Hidden and non measurable trade policies: the case of state controlled firms[1]

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Abstract

A hot issue in trade negotiations concerns the existence of stateowned firms and state subsidies. Disputes between the US and the EU and the issue of the recognition of the status of market economy to China are often the epitome of that. In Germany the giant Volkswagen is state controlled, in China almost 1/3 of firms are state controlled and loom in almost all industries with relevant or even dominant market shares. State enterprises maximize home social welfare. When they export or compete with foreign producers at home their specific objective function make them a possible vehicle for disguised trade policies. We investigate trade cases with oligopoly and state owned firms and find that both dumping and foreclosure of the domestic market may occur explaining the possibility of having home prices higher or lower than export prices. However, state owned firms could not be seen as the exclusive vehicle that a government may use for disguised trade policies, as, in certain circumstances, private enterprises may accomplish the mission.

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1 Introduction

After decades of gradual reductions of tariffs on trade it seems that traditional barriers have been to a large extent removed leaving quite low levels of duties and other taxes on the international exchange of goods and services. Unfortunately the apparent demise of traditional protection tools and the reduction of their weight in international exchanges does not imply that trade barriers have been consigned to history. Recent trade disputes between the US, the EU and Asian countries have raised the question of several non tariff trade barriers. Indeed a large set of disguised, administrative, contingent and strategic obstacles remain in place in many areas and "the perception that trade policy is no longer relevant arises to a large extent from the inability to precisely measure most non-tariff barriers that have replaced traditional tariffs and subsidies as the primary tools of trade policy" (Goldberg and Pavcnik, 2016). Indeed a set of new protective instruments have been devised by governments ranging from technical, environmental, health, quality standards up to direct intervention such as restricted public procurement, sway over firms strategies and so forth. In some cases countries use domestic firms as vehicles of trade policies for both export promotion and import containment. As a matter of fact companies cannot be considered as a homogeneous class across and within countries since they pursue specific goals according to their ownership setting (private, state, non profit, labour managed) and their internal (vertical) organization. Secondly, the economic and environmental performances may radically change according to whether the country in which a firm operates is foreign, poor, rich, highly regulated and so on. These heterogeneities matter since they generate specific strategies in domestic vis à vis foreign markets (if they export) and may become the vehicles of trade policies. The deepening of economic and institutional integration that has taken place since the establishment of the European Single Market in 1993 was to cancel or at least reduce radically all non tariff barriers that remained in place after the gradual elimination of traditional custom duties among EU member states. The possible use of firms as vehicles for disguised trade policies, for instance via restricted public procurement and many other actions, were banned. Even though there are still some rules of the EU Single Market which have not been entirely implemented, this pioneering program had followers and imitators worldwide. For instance, it inspired several actions carried out by the WTO since its birth in 1995 in the efforts to tackle the surviving thick jungle of non tariff restrictions to trade.

Nonetheless, quite a bunch of them survive. It is often awkward to identify the extent of remaining restrictions and uncover the underlying impact on trade, since the tools of nowadays trade policy are not quantifiable and their imprint not immediately detectable. Despite of that their influence is relevant and they raise fierce reactions. As said above trade policies may be embedded in firms' strategies, making things fuzzy since they are only indirectly traceable to government decisions and do not contain explicit reference to trade. That occurs also for minimum (complex) technical requirements, quality standards, competition and industrial policies. "The challenges in the measurement of trade policy raise the question of whether the world is truly liberalized, as many believe, or if this impression is misguided and due to our inability to measure the restrictions that really matter. "(Goldberg and Pavcnik, 2016, p.5).

In this context of "nontransparent or hardly measurable" trade policies there arises a number of relevant concurrent economic issues. A crucial one, we wish to investigate, is related to the presence of state owned firms in industries engaged in international trade. The question we face is: can state owned firms be instrumental to competition, industrial and trade policies? In this last case how do state owned firms affect international market equilibria? How much are state owned firms the perpetrators of disguised trade policies? Incidentally this is one of the main questions at the basis of the discussion on the recognition to China of the status of market economy (Puccio, 2015; Urdinez and Masiero, 2015; The Economist, 2018). As a matter of fact large and sometimes dominant state owned firms operate in France, Germany and other countries[1]. Here, governments and/or regulators may use public dominant firms to pursue specific goals such as domestic social welfare maximization[2]. However, this stance may raise a few trade policy concerns.

[1]In Germany regional public entities (Länder) have a control stake in the giant automaker Volkwagen and other firms. In France this is the case for Renault-Nissan. GM in the Usa has benefited from public capital injections. The dominant presence of public enterprises is quite relevant all over the globe, not just in Communist or formerly Communist countries.

[2]"The Chinese government's control over the Internet could get even tighter, with regulators floating a proposal for the state to take 1% stakes in major Chinese Internet companies, according to people familiar with the matter.

Under the proposal, for which China's Internet and media regulators have been soliciting companies' opinions, the government also would take a board seat at companies where it buys such "special management shares," the people say, giving it more direct influence over company policies on content and censorship." Li Yuan, China Wants to Own Small

Do ad hoc regulations and public firms provide a trade advantage or at least a shelter vis à vis countries where the state presence in the economy is absent or less relevant? In the case of state owned firms in Europe, China and elsewhere the majority of complaints raised by foreign trade partners regard the presumed dumping pricing policies associated to government subsidies, easier access to credit (see The Economist, 2018) or "excessively aggressive" policies of state firms. Several charges relate to noncompetitive practices such as selling goods in foreign markets at prices too low either with respect to domestic prices or costs, but, above all, with respect to foreign competitors.[3] Theoretically, only the second case may be defined as dumping, while the former is mere international price discrimination and the third is a legitimate cost advantage (Malueg and Schwartz, 1994). Nonetheless, several competition authorities and trade regulators do not reckon international price discrimination as a sound (and legitimate) firm strategy. Consequently they tend to sentence it when it goes beyond a reasonable price difference across countries. Then, it appears that there is large room for divergent assessments. At the end of the day, the question of dumping and related issues require further investigations and explanations.

A great deal of specific issues is related to trade with state owned firms and frequent disputes between China, the US and the EU are directly or indirectly linked to that.

