because choosing the partition of firms is not as flexible (more specifically, it is not continuous).[6]

It is easy to show that the equilibrium prices are lower than the Stackelberg prices, so that each country would like to raise prices above them.

Lemma 2 *A country that could pick prices directly in the first period would choose higher prices than the equilibrium prices.*

The highest prices a country can achieve are by selling all of its products through a single exporter (see Lemma 1). Each country would like to set prices even higher if it could. Therefore, partitioning products into separate exporters in any way must reduce profits.

Theorem 1 *In equilibrium, each country sells all of its products through a single exporter.*

Note that because separate exporters would themselves choose to merge, a government needs only to give them the opportunity, as opposed to actually brokering an agreement (see Deneckere and Davidson (1985) and Salant et al. (1983) in an industrial organization context and Horn and Persson (2001) in a trade context). Therefore, a government can simply take a lax approach to enforcing antitrust rules. If the cost of doing so to domestic consumer surplus (un-modelled here) is too high, a government can specifically allow cartels for the purposes of exporting, such as the United States does under the Webb-Pomerene Act of 1918 and the Export Trading Company Act of 1982.

2.2 Quantity Setting

Results differ in intuitive ways if exporters choose quantities in the second stage instead of prices. Whether we have a quantity setting game or a price setting game, each country would like to pick its exporter partition to mimic what it would do if it could pick the second stage strategy directly in the first period. Also, a Stackelberg quantity-setter chooses a higher quantities than a national champion

[6] Note that the proof of the following Theorem 1 is more involved than this intuition because a differentiated products setting implies multiple prices. Picking a partition with prices "close" to the desired prices must be defined properly.

in the simultaneous quantity setting game. While a Stackelberg price-setter acts less aggressively than a simultaneous national champion chooser, a Stackelberg quantity setter acts more aggressively, which has important implications for export policy. A country can extract higher quantities by relying on a more competitive market structure. That is, we expect in this game to see relatively fine partitions in G^h and G^f, as countries use competition among their exporters as a way to make a first-period commitment to high quantity. Rysman (2001a) shows that if $\gamma = 1$ (perfect substitutes), each country would like to have one more exporter than the other, leading to maximally competitive markets. This result appears in a number of other papers, such as Baye et al. (1996).

Note that if γ is close to zero, it is possible that countries still choose to have a national champion. Given the dependence of the result on the parameters and the discrete nature of the problem, we do not fully characterize equilibrium in the game with quantity setting.

3 Taxes and Subsidies

Production subsidies are the most widely studied tool for strategic trade and among the most important for policy consideration. How does the presence of taxes or subsidies affect the use of competition policy? In this section, we consider a three-period game in which governments choose their market structure in the first period, governments choose a per-unit tax system in the second period, and exporters choose prices in the third period. We also discuss the quantity-setting case. We allow countries to choose market structure before they choose tax policy because antitrust policy tends to be encoded in law and is presumably difficult to change, whereas taxes can be quickly adjusted for a given need. However, the timing affects the result so we will consider a different timing in Section 4.[7]

[7] We assume that the solution is interior. We proved that if products are symmetric ($\alpha_i = \alpha$, for every $i => a_i = a$, for every i), the solution is interior (the proof is available upon request). By continuity, the solution is interior if α_i are similar but not identical. However, numerical simulations show that if α_i are sufficiently different across products, the first order conditions do result in negative outputs or prices for products with low α_i. In the paper, we assume that the α_i are close enough to guarantee that the equilibrium is interior.

3.1 The Bertrand Case

3.1.1 The Tax Sub-Game

Consider the tax setting game in the third period. Let $\mathbf{t}$ be the n vector of taxes with $\mathbf{t}^c$ being the n^c vector of taxes for country c. Note that each element of $\mathbf{t}$ may be different and any element of $\mathbf{t}$ can be negative. In the final period, the profit to the exporter for each product i in country c is $(p_i^c - t_i^c)q_i^c$ and the revenue to the government from product i is $t_i^c q_i^c$. As usual in such games, taxes do not enter directly into the government's objective function . The government views taxes as pure transfer to the firms. However, taxes can be an effective way to get firms to choose prices that maximize the country's welfare. It is straightforward to solve the third stage problem. Closed form expressions can be easily derived in the case of linear demand.

