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Strategic Export Promotion

Federico Etro

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Dipartimento di Economia Politica
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STRATEGIC EXPORT PROMOTION

by Federico Etro*

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Abstract

This paper provides a general characterization of optimal export promoting policies for foreign competitive markets and apply it to strategic trade policy and exchange rate policy. Contrary to the ambiguous results of strategic trade policy under barriers to entry in the third market, I find that it is always optimal to subsidize exports as long as entry is free (under both strategic substitutability and complementarity) and I explicitly derive the optimal export subsidies under Cournot and Bertrand competition. Finally, I show that there is always a strategic incentive to implement competitive devaluations when entry in foreign markets is free, but not otherwise.

*University of Milan, Department of Economics, Intertic and ECG. I am extremely thankful to Kreso Zigic and seminar participants at Harvard University, CERGE (Prague), the University of Milan and IUE (Florence) for useful comments. *Contact*: Università degli Studi di Milano, Bicocca - Piazza dell'Ateneo Nuovo 1, U6-360. *E-mail*: federico.etro@unimib.it.

What are the strategic advantages that export promoting policies create for domestic firms? What is the optimal trade policy with respect to exporting firms? How much should we invest to promote international demand of domestic products? Do competitive devaluations give a real advantage to national firms in the foreign markets? There is a lot of debate about these questions between policymakers. This is not surprising since also at a theoretical level there are not clear or unambiguous answers. This paper provides a unified framework to rethink about the real advantages of the policies of export promotion both in terms of trade policy and exchange rate policy.

Common wisdom on the benefits of export subsidization largely departs from the implications of trade theory. While export promotion is often seen as welfare enhancing at least in the short run and often supported by governments, theory is hardly in favour of its direct or indirect forms. In the standard neoclassical theory with perfect competition, the scope of trade policy is to improve the terms of trade, that is the price of exports relative to the price of imports, and, as long as a country is large enough to affect the terms of trade, it is optimal to tax exports (since this is equivalent to set a tariff on imports). The same outcome emerges under monopolistic competition, as shown by Helpman and Krugman (1989). In case of imperfect competition, a second aim of strategic trade policy is to shift profits toward the domestic firms, hence a large body of literature has studied models with a fixed number of firms competing in a third market with positive profits. Here, the optimal unilateral policy is an export tax under price competition, or whenever strategic complementarity holds (Eaton and Grossman, 1986). Under quantity competition, an export subsidy can be optimal (Brander and Spencer, 1984), but only under certain conditions.[1] The same ambiguity of these results "*creates information requirements for policy intervention that appear to many of the architects of this theoretical innovation to be sufficiently intimidating to suggest that policymakers had better leave it alone*" (Bhagwati, 1988, p.106).[2]

Nevertheless, different forms of direct or indirect export subsidies are widespread. Governments strongly support exporting firms, they often hide forms of export promotion behind nationalistic pride, and consider the conquer of larger market shares abroad as a positive achievement in itself. The European Union coordinates trade between its members and the rest of the world in a similar spirit, and subsidizes exports of agricultural products and the aircraft industry. France is use to support its "national champions" with public funding. Italy has a long tradition of public support of the *Made in Italy*, which is quite im-

[1]These conditions are derived by Dixit (1984) and Klette (1994). See also Horstmann and Markusen (1986) for related results.

[2]The literature has developed other arguments against export subsidies, as in case of asymmetric information between firms and government or in case of retaliation (see Bhagwati, Panagariya and Srinivasan, 1998, Brander, 1995, and Wong, 1995, for surveis), and some in their favour, as in case of international competition both at the market level and at a preliminary R&D level (Zigic, 2003).

portant for the promotion of fashion, design and food industries. Japan, Korea and other East-Asian countries have implemented export promoting policies for decades. Heavily protected South-American countries have tried to subsidize manufactured products in which they could develop a comparative advantage (and not only those). Even US has implemented strong forms of export subsidization through tax exemptions for a fraction of export profits, foreign tax credit[3] and export credit subsidies.

It appears quite surprising that, in front of this, trade economists do not have clear and unambiguous arguments to explain why export subsidies could be the optimal unilateral trade policy.[4] I provide such an argument, studying a model of trade policy for a foreign market with free entry for international firms. Notice that free entry is a realistic assumption since a foreign country without a domestic firm in the market can only gain from allowing free entry of international firms. Under free entry, export subsidization is always the best unilateral policy both under quantity and price competition, or, more generally, under strategic substitutability and strategic complementarity. The intuition is simple. While firms are playing some kind of Nash competition in the foreign market, a government can give a strategic advantage to its domestic firm with an appropriate trade policy. When entry is free, an incentive to be accomodating is always counterproductive, because it just promotes entry by other foreign firms and shifts profits away from the domestic firm. It is instead optimal to provide an incentive to be aggressive, that is to expand production or (equivalently) lower the price, since this behaviour limits entry increasing the market share of the domestic firm.[5] As usual, this is only possible by subsidizing its exports. The same argument can be applied to other forms of indirect export promotion, as policies which boost demand or decrease transport costs for the exporting firms: as long as these policies increase the marginal profitability of the domestic firm, there is a strategic incentive to use them unilaterally.