In China state firms account for about 1/4 - 1/3 of total production and for almost 40% of stock market capitalization. In France and Germany the weight of public (or semi-public) firms is large but difficult to precisely reckon since several public entities are involved and the precise stake of state ownership is hard to guess. As a matter of fact the sway of government on corporate strategies may be deeper than the sheer state share may hint in the numerous hybrid firms (where the state has only a portion of the equity) and this makes the issue more complex and catching.

As literature (De Fraja and Delbono, 1990; Delbono and Rossini, 1992; Corneo and Jeanne, 1994) and observation suggest, state enterprises pursue specific objectives which by and large mirror the extent of government control. The most common, yet not unique, goal is domestic social welfare rather than sheer profit. However, this simple objective has to be qualified whenever a state firm extends its operations abroad. With trade it may be

Stake in Web Firms, *WSJ* April 27, 2016.

[3]See for instance: Zanardi, (2006) for questions related to dumping definition.

assumed that state firms maximize domestic social welfare without the profit of foreign rivals. In addition to that, when exporting, the presumption is that state firms maximize their operative profit obtained from sales abroad without any concern for the foreign social welfare. This assumption is close to the contribution of Corneo and Jeanne (1994) who consider the effects of privatization on welfare and exports of a country where there are private and state-owned firms. Their analysis is concerned only with countries net trade positions and does not explore strategic issues leaving many open questions as to the implications for trade and international competition of state firms which strategically export to foreign countries.

In the ensuing pages we shall investigate trade strategies of state owned firms and the implications for the degree of openness of a country. The purpose is to trace disguised trade policies carried out by state owned firms. We shall see that state owned firms affect the equilibria associated to reciprocal trade between countries with oligopolies. New equilibria, such as partial/total foreclosure, will appear together with more common (in)voluntary dumping and asymmetric benefits of trade (Brander and Krugman, 1983).

A second, yet non secondary, point regards the advantage a country (such as China, but the case could be made also for Germany or the US) may have due to a large internal market coupled to state owned firms. If a large market is somewhat protected it may provide domestic firms "an exorbitant" competitive advantage over rival countries, that may become quite damaging for small market oriented countries. What is the link with state-owned firms? With increasing returns to scale we may figure out that the pricing policy on the domestic market is based on a zero profit condition. A reasonable choice in that case is to charge the entire fixed cost on the domestic price, while selling abroad a quantity corresponding to the equalization of marginal revenue to marginal cost.

In our analysis based on simple international oligopoly markets we shall see that the strategies of state owned enterprises produce results which are not always in favour of free trade. In certain circumstances, we end up with some kind of dumping strategies. In other scenarios domestic market partial (or complete) foreclosure obtains as a market covered entirely by a single state firm tends to exclude foreign competition[4]. As a result trade opening has asymmetric effects simply because of the prevalence in one country of state enterprises.

[4]This point is made in Autor and al., 2016 and Friedman, 2018.

The concerns of many countries are not only directly related to issues of dumping and anti-dumping litigation (as underlined by Urdinez and Masiero, 2015) but to the more subtle incidence of state owned firms and their market behavior coupled to economies of scale and country size asymmetries. Although strong conclusions should not be based on an oversimplified model, the results of the paper can be productively linked to the current discussion on the recognition to China of the status of market economy. To this purpose we shall try to devise some instances of counteracting protection policy that could be adopted by a country where firms are all privately run.

To make the case more real, in Appendix B we provide some anecdotal evidence based on four instances of goods produced in China and sold in global markets. We compare the retail prices at which those goods are sold in China and in the EU. The four goods do not aim to provide any significant statistical basis to assess the pricing policies of Chinese exporting firms but simply wish to represent examples of possible behavior of Chinese firms. As we shall see, in two cases there will be a presumption that Chinese firms are carrying out a kind of dumping. The gap between the price in China and in the EU is positive and so large that we may classify it as dumping defined as a substantial difference between the domestic and the foreign price. In another instance the difference is not significant excluding any dumping. In a fourth case the price distance is reversed since the export price is significantly higher than the domestic one. We shall define this case as one of partial (or quasi) foreclosure since this price gap may become a barrier to entry. To sum up, mixed results in search of interpretation. Our main goal is to see whether they reveal any trace of possible disguised trade policy carried out by firms on behalf of state objectives. We find that disguised trade policies may be carried out not only via state owned but also private enterprises according to specific market circumstances.

The paper is organized as follows. In section 2 we go through a simple duopoly framework of Brander and Krugman (1983) type. In section 3 we go trough increasing returns to scale and state ownership. In section 4 we introduce price competition and differentiation. In section 5 we sketch an example of trade policy and in section 6 we read the epilogue.

2 An elementary duopoly framework

We start considering an international duopoly made by two independent enterprises, whose production is located in two distinct countries H (Home) and F (Foreign) separated by transport costs represented by the traditional iceberg parameter $t \in (0, 1[$ whereby only a share t of the value produced in one country reaches the foreign market[5]. Both firms manufacture a homogeneous good, follow the Cournot tenet and face two linear demand functions one in each market:

$$\begin{aligned} p_H &= a_H - q_H - tq_{FX} \\ p_F &= a_F - q_F - tq_{HX} \end{aligned} \tag{1}$$

where p_H and p_F are the market prices of the good respectively in market H and F, a_H and a_F are the respective market size, q_H, q_F are the sales of the two firms in their own countries while q_{HX}, q_{FX} are their exported outputs. We assume that consumers are not able to carry out commercial arbitrage buying a good in the country where the price is lower since the individual transport costs are prohibitive. One company is state owned and based in H while the rival is private. The total profit of the state owned firm is made by domestic plus foreign profit

$$\pi_{HS} = \pi_H + \pi_{HX}$$

where

$$\pi_H = p_H q_H \qquad \text{and} \qquad \pi_{HX} = tp_F q_{HX}$$

since we assume, for the sake of simplicity, that the production cost is null.