Let $\mathbf{p}^c(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f)$ be the third stage equilibrium prices. We now consider the second stage of the game. Each government chooses taxes taking the taxes in the other country, as well as market structure in both countries, as given. Therefore, the home government solves:

$$\max_{\mathbf{t}^h} \; \Pi^h \left(\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f), \mathbf{p}^f(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f)\right) = \mathbf{p}^h(\cdot)\mathbf{q}^h \left(\mathbf{p}^h(\cdot), \mathbf{p}^f(\cdot)\right)$$

It is straightforward to show that the equilibrium exists in this game, given the linearity of demand and the constant marginal cost.

As above, each country uses strategies in this stage to impact outcomes in the production stage. First, we consider the vector of prices that the government would like to achieve. Consider the set of prices the home government would choose if it could choose prices directly in the second stage, knowing that exporters in the foreign country will know the home products' prices before making their own choices. This "Stackelberg leader" takes market structure and taxes in the foreign country as given. We denote these prices as $\mathbf{p}^h_{ST}(G^f, \mathbf{t}^f)$, defined as:

$$\mathbf{p}^h_{ST}(G^f, \mathbf{t}^f) = \underset{\mathbf{p}^h}{\operatorname{argmax}} \; \Pi^h \left(\mathbf{p}^h, \mathbf{p}^f(\mathbf{p}^h, G^f, \mathbf{t}^f)\right) = \mathbf{p}^{h\prime}\mathbf{q}^h \left(\mathbf{p}^h, \mathbf{p}^f(\mathbf{p}^h, G^f, \mathbf{t}^f)\right) \tag{2}$$

and similarly for $\mathbf{p}^f_{ST}(G^h, \mathbf{t}^h)$. The functions $\mathbf{p}^f(\mathbf{p}^h, G^f, \mathbf{t}^f)$ gives the optimal prices for the independent foreign country exporters, given $\mathbf{p}^h$, G^f and $\mathbf{t}^f$. We show first that governments would like to mimic these prices, and second that doing so is feasible.

Lemma 3 *In the second stage of the game, the home government would like to pick taxes such that*

$$\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f) = \mathbf{p}^h_{ST}(G^f, \mathbf{t}^f)$$

and similarly for the foreign country.

Proof. Note that prices set by foreign exporters depend on home market structure and subsidies only through their effect on home country prices. That is, we can abuse notation and write $\mathbf{p}^f(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f)$ as $\mathbf{p}^f\left(\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f), G^f, \mathbf{t}^f\right)$. Therefore, the home country wants to solve:

$$\max_{\mathbf{t}^h} \; \mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f)'\mathbf{q}^h\left(\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f), \mathbf{p}^f\left(\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f), G^f, \mathbf{t}^f\right)\right)$$

This objective function is identical to the one in equation 2. ■

We will show that, unlike the case analyzed in the previous section, governments can achieve this result. An important result for this section is that a country can implement any set of prices through the appropriate set of taxes. This result follows from the fact that taxes are a continuous choice variable and prices are monotonic in each tax.

Lemma 4 *For any $\mathbf{p}^h \in [0, a_i]^{n^h}$, there exists a tax system $\mathbf{t}^h$ that induces $\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f) = \mathbf{p}^h$.*

Therefore, we have the following theorem characterizing the second stage of this game.

Theorem 2 *The home government picks taxes $\mathbf{t}^h$ such that:*

$$\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f) = \mathbf{p}^h_{ST}(G^f, \mathbf{t}^f).$$

With an export tax, the home government can reach any set of prices it wishes. Note that it can do so regardless of the market structure G^h. In a unilateral game, where the foreign country did not tax, the home country would be indifferent between all market structures. Regardless of which market structure it chooses, it could simply choose taxes in the second period to reach $\mathbf{p}^h_{ST}(G^f, \mathbf{0})$. In this sense, tax policy is more flexible and powerful than competition policy as a form of strategic intervention into trade. The choice of market structure becomes irrelevant if it does not have an impact on the other country's choice of taxes.