Last but not least, governments undertake competitive devaluations with the specific aim to support exporting firms. In spite of this, economic theory is again ambiguous on the merits of these policies. The traditional Mundell-Fleming model emphasizes the beggar-thy-neighbour effects of unilateral devaluations. However, the recent new open-economy macroeconomics shows that these devaluations can be beggar-thy-self policies (Corsetti and Pesenti, 2001).[6] Moreover, economists tend to underlie the perverse consequences that competitive devaluations have in terms of inflationary bias and creation of self-fulfilling

[3]See Desai and Hines (2003) on the impact of the EU complaint before the WTO against these subsidies: share price of american exporters fell sharply on this news.

[4]See Boone *et al.* (2006) and Kovac and Zigic (2006) for a related discussion.

[5]The result is closely related with recent progress in the theory of market leadership (Etro, 2004; 2006c; 2007). For a lot of material on these issues see www.intertic.org.

[6]This happens because in presence of imperfectly competitive markets and sticky prices, they lower the purchasing power of domestic agents'income and this negative terms of trade externality can more than offset the positive espansionary effect (due to the reduction of real wages under nominal rigidities).

financial crisis and bank runs, which have a recessionary impact on the real economy.[7]

Again, in front of this theoretical ambiguity it is difficult to make sense of the common wisdom according to which unilateral devaluations provide a positive strategic advantage on the international markets. Following the pioneeristic work by Dornbusch (1987), I evaluate the strategic incentives to exchange rate devaluations in a model where the incidence of exchange rate variations on prices is endogenous. Strategic effects of devaluations emerge only when firms produce at home, not if they directly produce in the foreign market. While under barriers to entry competitive devaluations may be a bad idea to provide a strategic advantage to domestic exporters, especially under price competition, under free entry there is always a strategic incentive to depreciate the currency to promote exports.

The rationale behind all these forms of exports promotion is always the same as long as the adoption of these policies helps the domestic firm to be aggressive in the foreign market, which is always the case when entry is free in this market. Ultimately, the scope of export policy is just to conquer market shares abroad and shift profits from firms of other countries toward domestic firms. If we interpret globalization as the opening up of new markets to international competition we can restate the main result as follows: in a globalized word, there are strong strategic incentives to conquer market shares abroad by promoting exports.

The paper contains a very general treatment in Section 1, where I introduce the model and solve for the strategic incentives to promote exports in presence of barriers to entry in the international market and with free entry. Sections 2 applies the general results to strategic trade policy: I wrote it in a way that should be clear to the expert reader independently from the general treatment, hence he or she may want to skip directly to this application at a first reading. Section 3 applies the general results to a partial equilibrium model of exchange rate policy. Section 4 concludes. Some extensions and technical details are left in the Appendix.

1 The Model

To be as general as possible, I will adopt a model of the market structure I have introduced in Etro (2002a, 2006a), use it to describe competition in a international market and augment it introducing export promoting policies.

[7]See Obstfeld and Rogoff (1996) and Kruman and Obstfeld (2000) on the macroeconomics of competitive devaluations. Notice also that also competitive devaluations induce perverse retaliatory reactions and can induce contagion of financial crisis. The IMF broadly accepts this negative view on competitive devaluations and tends to oppose them unless a fixed exchange rate clearly appears unsustainable.

Consider a foreign market where n firms from different countries are competing in Nash strategies. Let us assume that each firm chooses a strategic variable x_i with $i = 1, 2, ..., n$ which delivers the net profit function:

$$\pi_i = \Pi^i(x_i, \beta_i, s_i) - F \tag{1}$$

where $\beta_i = \sum_{k=1,k\neq i}^{n} h(x_k)$ for some positive, differentiable and increasing function $h(\cdot)$, while F is a fixed cost. The second argument represents the spillovers induced by the choices of the other firms on firm i's profits. I assume that $\Pi(x_i, \beta_i, s_i)$ is quasiconcave in x_i with $\Pi_{11} < 0$.[8] Since the main focus will be on free entry equilibria, I assume that spillovers are negative, $\Pi_2 < 0$. In general Π_{12} could be positive, so that we have strategic complementarity, or negative so that we have strategic substitutability.

Finally, s_i is the export policy chosen by the government of country i: in our main application, this is an export subsidy, but we will take in consideration also other forms of policies which promote exports. I assume that an increase in the policy raises profits, $\Pi_3 > 0$, hence I will define s_i as an export promotion policy for country i. I will allow Π_{13} to be positive or negative: only in the first case, the policy increases marginal profitability. All forms of trade subsidies under quantity and price competition imply $\Pi_{13} > 0$, but other indirect forms of export promotion can be characterized by $\Pi_{13} < 0$.

The welfare of country i, $W(s_i)$, depends positively on the profits of the domestic firm and negatively on the cost of its policy. In case of export subsidization, the cost of trade policy is the collection of tax revenue, but this may imply tax distortions or other kinds of costs due to general equilibrium or political considerations. Moreover, in case of lobbying activity, the weight given by the politicians to the costs of the policy may be smaller. Finally, other forms of export promotion can have different costs for national welfare. Nevertheless, in line with the literature on strategic trade policy, our focus will be mainly on the strategic incentive to export promotion, which will be defined as the indirect marginal benefit of an increase in s_i on the profit:

$$SI = \Pi_2(x_i, \beta_i, s_i)\frac{\partial \beta_i}{\partial s_i}$$

As long as this is positive, the government of country i has a strategic reason for promoting exports beyond any direct reason which depends on the first order impact of policy on welfare.