The consumer surplus in country H is

$$cs_H = \frac{(a_H - p_H)(q_H + tq_{FX})}{2}$$

while the profit of the foreign rival is:

$$\pi_F = p_F q_F + tp_H q_{FX}.$$

The state owned company maximizes domestic social welfare, that does not include the profit of the foreign firm selling in H. The state owned firm exports

[5]For a more detailed definition and an application see Rossini (2007).

in the market of the rival where it sets its quantities so as to maximize profit there. Unlike the H firm, the foreign firm located in F is a private profit seeking enterprise and operates in both F and H markets by setting optimal Cournot quantities. Let's define domestic social welfare maximized by the state firm in country H, as:

$$sw_H = cs_H + \pi_H.$$

From this simple framework we can obtain the following:

Lemma 1 *An international duopoly is made by two firms each exporting to the rival market. One maximizes home social welfare and profit abroad while the foreign rival is a pure Cournot profit seeker. In equilibrium, the domestic market of the state-owned firm turns out to be foreclosed to the foreign rival that is not able to export.*

Proof. For the sake of simplicity we assume symmetric markets, i.e., $a_H = a_F = a$. We simultaneously solve for the following FOCs:

$$\left\{ \begin{array}{c} \frac{\partial \pi_F}{\partial q_F} = 0 = a - 2q_F - q_{HX}t \\ \frac{\partial \pi_F}{\partial q_{FX}} = 0 = t(a - q_H - 2q_{FX}t) \\ \frac{\partial sw_H}{\partial q_H} = 0 = a - q_H \\ \frac{\partial \pi_{HX}}{\partial q_{HX}} = 0 = t(a - q_F - 2q_{HX}t) \end{array} \right\}$$

and get the equilibrium quantities:

$$q_F^* = \frac{a}{3}; \quad q_{FX}^* = 0; \quad q_H^* = a; \quad q_{HX}^* = \frac{a}{3t}.$$

SOCs are always met as the stability requirement over the sign of the principal minor of the determinant of the Hessian matrix. Equilibrium social welfare and consumer surplus are:

$$\begin{aligned} \pi_F^* &= \pi_{HX}^* = \pi_H^* = \frac{a^2}{9} \\ cs_H^* &= \frac{a^2}{2} \geq cs_F^* = \frac{2a^2}{9} \\ sw_H^* &= \frac{a^2}{2} \geq sw_F^* = \frac{a^2}{3}. \end{aligned}$$

If we include in sw_H^* the profit of the H firm in country F (π_{HX}^*) we get an *augmented* version of domestic welfare defined as $sw_{HN}^* = \frac{11a^2}{18} \geq sw_H^* \geq sw_F^*$. ■

It can be easily seen that the two firms obtain the same total profit, i.e., $\frac{a^2}{9}$. The state-owned company operates in both countries while the private firm is confined to the domestic market. Country H, where the state owns the firm, enjoys a higher consumer surplus (in country H the market price is zero and equal to the marginal cost of the domestic firm) and the same national producer surplus of the other country, since the H firm maximizes profit when operating abroad (we consider an augmented welfare definition, mentioned at the end of the proof of Lemma 1, comprising the profits of the domestic firm obtained abroad). Therefore, H enjoys a higher social welfare. The most notable outcome is that in country H the market is foreclosed to the foreign producer, while the funny thing is that this occurs without any prohibitive tariff or discriminatory measure in favour of the domestic producer. In other words we do not need any trade policy to keep the door of the domestic market shut to foreign competitors. We just require a state owned firm.

If we compare this case with the control solution represented by a standard Cournot international duopoly with two symmetric profit seeking firms, we can state:

Proposition 1 *Let's compare the asymmetric case containing a state-owned firm in H with the standard symmetric Cournot case with two profit seeking firms. The country with the state owned firm enjoys a larger social welfare than in the symmetric Cournot case, while the other country whose firm is foreclosed has a lower welfare. At the global tier social welfare and consumer surplus are higher with the presence of just one state owned firm (which maximizes profits abroad).*

Proof. Keeping the above framework, in the naive Cournot symmetric case we have:

$$q_F^* = q_H^* = \frac{a}{3}; \quad q_{HX}^* = q_{FX}^* = \frac{a}{3t}.$$

$$p_H^* = p_F^* = \frac{a}{3}$$

With the state-owned firm in H and the profit seeking firm in F the equilibrium market price in H is zero ($p_H^* = 0$) while in country F it is the same

as in the case of the symmetric Cournot international duopoly ($p_F^* = \frac{a}{3}$). In the symmetric private duopoly we have total profits, consumer surplus and welfare as follows

$$\pi_F^* = \pi_H^* = \frac{2a^2}{9}$$

$$\begin{aligned} cs_H^* &= cs_F^* = \frac{2a^2}{9} \\ sw_H^* &= sw_F^* = \frac{4a^2}{9}. \end{aligned}$$

Let's compare the corresponding equilibrium welfare and consumer surplus contained in the proof of Lemma 1. Simple inspection suggests that social welfare turns out to be larger in symmetric Cournot for country F but lower for country H with respect to the asymmetric case with a state owned firm in country H. At the global tier we have:

$$(cs_H^* + cs_F^*)_{SymmCournot} - (cs_H^* + cs_F^*)_{AsymmStateFirm} = -\frac{5a^2}{18}.$$

Moreover

$$(sw_H^* + sw_F^*)_{SymmCournot} - (sw_H^* + sw_F^*)_{AsymmStateFirm} = -\frac{5a^2}{18}.$$

If we use the augmented version of social welfare in H in the case of the state firm we have

$$(sw_H^* + sw_F^*)_{SymmCournot} - (sw_{HN}^* + sw_F^*)_{AsymmStateFirm} = \frac{8a^2}{9} - \frac{17a^2}{18} = -\frac{1a^2}{18}$$

which means that global social welfare differences decrease. ■

Foreclosure occurs also with product differentiation in the Cournot mode of competition (presented in Appendix C) and is quite a general outcome. As we have seen, asymmetry leads to prices which differ across borders. The country with the state owned firm has its market foreclosed, i.e., shielded from foreign competitors and a lower market price. No dumping occurs, yet there is a severe limitation of competition in the market of the country with the state owned firm. In terms of political economy this setting may be quite stable and sustainable with a good political consensus. That may be the case of some Chinese industries (see Autor et al., 2016; Friedman, 2018).