Of course, we are considering a game in which both countries intervene with tax policy. It is useful to keep in mind that, in equilibrium, both countries achieve the Stackelberg outcome. Both achieve the prices that a Stackelberg leader would choose against a market structure of G^{-c} with marginal costs $\mathbf{t}^{-c}$.

An important issue for solving the equilibrium in the first period is to determine the effect of market structure in country c on taxes in country $-c$. The next Lemma shows that a less competitive market structure in the home country (a coarser partition of goods) induces higher taxes on foreign products. Intuitively, governments compensate firms that face competitive foreigners by giving them a lower marginal cost. Let the optimal tax for country c be denoted $\mathbf{t}^c(G^h, G^f)$. We have the following Lemma:

Lemma 5 *Let $G^{h\prime}$ be a finer partition than G^h. Then $\mathbf{t}^f(G^h, G^f) > \mathbf{t}^f(G^{h\prime}, G^f)$.*

3.1.2 Market Structure

Now we consider the government's problem in the first period. The government recognizes the effect that its choice of market structure will have on tax choices in the second period and consequently on prices in the production stage. The home government solves:

$$\max_{G^h} \Pi^h \left(\mathbf{p}^h \left(G^h, \mathbf{t}^h(G^h, G^f), G^f, \mathbf{t}^f(G^h, G^f)\right), \mathbf{p}^f \left(G^h, \mathbf{t}^h(G^h, G^f), G^f, \mathbf{t}^f(G^h, G^f)\right)\right)$$

As above, the prices of foreign products depend on home country choices only through the effect these choices have on home prices and foreign taxes. Therefore, we can rewrite $\mathbf{p}^f \left(G^f, \mathbf{t}^f(G^f, G^h), G^h, \mathbf{t}^h(G^h, G^f)\right)$ as $\mathbf{p}^f \left(\mathbf{p}^h, G^f, \mathbf{t}^f(G^h, G^f)\right)$ where $\mathbf{p}^h$ is determined by the function $\mathbf{p}^h \left(G^h, \mathbf{t}^h(G^h, G^f), G^f, \mathbf{t}^f(G^h, G^f)\right)$. Also, governments recognize that taxes depend on market structure, so we write the Stackelberg price vector as $\mathbf{p}^h_{ST} \left(G^f, \mathbf{t}^f(G^h, G^f)\right)$. Using Lemma 3, we can rewrite the objective function as:

$$\max_{G^h} \Pi^h \left(\mathbf{p}^h_{ST}, \mathbf{p}^f \left(\mathbf{p}^h_{ST}, G^f, \mathbf{t}^f(G^h, G^f)\right)\right)$$
$$\text{where } \mathbf{p}^h_{ST} = \mathbf{p}^h_{ST} \left(G^f, \mathbf{t}^f(G^h, G^f)\right)$$

The important point to see from writing the objective function in this way is that the market structure in the home country affects profit in the home country only via its effect on the foreign taxes. As pointed out above, if the foreign country were not to use taxes for some reason, the home country would be indifferent to its choice of market structure in the first period. The home country taxes serve to "undo" any direct effect from its choice of market structure. With the foreign country setting taxes optimally in the second period, the home country market structure matters because foreign taxes will be affected. Each country would like the other country to set taxes as high as possible. Lemma 5 tells us that a country induces higher taxes on the other county's products by choosing a less competitive market structure.[8] Thus, each country benefits by grouping its exporters into a national champion. We have the following theorem:

Theorem 3 *In the unique Subgame Perfect Equilibrium, the first period strategies are for each country to assign all products to a single firm.*

Proof. The home country solves:

$$\begin{aligned} &\max_{G^h} \ \Pi^h \left(\mathbf{p}^h_{ST}, \mathbf{p}^f \left(\mathbf{p}^h_{ST}, G^f, \mathbf{t}^f(G^h, G^f) \right) \right) \\ &\text{where} \ \ \mathbf{p}^h_{ST} = \mathbf{p}^h_{ST} \left(G^f, \mathbf{t}^f(G^h, G^f) \right) \end{aligned}$$