I will now present a few examples of market structures which are nested in the general model. As a first example let us consider a market with substitute goods where the indirect demand for good i is $p_i = p\left[x_i, \sum_{k=1,k\neq i}^{n} h(x_k)\right]$ with $p_1 < 0$ and $p_2 < 0$ and the cost function, which includes transport costs, is $c(x_i)$

[8] In the paper, any subindex refers to derivatives with respect to the corresponding argument.

with $c'(\cdot) > 0$. It follows that:

$$\Pi^i(x_i, \beta_i, 0) = x_i p(x_i, \beta_i) - c(x_i) \tag{2}$$

where $\beta_i = \sum_{k=1,k\neq i}^{n} h(x_k)$. In case of perfectly substitute goods, we have $p_i = p(x_i + \beta_i)$ and $h(x_i) = x_i$.

As a second example let us consider a general class of models of price competition. Any model with direct demand $D_i = D\left[p_i, \sum_{j=1,j\neq i}^{n} g(p_j)\right]$ where $D_1 < 0$, $D_2 < 0$, $g(p) > 0$ and $g'(p) < 0$, is nested in our general framework after setting $x_i \equiv 1/p_i$ and $h(x) = g(1/x)$, so that $h'(x) = -g'(1/x)/x^2 > 0$. Under constant marginal costs, gross profits become:

$$\Pi^i(x_i, \beta_i, 0) = \left(\frac{1}{x_i} - c\right) D\left(\frac{1}{x_i}, \beta_i\right) \tag{3}$$

We will assume that strategic complementarity typically holds ($\Pi_{12} > 0$) as it does under weak conditions. As we will see later on, examples include many well known demand functions like the constant elasticity demand, the Logit demand and the demand with constant expenditure, while the linear demand case is not nested in our general model (indeed, in that case, a free entry equilibrium does not exist since profits are increasing in the number of firms). Another important case which is nested in this specification is the model of price competition with demand *a la* Dixit and Stiglitz (1977), which has been widely employed in the new trade theory (Krugman, 1980; Helpman and Krugman, 1985), and is studied in Appendix D.

In these basic models of the market structure we can introduce different policies for export promotion. In the rest of this section I will derive the general results and in the next two sections I will apply them to the typical tools of trade policies and to the exchange rate policy. The general discussion will be divided in the two crucial cases: in the first the foreign market is closed, in the sense that there are barriers to entry, in the second, the foreign market is competitive in the sense that entry is free.

1.1 Strategic policy for closed markets

Let us briefly summarize the results on the optimal unilateral trade policy for a foreign market with a fixed number of firms. More specifically, assume that $s_i = 0$ for all firms except the domestic one, whose policy s is chosen by the government of its home country at an initial stage. Consider the second stage after a policy s has been chosen and assume that a unique Nash equilibrium exists with the same strategy for the foreign firms, say x, and a different strategy for the domestic one, say z, depending on the policy s. The first order equilibrium conditions are:[9]

$$\Pi_1 \left[x, (n-2)h(x) + h(z), 0\right] = 0 \tag{4}$$

$$\Pi_1^H \left[z, (n-1)h(x), s\right] = 0 \tag{5}$$

Totally differentiating this system, we have $x'(s) \gtreqless 0$ if $\Pi_{12}\Pi_{13}^H \gtreqless 0$ and $z'(s) \gtreqless 0$ if $\Pi_{13}^H \gtreqless 0$. In the initial stage the government will choose the policy to maximize welfare. Using the envelope theorem and the previous results, we obtain the strategic incentive to export promotion as:

$$SI = \frac{(n-1)h'(x)h'(z)\Pi_2^H \Pi_{12}\Pi_{13}^H}{\Delta} \tag{6}$$

where $\Delta > 0$ is the determinant of the equilibrium system. When $\Pi_{13} > 0$, which (as we will see) is always the case when the policy is subsidization, this effect is positive under strategic substitutability ($\Pi_{12} < 0$) and negative under strategic complementarity ($\Pi_{12} > 0$), while the result is inverted when $\Pi_{13} < 0$. It is now immediate to conclude with:

PROPOSITION 1. **Under barriers to entry in the foreign market, a) when the export policy increases the marginal profitability of the domestic firm, there is (not) a strategic incentive to export promotion if strategic substitutability (complementarity) holds, b) when the export policy decreases the marginal profitability of the domestic firm, the opposite holds.**

Notice that with just one domestic firm, the kind of policy does not depend on the number of international firms. The optimal policy implies an aggressive firm under strategic substitutability and an accomodating firm under strategic complementarity. However, the result is sensitive to the number of domestic firms: if this is large enough, there is a bias against export promotion (Dixit, 1984, and Klette, 1994).

Nevertheless, we can conclude with an unambiguous implication: in standard models of quantity and price competition, the foreign market gains from an increase in the number of international firms (since this will increase production and lower the equilibrium price), hence, it becomes crucial to investigate what happens under free entry.[10]

[9] Given the symmetric equilibrium, I will drop the index i for the international firms and use the index H for the domestic one.