A simple corollary may be derived from the previous results just by considering the effects of changes in country size. In the traditional Cournot framework there is a positive effect of increasing market size of a country on the social welfare of the foreign partner. However, when in one country the pre-trade market is covered by a state firm this effect disappears turning the reciprocal benefits of trade opening quite asymmetric. This can be detailed in the following:

Corollary 1 *As the size of the market of country H increases the social welfare of country F does not change since the firm of country F is foreclosed, while in the traditional Brander-Krugman (1983) Cournot model of trade the profits of firm F grow (and hence sw_F) when the partner country gets larger.*

Proof. From the two previous proofs, simply assuming that the demand in country H is

$$\begin{aligned} p_H &= a_H - q_H - tq_{FX} \\ p_F &= a_F - q_F - tq_{HX} \end{aligned}$$

we can see that

$$sw_F^* = \frac{{a_F}^2}{3} \text{ and } \frac{\partial sw_F^*}{\partial a_H} = 0.$$

■

The above results show that opening trade between a country where there is a prevalence of state owned firms and a country with profit seeking firms generate effects which may make trade benefits quite asymmetric and somewhat unpleasant, calling for some commercial policy as a reaction to state ownership seen as a disguised trade policy. Here, the "hidden barrier" to trade is the foreclosure generated by the domestic pricing strategy adopted by the state owned firm that makes the domestic market almost incontestable by foreign firms. The only possibility to react to the barrier represented by foreclosure should be for a private firm to adopt a zero profit condition at home. Other counteracting policies can be devised and we shall provide an example in section 6.

3 Increasing returns to scale and state ownership

Further interesting cases may be suggested by increasing returns technology. The scenario is similar to the one of the section above. We consider again two firms located in country F and H now producing with concave costs due to a fixed commitment that implies increasing returns to scale. Competition authorities may try to regulate pricing if they are afraid of natural or quasi natural monopoly. In that case it is quite likely that the mode of behavior of a regulated firm tends to coincide with that of a state owned firm[6]. Anyway, for both private profit seeking and state owned firms, every time we examine increasing returns to scale (*irs*) the question is: what pricing policy adopt. The theory of contestable markets (Baumol, Panzar and Willig, 1982) suggests a market solution which is close to the planner objective, i.e., average cost pricing. A firm enjoying *irs* should either be playing in a contestable environment or be subject to some kind of regulation or state ownership whenever fixed costs are sunk. In all cases the firm may end up with a zero profit condition as the best strategy of conduct on the domestic market where regulation is supposedly enforced. In this case the state-owned firm and the corresponding profit seeking firm behave in similar ways[7] and adopt average cost pricing. But what will be done on the foreign market? Trade broadens the range of analysis and relaxes the domestic market constraint. A firm has the possibility of making profits in the foreign market where regulation is absent or different with respect to the domestic market. For instance, a state owned firm may charge fixed costs entirely on the domestic market, while in the foreign market it maximizes profits without the fixed cost burden. This way of modeling *irs* and trade differs from traditional models in the literature originated from Helpman (1984) and Krugman (1980) where the strategies of firms are the same regardless of the market where they operate. Here, we assume that firms, since they are state owned, adopt distinct strategies at home vis à vis abroad. In a more detailed way, each firm decides the quantity to sell by setting profits to zero on the domestic market and sets the optimal quantity to export by maximizing profits abroad. Then, the equilibrium appears as follows:

Proposition 2 *(symmetric state owned duopoly) In a symmetric interna-*

[6]See for instance Bauer (2005) and Decker (2014).

[7]See again Bauer (2005) and Decker (2014).

tional duopoly with two state owned firms with irs each firm charges fixed costs on the domestic sales making zero profits at home while maximizing profit in the foreign market. Market prices are larger than average costs and allow non negative profits derived from exports. When markets differ in size the market price is higher in the larger market. This gives rise to a kind of "involuntary dumping" by the firm based in the large country exporting to the small market.

Proof. Let us consider separately domestic and export profits, first for the domestic firm, secondly for the foreign firm:

$$\begin{aligned} \pi_H &= p_H q_H - f \quad \text{domestic} \\ \pi_{HX} &= t p_F q_{HX} \quad \text{foreign} \\ \pi_F &= p_F q_F - f \quad \text{domestic} \\ \pi_{FX} &= t p_H q_{FX} \quad \text{foreign} \end{aligned} \tag{2}$$

where f stands for fixed cost. The state owned firms simultaneously set the quantities in their respective domestic markets by charging the fixed cost on the domestic balance sheet and setting domestic profits equal to zero. Then, they set marginal profits to zero in the foreign market. The resulting equilibrium quantities are[8]:

$$q_H^* = \frac{1}{2}\left(a_H + \sqrt{a_H^2 - 8f}\right); q_{HX}^* = \frac{a_F - \sqrt{a_F^2 - 8f}}{4t}; \tag{3}$$

$$q_F^* = \frac{1}{2}\left(a_F + \sqrt{a_F^2 - 8f}\right); q_{FX}^* = \frac{a_H - \sqrt{a_H^2 - 8f}}{4t}. \tag{4}$$

Prices are:

$$p_H^* = \frac{1}{4}\left(a_H - \sqrt{a_H^2 - 8f}\right); \; p_F^* = \frac{1}{4}\left(a_F - \sqrt{a_F^2 - 8f}\right).$$

It can be easily seen that

$$p_H^* \geq p_F^* \quad if \quad a_H \geq a_F.$$

[8]Feasibility requires

$$a_{H,F} \geq 2\sqrt{2f}.$$

Then, in case of asymmetric countries the firm of the larger country carries out "involuntary dumping" to the smaller country. Profits are zero in the domestic markets, i.e., $\pi^*_H = \pi^*_F = 0$, while abroad they are:

$$\pi^*_{HX} = \frac{1}{16}\left(a_F - \sqrt{a_F^2 - 8f}\right)$$

and

$$\pi^*_{FX} = \frac{1}{16}\left(a_H - \sqrt{a_H^2 - 8f}\right),$$

the profit of the firm residing in the larger market is lower since it exports less than the firm of the smaller market. ■

The outcome is interesting on several grounds. First of all it says that the larger country with state owned firms displays higher prices, larger than marginal (and average) costs. The above proposition may be used again to explain "involuntary dumping". This trade strategy may mimic that adopted by some state owned Chinese firms owing to the size of Chinese market and economies of scale. Notice that this effect may become more severe in the presence of excess capacity. Nonetheless, all that may benefit the firm residing in the smaller market which will gain more from trade than the rival from the large country. This replicates a recurrent trade result maintaining that small countries benefit more than large ones from free trade. Textbook wisdom says that small countries wish radically free trade. Large countries are more reluctant. The resemblance of the above outcome with a contestable market equilibrium may let to infer that this equilibrium is somewhat desirable. As a matter of fact it may be so. But in case of asymmetry in country size the smaller country may be induced to introduce defensive policies against some kind of dumping even though this sort of dumping is coupled to the opportunity to access a larger market. Only if the market of the larger country is not protected by barriers, the firm of the smaller country makes larger profits from exports than the firm of the large country selling in the small market. In that case, the small country may be happy with dumping since there is a related opportunity to sell in the foreign market where prices are higher.