As noticed above, the market structure in the home country affects profit in the home country only via its effect on foreign taxes. Consider any market structure G_0^h. If the home country market structure changes from G_0^h to a less competitive market structure G_1^h, the optimal taxes for the foreign country increase from $\mathbf{t}^f(G_0^h, G^f)$ to $\mathbf{t}^f(G_1^h, G^f)$ (see Lemma 5). The change in the home market structure affects home profit in the following way:

$$\Pi^h \left(G_1^h \right) - \Pi^h \left(G_0^h \right) = \int_{\mathbf{t}^f(G_0^h, G^f)}^{\mathbf{t}^f(G_1^h, G^f)} \left\{ \left[\left(\frac{\partial \Pi^h}{\partial \mathbf{p}^h_{ST}} + \frac{\partial \Pi^h}{\partial \mathbf{p}^f} \frac{\partial \mathbf{p}^f}{\partial \mathbf{p}^h_{ST}} \right) \frac{\partial \mathbf{p}^h_{ST}}{\partial \mathbf{t}^f} \right] + \left[\frac{\partial \Pi^h}{\partial \mathbf{p}_f} \frac{\partial \mathbf{p}^f}{\partial \mathbf{t}^f} \right] \right\} d\mathbf{t}^f$$

[8] In the Fudenberg and Tirole (1984) taxonomy, both countries follow a "puppy dog" strategy. They strategically choose a lax competition policy in the first stage of the game in order to induce the other exporting country to be less aggressive in the following stage, when choosing taxes.

The quantity in the first squared parentheses is zero, because of the first order condition of the Stackelberg leader. Hence:

$$\Pi^h\left(G_1^h\right) - \Pi^h\left(G_0^h\right) = \int_{\mathbf{t}^f(G_0^h,G^f)}^{\mathbf{t}^f(G_1^h,G^f)} \left[\frac{\partial \Pi^h}{\partial \mathbf{p}_f}\frac{\partial \mathbf{p}^f}{\partial \mathbf{t}^f}\right] d\mathbf{t}^f \tag{3}$$

Notice that, if products are substitutes, it must be that $\left(\frac{\partial \Pi^h}{\partial \mathbf{p}_f}\frac{\partial \mathbf{p}^f}{\partial \mathbf{t}^f}\right) > \mathbf{0}$. An increase in the tax on a foreign good is equivalent to an increase of its perceived marginal cost. If the marginal cost of a foreign good increases, the home country profit cannot decrease (an analytic proof in the case of linear demand is available upon request). We conclude that the previous expression has to be positive. This implies that the home country chooses the least competitive market structure. By symmetry, so does the foreign country. ■

The proof makes clear that choosing a national monopoly is a dominant strategy in the first stage of the game. The only important condition is that the other country sets taxes optimally in the second stage of the game.

An important issue is whether, absent government brokering, firms have an incentive to merge in the first stage of the game. Remember that firms incentives are based on net profits: $(p_i^c - t_i^c)q_i^c$ for good i. If given the opportunity, would separate exporters from the same country choose to merge? We prove that they would:

Theorem 4 *A merger in the home country increases the profit, net of tax, of each home product.*

On the other hand, a merger in the home country has a negative effect on foreign products' profit:

Theorem 5 *A merger in the home country decreases the profit, net of tax, of each foreign product.*

A less competitive home market structure induces the foreign country to increase the taxes on its goods. This will make foreign firms weaker competitors, increasing the net profit of home firms.

3.2 The Cournot Case

In this section, we study a three period game in which governments choose their market structure in the first period, governments choose a per-unit tax in the second period, and exporters choose quantities independently in the third stage. We will show that, as in the case of Bertrand competition, countries decide to group all their goods with a single exporter.

Relabeling prices as quantities, Theorem 2 and the associated Lemmas are unchanged. That is, each country can pick taxes to reach any vector of quantities it likes and picks taxes to reach the vector of quantities it would choose if it could choose quantities directly in the second period, taking foreign market structure and tax policy as given. Note that in the quantity setting case, taxes are typically negative. Countries subsidize their exporters.