[10] One should keep in mind that free entry may not be always the relevant assumption. Empirically, few firms are actually able to export. It seems that there are indeed very large barriers to exporting, that typically take the form of fixed costs (on top of the variable cost of shipping goods, tariffs and others). Nevertheless it appears reasonable that in a global context, there are potential entrants in most international markets.

1.2 Strategic policy for competitive markets

I will now assume that the number of potential entrants is great enough that a zero profit condition pins down the effective number of firms competing in the foreign market. The equilibrium conditions are the two first order conditions, (4) and (5), and the zero profit condition which binds on the international firms (since these do not profit from the optimal export policy):

$$\Pi\left[x,(n-2)h(x)+h(z),0\right]=F \tag{7}$$

Totally differentiating the system (4)-(5)-(7) we obtain a fundamental result for what follows:

PROPOSITION 2. **Under free entry in the foreign market, a change in the domestic policy does not affect the equilibrium strategy of all the other firms but only their equilibrium number.**

Proof: see Appendix A.

The intuition behind Prop. 2 is simple. Optimization by the foreign firms and the free entry condition constraining their number pin down the first and the second argument of their profit functions: their strategic variable and the level of spillovers from the other international firms and the domestic firm. This implies that only the number of international firms changes with the strategic variable of the domestic firm and hence with the strategic policy, while the strategy of the international firms is independent from the policy. Moreover, we have:

$$\frac{dn}{ds}=\frac{h'(z)\Pi_{13}^{H}/h(x)}{\Pi_{11}^{H}-h'(z)\Pi_{12}^{H}}\lesseqqgtr 0 \text{ and } \frac{dz}{ds}=-\frac{\Pi_{13}^{H}}{\left[\Pi_{11}^{H}-h'(z)\Pi_{12}^{H}\right]}\gtreqqless 0 \text{ if } \Pi_{13}^{H}\gtreqqless 0$$

In the initial stage, the government will choose the policy to maximize welfare. Using the envelope theorem and the previous results, we obtain the strategic incentive to promote exports:

$$SI=\frac{h'(z)\Pi_{2}^{H}\Pi_{13}^{H}}{\Pi_{11}^{H}-h'(z)\Pi_{12}^{H}} \tag{8}$$

Its sign is the sign of Π_{13}, hence:

PROPOSITION 3. **Under free entry in the foreign market, when the export policy increases (decreases) the marginal profitability of the domestic firm, there is (not) a strategic incentive to export promotion.**

Notice that the result would not change in presence of more than one domestic firm, as long as some entry of foreign firms takes place in equilibrium.[11]

[11] Actually, it is immediate to verify that with n_H domestic firms, the equilibrium strategy

One should keep in mind that our discussion is relevant in the short term, since in the long run strategic trade policy may induce further effects. First, new domestic firms may endogenously enter in the foreign market and drive net profits to zero.[12] Moreover, in a more general model, export promoting policies may create asymmetries in the domestic markets (which are absent in our model). While these aspects are beyond the scope of the present paper, they should be kept in mind as possible limitations for our outcomes. Second, other countries could retaliate introducing export promoting policies as well. This important extension is left for further research,[13] but it may represent a limitation of our case for export promoting policies in a long term perspective. Nevertheless, in line with the related literature, we believe that it is important to realize which are the short run strategic incentives to promote exports in alternative contexts, since policymakers are often more myopic than they should be. In Appendix B I present a more genaral analysis of optimal export promotion and, following Grossman and Helpman (1994), of the political economy considerations which may lead policymakers.

2 Trade Policy

In this section I will apply our general results to the theory of strategic trade policy. I will derive the optimal strategic unilateral trade policy in different models. The focus will be on specific subsidies, but similar results could be obtained with *ad valorem* subsidies. Finally, I will briefly consider other forms of export promotion.

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of each firm would not change and the strategic incentive to promote exports would just be:

$$SI = \frac{n_H h'(z)\Pi_2^H \Pi_{13}^H}{\Pi_{11}^H - h'(z)\Pi_{12}^H}$$

The economics behind this result is interesting: under free entry there is not a terms of trade effect induced by an export promoting policy (which is present with entry barriers; see Dixit, 1984): as we will see in the applications, domestic firms just crowd out foreign firms. The same would happen if a limited number of other countries would promote its own exports: as long as free entry holds on other firms, these countries would adopt the same policy and share the benefits of export promotion.

[12] Venables (1985) studies a particular example of this case. See also Markusen and Venables (1988). Brander (1995) summarizes the results on entry for the reciprocal-markets model.

[13] In such a war, all countries would want to promote exports of their firms, but, contrary to the case with barriers to entry, there cannot be a symmetric equilibrium, because all firms would make zero profits and each government would prefer not to promote exports anymore. However, there can be asymmetric equilibria were some countries promote exports and other do not. More interestingly, these equilibria may be Pareto efficient compared to free trade with free entry, since they would increase production or lower prices in the foreign country, while providing some profits to exporting countries.