3.1 The case of a mixed international duopoly with irs

Here we go through the catching case of a mixed international duopoly made by one state owned and one profit seeking firm with increasing returns to scale. The analysis may be used to cast some light on the issue of trade between countries with firms displaying different ownership structures, partly seen in the case of constant returns to scale in the sections above. Let us assume that the private firm is located in country F while the state owned is based in H. The private firm maximizes profits in both the domestic and the foreign market charging the fixed cost on the domestic sales. The state owned firm in H sets profits in the domestic market to zero charging the fixed cost on the domestic sales, while maximizing profits abroad. If we go through the usual Cournot Nash solution the equilibrium looks as described in the following:

Proposition 3 *In an international mixed duopoly with one private and one state owned firm, the market price is higher in the country where the state owned firm is located with respect to the partner country with the private firm. As a result there arises a kind of involuntary "dumping" by the state owned firm. Only if the country of the private firm is sufficiently larger than the country of the state owned firm dumping is reversed.*

Proof. The private firm maximizes profits in both markets while the state owned maximizes social welfare at home charging fixed cost on the domestic sales and maximizes profits abroad. The resulting equilibrium quantities are:

$$q_H^* = \frac{1}{2}\left(a_H - \sqrt{a_H^2 - 8f}\right); \quad q_{HX}^* = \frac{a_F}{3t};$$

$$q_F^* = \frac{a_F}{3}; \quad q_{FX}^* = \frac{a_H + \sqrt{a_H^2 - 8f}}{4t}.$$

As for prices we have:

$$p_F^* = \frac{a_F}{3}; \quad p_H^* = \frac{a_H + \sqrt{a_H^2 - 8f}}{4};$$

it appears that, in case $a_H = a_F$ we have that $p_F^* \leq p_H^*$. On the contrary if $a_H \leq a_F$ then $p_F^* \geq p_H^*$. ■

When we consider mixed international duopolies with increasing returns to scale we can observe at least two cases of dumping: if countries have the same size the state owned firm adopts a sort of strategic involuntary dumping selling in the foreign country at a price lower than at home. This result is reversed whenever we introduce country size differences and the market of the private firm is larger.

4 Product differentiation and price competition between state owned firms

Now we go through the analysis of product differentiation and price competition and see how trade and asymmetric behavior of firms lead to results that parallel evidence on prices across countries and in particular China. As before two firms respectively based in country F and H produce and export a differentiated good strategically setting the price of their own good. To describe differentiation we introduce the parameter $s \in [0, 1]$ indicating maximum differentiation at the lower bound and minimum differentiation at the upper bound. The inverse demand functions are:

$$\begin{aligned} p_H &= a_H - q_H - s\ t\ q_{FX} \\ p_F &= a_F - q_F - s\ t\ q_{HX} \\ p_{HX} &= a_F - s\ q_F - t\ q_{HX} \\ p_{FX} &= a_H - s\ q_H - t\ q_{FX} \end{aligned}$$

while direct demand functions

$$\begin{aligned} q_H &= \frac{p_H + a_H(s-1) - s\ p_{FX}}{s^2 - 1} \\ q_F &= \frac{p_F + a_F(s-1) - s\ p_{HX}}{s^2 - 1} \\ q_{FX} &= \frac{-s\ p_H + a_H(s-1) + p_{FX}}{t(s^2 - 1)} \\ q_{HX} &= \frac{p_{HX} + a_F(s-1) - s\ p_F}{t(s^2 - 1)}. \end{aligned}$$

Profit functions are

$$\begin{aligned} \pi_H &= p_H q_H - f = 0 \\ \pi_F &= p_F q_F - f = 0 \\ \pi_{HX} &= t\ p_{HX} q_{HX} \geq 0 \\ \pi_{FX} &= t\ p_{FX} q_{FX} \geq 0. \end{aligned} \tag{5}$$

As before the fixed cost is charged on the domestic profit and break even as they are state owned. On the foreign market they set price maximizing

profits. Then, the solution for the equilibrium prices comes from the following first order conditions (FOCs) under the constraints (5) set above

$$\begin{cases} \frac{\partial \pi_{FX}}{\partial p_{FX}} \\ \frac{\partial \pi_{HX}}{\partial p_{HX}} \\ \pi_H \\ \pi_F \end{cases} = 0$$

The equilibrium prices are:

$$\begin{aligned} p^*_{HX} &= -\frac{a_F(s-1)((2+s)s-4)+s\sqrt{{a_F}^2(s+s^2-2)-8f(2-3s^2+s^4)}}{4(s^2-2)} \\ p^*_{FX} &= -\frac{a_H(s-1)((2+s)s-4)+s\sqrt{a_H^2(s+s^2-2)-8f(2-3s^2+s^4)}}{4(s^2-2)} \\ p^*_H &= \frac{a_H(s+s^2-2)-\sqrt{(s-1)(a_H^2(s-1)(2+s)^2-8f(1+s)(s^2-2))}}{2(s^2-2)} \\ p^*_F &= \frac{a_F(s+s^2-2)-\sqrt{(s-1)({a_F}^2(s-1)(2+s)^2-8f(1+s)(s^2-2))}}{2(s^2-2)} \end{aligned}$$

From the above results and ensuing proof we can establish the following:

Proposition 4 *State owned firms facing increasing returns to scale, adopt a Bertrand mode of behavior abroad, differentiate their products and break even on their domestic market where they charge the fixed costs. Each firm sells at a lower price a larger quantity on the foreign market giving rise, again, to a reciprocal "involuntary" dumping partly similar to the original Brander - Krugman type. If countries are not symmetric in terms of size the firm of the larger country adopts a more aggressive dumping (lower price) in the foreign country than its rival but sells less. The rival firm sells more in the larger (foreign) country and makes higher profits.*

Proof. Just calculate the difference between the two prices made by the two firms in their respective foreign markets:

$$\begin{aligned} p_F - p_{FX} &= \frac{1}{4(s^2-2)}(a_H(s-1)(s(s-2)-4)+2a_F(s^2+s-2)+ \\ &\quad +s\sqrt{(s-1)(a_H^2(s-1)(2+s)^2-8f(1+s)(s^2-2))}- \\ &\quad -2\sqrt{(s-1)({a_F}^2(s-1)(2+s)^2-8f(1+s)(s^2-2))} \end{aligned}$$

which is always non negative. Numerical simulations reported in Appendix A provide a description of the content of the above Proposition. ■

The above proposition somehow generalizes the previous results to a Bertrand cum-differentiation scenario. Dumping now becomes more detailed. It involves selling in the foreign market at a lower price in the presence of a domestic firm which sets a higher price. This effect may be exacerbated by size asymmetries among countries.

5 Bertrand competition and foreclosure in an asymmetric framework

Is there still a case for foreclosure with Bertrand competition and state owned firms? The question matters since Bertrand competition has to be associated to large capacity that allows firms to make real the "Bertrand threat" of driving prices down. This question is worth answering in times of overcapacity due, for instance, to prolonged recessions or structural changes. In some industries such as automotive there is chronic overcapacity, making Bertrand much more than a sheer academic toy. To investigate these issues, we consider a market in which a state owned firm based in country H competes with a profit seeking rival of country F. By investigating this setting we get the following result:

Proposition 5 *With Bertrand competition, irs, differentiation, a state owned competing with a foreign profit seeking firm sells at home at a price lower than abroad, while the rival firm, which maximizes profits, adopts a dumping strategy*

Proof. Unlike the previous case the profit functions are now:

$$\begin{aligned} \pi_H &= p_H q_H - f = 0 \\ \pi_F &= p_F q_F - f \geq 0 \\ \pi_{HX} &= t\, p_{HX} q_{HX} \geq 0 \\ \pi_{FX} &= t\, p_{FX} q_{FX} \geq 0. \end{aligned} \tag{6}$$

Again the fixed cost is charged on the domestic profit. The state owned in the domestic market breaks even while the rival maximize profit. On the foreign

market they behave the same way. Then, the solution for the equilibrium prices comes from the following system made by three first order conditions (FOCs) and a zero profit condition:

$$\begin{cases} \frac{\partial \pi_{FX}}{\partial p_{FX}} \\ \frac{\partial \pi_{HX}}{\partial p_{HX}} \\ \pi_H \\ \frac{\partial \pi_F}{\partial p_F} \end{cases} = 0$$

Direct demand functions are as in the previous case. As it can be seen the home firm has a zero profit goal which corresponds to the maximum consumer surplus from the domestic market when a foreign firm sells a differentiated good. Equilibrium variables are

$$p^*_{FX} = \frac{-a_H(s-1)(-4+(s-2)s) + s\sqrt{(s-1)(a_H^2(s-1)(2+s)^2 - 8f(1+s)(s^2-2))}}{4(s^2-2)}$$

$$\begin{aligned} p^*_F &= p^*_{HX} = a_F(1+\frac{1}{s-2}) \\ p^*_H &= \frac{a_H(s+s^2-2) + \sqrt{(s-1)(a_H^2(s-1)(2+s)^2 - 8f(1+s)(s^2-2))}}{2(s^2-2)}. \end{aligned}$$

while quantities are:

$$\begin{aligned} q^*_F &= \frac{a_F}{2+s-s^2} \\ q^*_{HX} &= \frac{a_F}{(2+s-s^2)t} \\ q^*_H &= \frac{a_H(s+s^2-2) - \sqrt{(s-1)(a_H^2(s-1)(2+s)^2 - 8f(1+s)(s^2-2))}}{(s^2-1)4} \\ q^*_{FX} &= \frac{a_H(s-1)(-4+s(s-2)) - s\sqrt{(s-1)(a_H^2(s-1)(2+s)^2 - 8f(1+s)(s^2-2))}}{(2-3s^2+s^4)4t} \end{aligned}$$

and profits are:

$$\begin{aligned}
\pi_H^* &= 0 \\
\pi_{HX}^* &= -\frac{a_F^2(s-1)}{(s-2)^2(1+s)} \\
\pi_F^* &= -\frac{a_F^2(s-1)+f(s-2)^2(1+s)}{(s-2)^2(1+s)} \\
\pi_{FX}^* &= -\frac{[a_H(s-1)(-4+s(s-2))-s\sqrt{(s-1)(a_H^2(s-1)(2+s)^2-8f(1+s)(s^2-2))}]^2}{(s^2-2)^2(s^2-1)16}.
\end{aligned}$$

It appears that in case of countries of equal size ($a_H = a_F$) we have:

$$p_H^* \leq p_{FX}^* \leq p_{HX}^* = p_F^*.$$

■

Therefore the state owned firm sells at home at a price lower than the export price while the opposite occurs for the foreign profit seeking firm. The low domestic price set by the state owned firm does not lead to foreclosure since the foreign rival is shielded by differentiation. In this case we may observe low prices at home and the presence of foreign competitors selling at higher prices, lower than the price set at home. In other words the foreign profit seeking firm carries out dumping.

6 What kind of trade policy?

As it happens frequently with the new[9] theories of trade the policy prescriptions vary quite a lot according to specific market structure and strategies adopted by firms, for instance Cournot versus Bertrand, private vs. state owned firms. In the above sections we have seen a bunch of opposite results within an oligopoly framework with private and state owned firms adopting Bertrand or Cournot stances with or without economies of scale and differentiation. First, we have seen in a simple case of a homogeneous mixed duopoly with constant returns to scale that the market price in the country with the state owned firm is lower than in the foreign country where the public firm

[9]We refer to the theories which have been produced since the 1980s. See for this distinction Head and Spencer (2017).

exports maximizing profit. In this case the market of the state owned firm is foreclosed to the foreign firm.