The fact that quantities are strategic substitutes does not reverse the result in Lemma 5; as before, a less competitive market structure in the home country (a coarser partition of goods) induces the foreign country to set higher taxes:

Lemma 6 *Let $G^{h\prime}$ be a finer partition than G^h. Then $\mathbf{t}^f(G^h, G^f) > \mathbf{t}^f(G^{h\prime}, G^f)$.*

We are ready now to consider the government's problem in the first period. As above, the fact that home taxes can "undo" the choice of home market structure means that the only impact of home market structure is on foreign taxation. Since the home country prefers high foreign taxes, Lemma 6 tells us that the home country would like to pick the least competitive market structure, the national champion policy.

Theorem 6 *In the unique Subgame Perfect Equilibrium, the first period strategies are for each country to assign all products to a single firm.*

Proof. Relabeling prices as quantities, the steps are the same as in Theorem 3 up to equation 3, which is now:

$$\Pi^h\left(G_1^h\right) - \Pi^h\left(G_0^h\right) = \int_{\mathbf{t}^f(G_0^h, G^f)}^{\mathbf{t}^f(G_1^h, G^f)} \left[\frac{\partial \Pi^h}{\partial \mathbf{q}_f} \frac{\partial \mathbf{q}^f}{\partial \mathbf{t}^f}\right] d\mathbf{t}^f$$

The term in parenthesis is positive (the proof for the linear demand case is available upon request). The intuition is the same as before: if the marginal cost (including taxes) of a foreign good increases, the home country total profit increases. From Lemma 6, we know that $\mathbf{t}^f(G_0^h, G^f) < \mathbf{t}^f(G_1^h, G^f)$. Therefore, local surplus increases in local concentration. ■

As for the case of price competition, each country's choice of assigning all goods to a single exporter is a dominant strategy, given optimal behavior from the second stage of the game on. In general, a move toward a less competitive market structure for country c, for example through mergers, increases always country c's total profit.

An important issue is whether exporters would themselves choose to merge, if given the opportunity. A striking result of Salant et al. (1983) is that in a standard Cournot oligopoly with linear demand and constant marginal costs, horizontal mergers tend to be not profitable for the merging firms, while they always increase the profit of non merging firms. For example, a two firms merger is always unprofitable for the merging firms, unless the merger leads to monopoly. In our model, any merger among home firms increases profit from any home good and decreases profit from any foreign good:

Theorem 7 *A merger in the home country increases the profit, net of tax, of each home product and decreases the profit, net of tax, of each foreign product.*

Furthermore, it is possible to prove that the profit of merging home firms tend to increase more than the profit of non merging firms from the same country. In sharp contrast to the result in Salant et al. (1983), a merger between home firms is always profitable for both the merging and non merging home firms, and tend to be more profitable for the merging firms. Furthermore, it will decrease the profit of foreign firms. This implies that a government does not need to force an agreement, as firms have themselves an incentive to merge.

The reason for this result is that a less competitive home market structure induces the foreign country to decrease subsidies to its products, making foreign firms weaker competitors. At the same time, the home country will increase subsidies to the merging firms and decrease subsidies to the non merging firms in order to induce an increase in the quantity of all home goods.

4 A Different Timing Assumption

In the previous sections, we allowed the countries to choose market structure before they choose taxes. Antitrust policy tends to be encoded in laws and it is difficult to change, whereas taxes can be quickly adjusted. However, results crucially depend on the timing, and this section explores the implication of a different timing assumption. We consider the following two-stage game. Governments choose taxes and market structure simultaneously in the first period. In the following period firms compete in price. The case of firm competing in quantities can be analyses in a similar fashion.

We show that this game exhibits multiple equilibria. Given any market structure for the home and foreign market, there is a corresponding Subgame Perfect Nash equilibrium.