2.1 Optimal export subsidy with Cournot competition

Consider the general model of quantity competition which allows for imperfect substitutability between goods. The gross profit of the domestic firm in presence of an export specific subsidy is:

$$\Pi^H = z\left[p\left(z, \beta_H\right) + s\right] - c(z)$$

where we remember that z is now production of the domestic firm, $p(\cdot)$ is the inverse demand which depends on the spillovers from the production of other firms β_H, $c(\cdot)$ is the cost function and s is its subsidy. This profit function is clearly characterized by $\Pi_{13}^H = 1 > 0$. The equilibrium first order conditions in the second stage where nash competition takes place in the foreign market are:

$$\begin{array}{c} p(x,\beta) + xp_1(x,\beta) = c'(x) \\ s + p(z,\beta_H) + zp_1(z,\beta_H) = c'(z) \end{array}$$

where $\beta = (n-2)h(x) + h(z)$ is the spillover received by an international firm from the strategies of all the other firms in the market and $\beta_H \equiv (n-1)h(x)$ is the spillover received by the domestic firm. If the number of firms is given, it is standard to derive the optimal trade policy. For instance, in case of perfectly substitute goods we have

$$s_H^*(n) = \frac{p\varepsilon}{1 + 1/\left[n(1-\chi)\right]} \tag{9}$$

where $\varepsilon \equiv -zp'/p$ is the elasticity of demand (with respect to domestic production) and $\chi \equiv -xp''/p'$ is the elasticity of the slope of the inverse demand which represents the degree of convexity of demand. As well known, in the linear case with demand $p = a - \sum x_j$ and marginal cost c we have $\chi = 0$ and $s_H^*(n) = (a-c)(n-1)/2n > 0$ but, if demand is convex enough, an export tax may become optimal.

Let us now consider free entry. In the second stage we have also the zero profit condition:

$$xp(x,\beta) = c(x) + F$$

The equilibrium system expresses production levels and the number of firms as functions of the subsidy s, but we know from Prop. 2 that the production of foreign firms x and their spillovers β are actually unaffected by changes in the subsidy, while $z(s)$ and $\beta_H(s)$ depend on the subsidy. Hence, we can write the welfare of the domestic country as the profits of the domestic firm net of the tax revenue necessary to finance the subsidy:

$$\begin{aligned} W(s) &= z(s)p\left(z(s), \beta_H(s)\right) - c(z) - F = \\ &= z(s)p\left[z(s), \beta + h(x) - h(z)\right] - c(z) - F \end{aligned}$$

which has an interior solution for the optimal subsidy (without entry deterrence) if goods are poor substitutes or if marginal costs are increasing enough. If such an interior solution exists, it must satisfy the first order condition:

$$p(z(s), \beta_H) + z(s)\left[p_1(z(s), \beta_H) - p_2(z(s), \beta_H) h'(z)\right] = c'(z)$$

which is a complicated implicit expression. However, if we substitute this in the equilibrium first order condition for the domestic firm, we can derive a neater expression for the optimal export subsidy:

$$s_H^* = \left[-p_2(z, \beta_H) h'(z)\right] z > 0 \tag{10}$$

Under perfect substitutability, this becomes:

$$s_H^* = p\varepsilon > 0 \tag{11}$$

which is increasing in the elasticity of demand (notice that p is independent from the subsidy). Moreover, it implies that domestic firms produce until their marginal cost equates the equilibrium price ($p = c'(z)$) and enjoy positive profits because returns to scale are decreasing for their level of production. Notice that the optimal subsidy would be the same in presence of other domestic firms: there is not a terms of trade effect because the equilibrium price is independent from the subsidy, while domestic firms crowd out foreign ones. It is simple to derive the optimal *ad valorem* subsidy in this case: for instance, with perfect substitutability (11) implies that the optimal rate of export subsidization would be simply equal to the elasticity of demand.

The role of trade policy is the same as with barriers to entry, but here it is always optimal to induce an aggressive behaviour of the national firm, which is done through subsidization. If there is low substitutability between goods and the marginal costs are constant or decreasing (or even not too much increasing), it is even better to set a subsidy which deters entry of international firms. Such a subsidy has to satisfy the free entry condition for n slightly smaller than 2, which implies that just one firm (the domestic firm) can profitably remain in the market:

$$xp\left[x, z(s_H^*)\right] - c(x) = F$$

For instance, consider the linear example. Here, imagining that there is entry in equilibrium and imposing the free entry condition for a given subsidy s, we obtain the equilibrium production for each international firm $x = \sqrt{F}$ and the number of firms $n = (a - c - s)/\sqrt{F} - 1$, which imply total production $Q = a - c - \sqrt{F}$. Consistently with Prop. 2, the subsidy does not affect the level of production of the other firms but decreases their number. The equilibrium production of the subsidized firm is instead $z = \sqrt{F} + s$, which generates profits $\Pi^H = (\sqrt{F} + s)^2$. The government maximizes profits net of the tax revenue necessary to finance the subsidies:

$$W(s) = \sqrt{F}\left(\sqrt{F} + s\right) - F$$

Since this is always an increasing function of s, it is optimal to increase subsidization as long as there is entry. But entry is deterred at:

$$s_H^* = a - c - 3\sqrt{F} > 0 \tag{12}$$

which is the optimal subsidy. The intuition for this result is the following. Free entry pins down the equilibrium price level of the foreign firms as long as some of them enter. This implies that the choice of the subsidy does not affect the equilibrium price at which the domestic firm will sell its production but increases its market share. Since there are fixed costs of production, an increase in the market share reduces average costs and hence it increases net profits. Consequently it is optimal to raise the market share as much as possible, which amounts to full entry deterrence.