In a different scenario, with state owned firms and *increasing returns to scale*, foreclosure does not appear. A bunch of mixed results appear. In a mixed Cournot duopoly, the market price is higher in the country of the state owned firm. In that case there is a kind of "involuntary dumping" by the public firm which sells abroad at a price lower than at home. This dumping may be reversed if the country of the state owned firm is much smaller than the country of the rival firm.

If we extend the analysis to Bertrand competition with *irs* and differentiation in the case of a symmetric duopoly made by two state owned firms there is reciprocal dumping and, in case of size asymmetries, the firm of the larger country adopts a more aggressive dumping. If we consider a state owned *vs.* a profit seeking firm in the same framework we end up finding that the private firm carries out dumping.

Clearly these different results exclude the possibility of featuring a unique "simple" dumping or foreclosure case to be counteracted by a catchall "antidumping" duty or anything close to it. If a country is quite keen on reacting to foreign dumping or foreclosure it must clearly state the case and devise specific commercial policies. Nonetheless, we have to stress that it is hard either for a regulator or a trade policy maker to trace a market outcome to its strategic determinants and design "proper" commercial policies, as Head and Spencer (2017) notice.

What kind of trade policy may be envisaged? Given the wide variety of specific scenarios, only a piecemeal approach is feasible, even though the strategies seen above are quite hard to single out and assess.

We proceed confining our analysis of possible trade policies to the specific case of foreclosure, which may occur in industries where goods are fairly homogeneous and production takes place at constant returns to scale.

As seen above in section 2, a foreign profit seeking firm may be kept out of a country where the incumbent firm is state owned. The foreign country may wish to support the national firm to export. What kind of rationale should inspire export promotion of the domestic firm? The policy may actually come from the consideration of a broadly encompassing social welfare function that a government may be supposed to maximize. The goal may depart from traditional textbook social welfare functions since the aim

of the government may be to provide national firms a basic support to sell in all foreign markets. Policy makers know that exporting is a healthy industrial strategy since it stimulates innovation and competitiveness of domestic firms with considerable spillovers and feedbacks on the entire national economy. Moreover, the foreign state owned firm sells in the market of the profit seeking rival which may solicit the government to guarantee reciprocity in terms of trade opportunities. Therefore, a trade policy to counteract foreclosure should neither be traced back to mercantilist attitudes nor to any general macroeconomic reason. It may simply be oriented to guarantee a state boost for exporting firms and to obtain reciprocity standards.

On the basis of these considerations, we provide just an instance of a possible policy out of the large cluster of measures that may be adopted.

In this sense we open the way to a fresh analysis of counteracting trade policy measures aimed at reciprocity standards when foreign firms have organization structures and market strategies that are heterogeneous with respect to domestic firms.

We confine to foreclosure induced by state owned firms and we devise a simple trade protection policy that allows a country to compensate the disadvantage that emerges with respect to the foreign country of the state owned firm. Perhaps, the simplest measure that could be set in place is a subsidy.

We summarize some of the features of this protective policy in the following proposition:

Proposition 6 *A per unit of output production subsidy may be set by the country home of the profit maximizing firm competing with a foreign state owned enterprise. The goal of the government is to let the profit seeking firm be internationally as competitive as the state-owned foreign firm and export the same quantity. In such a case the subsidy increases with the size of the market and decreases as the foreign state-owned firm costs increase.*

Proof. We use a more general framework with respect to the model of previous sections introducing heterogeneous costs across firms. Therefore, while the demand functions remain the same, the profit functions now look as follows:

$$\pi_F = (p_F - c_F)q_F + t(p_H - c_F)q_{FX}$$

$$\pi_H = (p_H - c_H)q_H + t(p_F - c_H)q_{HX}$$

where c_F and c_H are the average costs of production of the two firms F and H. If firm F is a social welfare maximizer while firm H is a profit seeker the equilibrium quantities of the Cournot game are (assuming symmetric markets, i.e., $a_H = a_F = a$):

$$\begin{aligned} q_H &= \frac{1}{3}(a + c_F - 2c_H) \\ q_{HX} &= \frac{c_F - c_H}{2t} \\ q_{FX} &= \frac{a - 2c_F + c_H}{3t} \\ q_F &= a - c_F. \end{aligned}$$

If $c_H \geq c_F$ exports of country H to F are negative. To make them non negative we should provide firm H with a subsidy per unit of output τ as follows:

$$\tau \geq \left| \frac{c_F - c_H}{2t} \right|.$$

As it can be seen the subsidy depends directly on the gap between the costs of the two rivals. The subsidy decreases as transport costs decrease ($t \to 1$). If country H objective is to let the firm export the same amount of F the subsidy may be found first by equating q_{FX} and q_{HX} and solving in terms of c_H:

$$q_{FX} = q_{HX} \text{ if } c_H^s = \frac{1}{5}(7c_F - 2a) \leq c_F,$$

where c_H^s is the cost of H that makes for an export equal to that of F. Therefore, if $c_H = c_F$, the subsidy that lets the profit seeker export as much as the state-owned firm must be equal to:

$$c_F - c_H^s = c_F - \frac{1}{5}(7c_F - 2a) = \frac{2}{5}(a - c_F).$$

Then the export subsidy for the H firm to export as much as the state-owned firm should be:

$$\tau_{EX} = \frac{2}{5}a - c_F.$$

As it can be seen the subsidy should be calibrated to the size of the market (increases with the size) and to the cost of the rival (if the rival becomes more efficient the subsidy for H must increase). ■

We may design subsidies or other trade policy tools bound to pursue alternative public goals. In the above proposition we have just provided an instance of a policy measure that could be adopted by a government of a country whose profit seeking firm is foreclosed by a foreign state owned firm. If the government wants the domestic firm to export as much as the foreign rival it must subsidize the domestic profit seeker with a per unit production subsidy that is directly proportional to the size of the market and inversely to the cost of the rival.