The second stage equilibrium prices are identical to the third stage equilibrium price of the game analyzed in section 3.1. Let $\mathbf{p}^c(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f)$, for $c = h$ or $c = f$, be these prices for country c. In the first stage, each government chooses taxes and market structure taking the taxes and market structure in the other country as given. Therefore, the home government solves:

$$\max_{\mathbf{t}^h, G^h} \Pi^h \left(\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f), \mathbf{p}^f(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f) \right)$$

Lemma 3 is valid in this context as well. As before, the home country would like to mimic the Stackelberg leader prices, and choose $\mathbf{t}^h$ and G^h such that:

$$\mathbf{p}^h(G^h, \mathbf{t}^h, G^f, \mathbf{t}^f) = \mathbf{p}^h_{ST}(G^f, \mathbf{t}^f)$$

Given foreign market structure and taxes, the home Stackelberg prices represent an optimal vector of prices that the home country would like to reach in the two-stage game by appropriately using its choice of market structure and taxes. Theorem 2 is still valid. It shows that, given any market structure G^h, there is a choice of taxes $\mathbf{t}^h$ that induces the Stackelberg prices. Given G^f and $\mathbf{t}^f$, there is a single optimal home products' vector of prices. However, given any home market structure, these prices can be reached with an appropriate choice of taxes.

For example, consider the second stage optimal taxes in the three-stage game analyzed in section 3.1: $\mathbf{t}^h(G^h, G^f)$ and $\mathbf{t}^f(G^h, G^f)$. By definition, $\mathbf{t}^c(G^h, G^f)$ represents the optimal choice of taxes for country c, given the other country's taxes $\mathbf{t}^{-c}(G^h, G^f)$ and the market structure (G^h, G^f). These taxes induce the Stackelberg prices. This implies that $\left(G^c, \mathbf{t}^c(G^h, G^f)\right)$ is an optimal response to $\left(G^{-c}, \mathbf{t}^{-c}(G^h, G^f)\right)$.

The two-stage game has as many Subgame Perfect equilibria as possible market structures (G^h, G^f).

Each equilibrium is equivalent to the equilibrium in the corresponding subgame of the three-stage game analyses in section 3.1.

We can understand the result by considering the reason why choosing a national champion policy is optimal in the three-stage game. Above we showed that the first period choice of market structure for country c is important because of its impact on the second period choice of taxes by country $-c$. If country $-c$ does not chooses taxes, country c's market structure choice is irrelevant. In a two-stage game where governments choose taxes and market structure simultaneously, country c has no possibility to influence the other country's choice of taxes. Given the other country's market structure and taxes, the choice of a market structure becomes irrelevant for country c. There is a unique "best response price", and taxes can "undo" any effect of market structure choice.

5 Conclusion

This paper contributes to the literature on the interaction between competition policy and trade policy. We study a three-stage game in which firms from two countries export to a third consuming country. In the first stage, governments choose simultaneously the market structure for their goods, each country chooses a tax system in the second stage, and then firms choose their strategies independently. We consider both the cases of price-setting and quantity-setting, and show that in the only Subgame Perfect Equilibrium each country decides to have one firm controlling all national goods, the national champion policy. We show that this result is explained by the impact that each country's first period choice of market structure has on the second period tax system choice of the other country. In particular, a less competitive market structure induces the other country to choose less aggressive taxes. We further show that separate exporters from the same country have themselves incentive to merge.

One important contribution of this paper is to expand the literature in considering the case of differentiated products and price competition, while previous papers have focused mainly on quantity competition and homogeneous goods.

The focus of this paper was to study the conditions under which a government might have incentives to choose a more or less lax competition policy, *given* the number of products freely determined by the market. However, a referee raised the interesting point that discontinuing some products might increase a country's profit. This possibility might be investigated by adding a new stage at the beginning of the game, where countries choose the number of products to offer. Unfortunately, given the discrete nature of the problem, a complete characterization of the equilibrium is very complex. Simulation analyses suggest that there are two basic effects at work. On the one hand, there is a demand-enhancing effect that provides incentive to introduce a new product. On the other hand, if a country increases the number of its products, the other country has an incentive to choose lower taxes (or higher subsidies). The intuition is that the other country knows that its national champion will have to face a stronger competition and has incentive to make its champion a stronger competitor by lowering its perceived marginal cost. This effect provides disincentive to introduce a new product. When products are highly differentiated (γ close to 0), the second effect is small and the first is large. Thus, each country has an incentive to increase the number of its products. However, when products are less differentiated, the second effect can dominate (as born out in our simulation results) and a country might be better off discontinuing some products.[9]

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