Summarizing:

PROPOSITION 4. **Under quantity competition and free entry, an export subsidy is always optimal, since it helps the domestic firm to sell more than others in the foreign market**.

2.2 Optimal export subsidy with Bertrand competition

Consider our general model of price competition with an export specific subsidy, so that the gross profit function for the leader is:

$$\Pi^H = (p_H - c + s) D(p_H, \beta_H)$$

where we remember that $D(\cdot)$ is the direct demand depending on the price of the domestic firm p_H and on the spillovers from the prices of the other firms β_H. This profit function clearly satifies $\Pi_{13}^H = -p_H^2 D_1 > 0$.

It is tedious to characterize the optimal export subsidy under barriers to entry, but Appendix D solves for this in the case of the Dixit-Stiglitz specification of the demand function. Here we will focus on the free entry case, in which the equilibrium conditions in the second stage are:

$$(p-c)D_1(p,\beta) + D(p,\beta) = 0$$
$$(p_H - c + s)D_1(p_H, \beta_H) + D(p_H, \beta_H) = 0$$
$$(p-c)D(p,\beta) = F$$

where $\beta = (n-2)g(p) + g(p_H)$ is the spillover received by an international firm from the strategies of all the other firms in the market and $\beta_H = (n-1)g(p)$ is the spillover for the domestic country. This system expresses prices and the number of firms as functions of the subsidy s, but we know from Prop. 2 that the price of foreign firms p and their spillover β are actually unchanged with changes in the subsidy, while $p_H(s)$ and $\beta_H(s)$ depend on it. Hence, assuming that the cost of trade subsidies is given by the tax revenue necessary to finance them, we can write the welfare of the domestic country as:

$$\begin{aligned} W(s) &= [p_H(s) - c]\, D\,[p_H(s), \beta_H(s)] - F = \\ &= [p_H(s) - c]\, D\,[p_H(s), \beta + g(p) - g(p_H)] - F \end{aligned}$$

which is maximized by a subsidy satisfying the first order condition:

$$D\,(p_H, \beta_H) + (p_H - c)\,[D_1\,(p_H, \beta_H) - D_2\,(p_H, \beta_H)\, g'(p_H)] = 0 \qquad (13)$$

If we now substitute this in the equilibrium first order condition for the domestic firm, we can derive a neater expression for the optimal export subsidy:

$$s_H^* = \frac{(p_H - c)D_2\,(p_H, \beta_H)\, g'(p_H)}{[-D_1\,(p_H, \beta_H)]} > 0 \qquad (14)$$

Clearly, also this is an implicit expression, since on the right hand side p_H depends on the optimal subsidy, however, this expression makes clear our main point: the optimal export subsidy is positive. Summarizing:

PROPOSITION 5. **Under price competition and free entry, an export subsidy is always optimal, since it helps the domestic firm to lower its price in the foreign market**.

The result overturns common wisdom for models with strategic complementarity and barriers to entry. An accomodating behaviour is not anymore optimal because it would just induce new firms to enter. The only chance for the government to increase the profits of the domestic firm is to induce an aggressive behaviour. Then the firm will undercut the competitors gaining in market share and will spread a low mark up over a large portion of the market, leaving the few remaining firms with zero profits.

An explicit characterization can be obtained in the case of a Logit demand, $D_i = e^{-\xi p_i} / \sum e^{-\xi p_j}$ with $\xi > 0$. In this case, international firms choose the price $p = c + F + 1/\xi$ and it is easy to derive that the optimal subsidy must induce a price for the domestic firm equal to $p_H(s_H^*) = c + 1/\xi$, which requires a very simple expression for the optimal export subsidy:

$$s_H^* = F > 0 \qquad (15)$$

Another explicit result for the optimal export subsidy can be derived in models with isoelastic demand and in the Dixit-Stiglitz model which can be microfounded in a standard way. For instance a Dixit-Stiglitz demand:

$$D_i = \left(\frac{p_i}{P}\right)^{-\frac{1}{1-\theta}} \quad \text{with } P \equiv \left(\sum_{j=1}^{n} p_j^{-\frac{\theta}{1-\theta}}\right)^{-\frac{1-\theta}{\theta}}$$

delivers an equilibrium price $p_H = c/\theta$ for the domestic firms and a higher price p for all the other international firms through a positive export subsidy. In Appendix D I explicitly derive this optimal export subsidy as:

$$s_H^* = \frac{p_H^{\frac{1+\theta}{1-\theta}} - c}{1 + \left(\frac{p_H}{p}\right)^{\frac{\theta}{1-\theta}} \left(\frac{p-c}{F}\right)^{\theta}} > 0 \tag{16}$$

Here the intuition is simple and I will explore it in further detail. The free entry condition pins down the price index P and the price of the foreign firms independently from the domestic subsidy. This implies that the subsidy can be chosen to maximize the profits of the domestic firm net of the cost of the subsidy taking as given the aggregate price index. This is the same as directly choosing the price of the domestic firm without a subsidy to maximize profits while ignoring the effect of the price choice on the price index. Such a choice delivers a lower price than the one chosen by foreign firms, since those firms take in consideration the effect of their price on the aggregate price level and an increase in the latter raises their demand level and hence their profits. Consequently in equilibrium the domestic firm undercuts its competitors and obtains a larger market share, but this is possible only in presence of a positive export subsidy, which reduces the effective marginal cost of production and hence induces a lower mark up for the national firm. The gain in market share is however sufficient to create positive profits for the national firm.