We have presented just an example of commercial policy carried out to counteract a foreign country (disguised) trade policy that gives rise to domestic market foreclosure due to the presence of a state-owned firm. Alternative trade policies may be designed to react to dumping and foreclosure resulting from specific strategies carried out by foreign public or private firms. We leave an extensive analysis of this issue for a next paper.

7 Epilogue

Nowadays most trade policies are not easy to detect and are hardly measurable. Quite a few current international trade disputes arise due to administrative, environmental, technical barriers, enterprise ownership structure and strategies, fiscal rules and so on. In this paper we concentrate on some issues on the behavior of firms which are partly or entirely under public control in trade. It seems that trade policies that some countries (China, the US and the EU) adopt are, in a disguised way, "delegated" to firms whose strategies and ownership structure are part of export promotion policies. State-owned firms may be one important vehicle of this endeavour in countries with a strong presence of the state in the economy such as China. Nonetheless, similar traits may be replicated in market economies especially as far as the use of state-owned companies (or quasi state owned) is concerned. For instance in France the government has a controlling stake (some 20%) in the car manufacturer Renault-Nissan, while in Germany the giant Volkswagen is under the control of local states (Länder). In China state owned firms which are strong exporters, cover about one third of the economy.

Once we consider state owned firms competing with foreign private enterprises a rich bunch of equilibria appear. There may be a tendency for state firms to make the entrance in the domestic market by foreign firms hard via

foreclosure when goods are almost homogeneous and production takes place with constant returns to scale. This is a mode of behavior coming from a simple theoretical model which is not entirely general and it is based on a Cournot mode of interaction in oligopoly. Nonetheless, it may occur in some industries and perhaps reinforced by administrative restrictions (Autor et al. 2016; Friedman, 2018). For this specific case we have provided a possible counteracting trade policy measure based on a contingent subsidy.

However, a bunch of heterogeneous results appear when we consider increasing returns to scale, price competition and product differentiation.

Here the results are quite mixed and state owned enterprises do not seem to be anymore the preferred carriers of disguised trade policies. For instance, we see that (involuntary) dumping is quite common. However, state owned firm cannot be the only culprit. If there are country size asymmetries dumping can be carried out also by private firms. In this more realistic framework there is no room for a unique trade policy and only a piecemeal approach may be adopted. Moreover it is not possible to maintain that state owned firms can be the vehicle of disguised trade policies in all circumstances since in some cases it appears that for a government it may be better to "protect" a private firm.

In the case of market foreclosure induced by a state owned foreign rival a subsidy can be designed to allow the domestic profit seeking firm to export to the foreign market as much as the foreign state-owned firm. This subsidy may come from a government wishing to guarantee reciprocity in terms of market opportunities to its firms in a foreign market foreclosed by the presence of a state owned firm. That is just an example of a trade policy out of many possible actions that may be undertaken by a government aiming to provide industrial support to domestic firms on foreign markets.

8 Appendix A

We present simulations in Table 1 of the content of Proposition 4.

Table 1

parameters	1st sim	2nd sim	3rd sim	4th sim	5th sim
a_H	10	20	20	20	
a_F	10	=			
f	2	=			
s	0.8	=		0.5	
t	0.7	=	0.5	0.7	

Table 2

	1st sim	2nd sim	3rd sim	4th sim
p_{HX}	2.54	2.54		4.22
p_{FX}	2.54	5.24		8.54
p_H	3.84	8.10		14.16
p_F	3.84	3.84		6.89
q_{HX}	10.07	10.07	14.09	8.04
q_{FX}	10.07	20.80	29.12	16.27
q_F	0.52	0.52		0.29
q_H	0.52	0.25		0.14
π_{FX}	17.86	76.33		97.27
π_{HX}	17.86	17.88		23.78
π_F	0	0	0	0
π_H	0	0	0	0

1st Sim: symmetry, zero profit at home and fixed cost charged at home, Bertrand competition abroad. There is reciprocal dumping and sales are higher in the export market than at home.

2nd sim: asymmetry H market is larger ($a_H = 20$) than F ($a_F = 10$). Same strategies as above.

9 Appendix B

Table B.1

Full Prices of Chinese manufactured goods in Europe and China (May 2016)

	Huawei Mate 8	LG Hom Bot[10]	Lenovo Yoga 700 (14")	Wanli Tyres[11]
China	y $_{3699} \simeq 503E$	y $_{4498\text{-}5598} \simeq 612 - 762E$	y $_{6999} \simeq 952E$	y $_{433} \simeq 59E$
EU	$_{502\text{-}583}$E	$_{508}$E	$_{799}$E	$_{63}$E
	Diff.$\simeq 0$	dumping	dumping	foreclosure

where y = yuan and E = Euro.

10 Appendix C

We prove in this appendix the remark concerning the foreclosure with a differentiated Cournot framework. Demand functions, based on Singh and Vives (1983) framework, are[12]:

$$\begin{aligned} p_H &= a - q_H - stq_{FX} \\ p_F &= a - q_F - stq_{HX} \end{aligned}$$

while profits are

$$\begin{aligned} \pi_H &= p_H q_H + tp_F q_{HX} \\ \pi_F &= p_F q_F + tp_H q_{FX}. \end{aligned}$$

The consumer surplus in H is

$$CS_H = (a - p_H)(q_H + tq_{FX})/2.$$

[10] Code VR 64701 LVMP . VR 6340LV = 4498 yuan, VR6270LVM = 5598 yuan, VR6260LVM= 4998 yuan.

[11] Code 225/55R17 101 WZRXL

[12] We confine, for the sake of simplicity, to a simple case of two countries of equal size ($a_H = a_F = a$).

To get the equilibrium quantities we must solve the system

$$\begin{cases} \frac{\partial \pi_F}{\partial q_F} \\ \frac{\partial \pi_F}{\partial q_{FX}} \\ \frac{\partial (\pi_H + CS_H)}{\partial q_H} \\ \frac{\partial \pi_{HX}}{\partial q_{HX}} \end{cases} = 0$$

The equilibrium variables are:

$$q^*_{HX} = \frac{a}{3st}; q^*_F = \frac{a}{3}; q^*_H = a; q^*_{FX} = 0; p^*_H = 0; p^*_F = \frac{a}{3}; \pi^*_{HX} = \frac{a^2}{9s}; \pi^*_F = \frac{a^2}{9}.$$

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