2.3 Discussion

Beyond subsidization, many other trade policies can affect the profits of exporting firms: for instance, policies which increase demand for the domestic product, promote domestic R&D or reduce transport costs for exporting firms (Spencer and Brander, 1983). A main example of the latter kind is given by investments in infrastructures for international communication networks, but more indirect examples include the establishment of easier business connections with other countries, reduction of bureaucracy for export duties and even the development of trade and currency unions to reduce import tariffs and uncertainty costs related with the exchange rate. In Appendix C I show that when entry in the international markets is free, under weak conditions there are stronger incentives for governments to invest in these forms of strategic export promotion .[14]

[14]Notice, however, that improvements of infrastructures may have a bilateral impact, both on domestic exporters, but also on foreign firms that want to enter the domestic market. The entry of foreign firms, or the change in the market share of foreign firms following an improvement in infrastructure will have an impact on the survival of domestic firms, on the total number of domestic firms, and hence on the number of domestic exporters. In that respect, looking at the endogenous entry of domestic firms in the export market, may modify the predictions of the current model.

Finally, one could also consider competition *for* the international markets rather than competition *in* the international markets.[15] Traditional models of patent races are nested in our general framework (see Etro, 2002a, 2004) and can be used to study trade policy for firms investing in some forms of innovation to conquer foreign markets. Also in these contexts, export promotion is always optimal if access to the international competition is free: in this case, subsidies are simply R&D subsidies as shown in Etro (2006c); for a related analysis see Impullitti (2006a,b).[16]

3 Exchange Rate Policy

Our model allows to study another important tool which is used by governments to promote exports: competitive devaluations. It is commonly taken for granted that exchange rate devaluations are beneficial to exporting firms, allowing to increase demand for their products and providing a strategic advantage to them. In this sense, there is a strategic incentive to implement unilateral competitive devaluations directly under fixed exchange rates or indirectly through a monetary expansion which depreciates the currency when the exchange rate is flexible. As we will make clear, this is not generally true, but a devaluation definitely gives a strategic advantage to exporting firms when free entry holds in the foreign markets.

Our model of imperfect competition between international firms for a foreign market is particularly useful for such a purpose, since it is consistent with international market segmentation, which allows firms to choose different prices for different markets (in particular the price of a good in domestic currency does not need to be the same in the domestic and the foreign market).[17] Hence, following Dornbusch (1987), we can endogenize the effects of variations in the nominal exchange rate on prices. The effects of exchange rate policy for exporting firms crucially depend on the location of production, on whether local currency pricing or producer currency pricing holds[18] and on the strategic reaction of firms to the policy. In our partial equilibrium context, we will focus on the strategic effects of a devaluation on the domestic firm. Clearly, a devaluation has other consequences in general equilibrium, but the point here is just to understand whether the usual claim that a devaluation gives a strategic advantage to exporting firms is correct.

Our focus will be on a particular situation where all firms produce in their domestic country, bear production costs in domestic currency, choose their strat-

[15]See Aghion and Griffith (2005) for a survey.

[16]See Etro (2002b) for this point in a general equilibrium model of Schumpeterian growth.

[17]In other words, the law of one price does not hold, as usually happens in the real world because of transport costs and other frictions.

[18]See Engel (2000) and Betts and Devereux (2000) for theoretical discussions on local currency pricing versus producer currency pricing respectively in a standard Mundell-Fleming model and in a new open macroeconomy model.

egy taking into account the exchange rate and then export abroad. Under price competition this corresponds to the case of producer currency pricing. Such a case is typical of medium and small firms which are active at a national level, often producing typical domestic products and exporting some of them abroad, but also of larger firms which are not directly active in the foreign market under consideration but sell their goods to distributors of this market.[19] Once again, we will separate the discussion between the cases of quantity competition and price competition. The bottom line will be that competitive devaluations are always desirable to provide a strategic advantage to domestic firms when foreign markets are competitive.

Potentially, one could extend this framework to derive an optimal competitive devaluation comparing its benefits on the export side with its costs on the import side. However, one must always keep in mind that this analysis is relevant in the short run: as well known, in the long run, markets equilibrate in such a way that nominal variables, as the exchange rate, are irrelevant.

3.1 Competitive devaluations with Cournot competition

Imagine a quantity competition in the foreign market. Foreign demand for good i is as usual $p_i = p\left[x_i, \sum_{j\neq i} h(x_j)\right]$ where x_j is production for firm j, but revenues in domestic currency are $E_i x_i p_i$ where E_i is the price of the foreign currency in terms of currency of country i, that is the exchange rate of this country. For expository purposes, imagine an initial situation where, without loss of generality, all the exchange rates (with the foreign country where firms compete) are unitary. If the domestic country can adopt a competitive devaluation and rise the exchange rate to the level E, the profit of the domestic firm becomes:

$$\Pi^H = Ezp\left(z, \beta_H\right) - c(z) \tag{17}$$

which can be rewritten in our framework as $\Pi^H\left(z, \beta_H, s\right)$ where $s = E - 1$, implying $\Pi^H_{13} = p + zp_1 = c'(z)/E > 0$. Hence Prop. 1 and 3 apply and

[19] The alternative situation, which is not relevant for our purposes, emerges when international firms produce and compete abroad with independent production units. This is typical of multinational firms which are directly active in other countries where they sell their products. Under price competition, this case of local currency pricing with market power implies no pass-through of the nominal exchange rate on prices. In this situation, a devaluation is not going to affect the equilibrium in the foreign market. All firms would choose the same prices in foreign currency after a devaluation, but the profits of the domestic firm would be artificially increased in the domestic currency. The same would happen under quantity competition, since production decisions abroad would be independent from the exchange rate again, but profits in domestic currency would be inflated by a devaluation. It is clear that such a gain in profits should be compared with the losses for the society in terms of higher prices of the imports. However, this is not our focus; what matters for our purposes is that in such a context there is not a strategic incentive to implement a competitive devaluation. This policy does not give a real strategic advantage to the domestic firm in the foreign market but just artificially increases its profits.

tell us that after a devaluation the domestic firm will increase its production level. Under barriers to entry, as long as strategic substitutability holds, the other firms will decrease production so that the market share of the domestic firm increases (as it was shown by Dornbush, 1987): this creates a strategic incentive to devaluate.[20] Also under free entry the domestic firm expands its market share, but the other firms produce the same as before the devaluation, while some of them exit the market.[21] Summarizing, we have:

Proposition 6. **Under quantity competition, a) when the number of firms is exogenous there is a strategic incentive for competitive devaluations if strategic substitutability holds and b) when entry is free there is always a strategic incentive for competitive devaluations.**

Notice that a devaluation always increases exports. When entry is free and goods are perfect substitutes, the elasticity of domestic production with respect to the exchange rate is simply $(\sigma + \mu)^{-1}$, that is decreasing in the elasticity of the marginal cost σ and in the mark up $\mu = [Ep - c(z)]/c(z)$. Since the devaluation does not affect the equilibrium price, the elasticity of exports Ezp to the exchange rate is just $1 + (\sigma + \mu)^{-1} > 1$.

3.2 Competitive devaluations with Bertrand competition

The case of price competition is the most interesting, since it is the usual case under study in macroeconomic models on the exchange rate and probably the most realistic for our purposes.

Imagine again an initial situation where all the exchange rates are unitary. In particular, the price of the foreign currency in terms of domestic currency, E, is initially unitary. This implies that if p_H^* is the price of the domestic good in foreign currency, the price of the same good in domestic currency is $p_H = Ep_H^*$. If the latter is constant, a devaluation (an increase in E) will reduce the price in foreign currency, and an appreciation of the exchange rate will increase it. However, prices in domestic currency for foreign segmented markets can be changed after a devaluation and our purpose is exactly to check how they are changed.

Since production takes place at home and demand depends on prices in foreign currency, the relevant profit function for the domestic firm is:

$$\Pi^H = (p_H - c)\, D\left[\frac{p_H}{E}, \sum g(p_j^*)\right] = (Ep_H^* - c)\, D\left(p_H^*, \beta_H\right) \tag{18}$$

which can be rewritten in our framework with $z = 1/p_H^*$ and $s = E - 1$. With such a change of variables, the strategic variable for each firm becomes the price

[20] But it also creates a negative terms of trade effect which can eliminate the strategic incentive to devaluate if there are many domestic firms.

[21] In this case, when there are many domestic firms, there is not a terms of trade effect and a devaluation remains desirable from a strategic point of view.

in foreign currency (but on the basis of its value in terms of domestic currency, which is what matters in the profit function). Clearly, for all the international firms except the domestic one, the price is the same in foreign and domestic currency, $p_j^* = p_j$ for $j \neq H$.

Defining with $\mu_i = (p_i - c)/c$ the mark-up of firm i, and with $\epsilon_i = -p_i^* D_1/D > 1$ its perceived price elasticity of demand, we can express the equilibrium first order conditions as:

$$\mu_i = \frac{1}{\epsilon_i - 1}$$

while the second order conditions require $\eta_i < 2\epsilon_i$, where $\eta_i \equiv -p_i^* D_{11}/D_1$ is the price elasticity of the slope of demand and represents the degree of convexity of the demand function.[22]

As usual, the incentives to change strategy for the domestic firm depend on the cross effect $\Pi_{13}^H = -p_H^{*2}\left[D + p_H^* D_1\right]$, which is positive in equilibrium. Hence, the price of the domestic firm in foreign currency p_H^* is always decreasing in the exchange rate, that is after a devaluation. In general, Prop. 1 implies that a competitive devaluation is not desirable under barriers to entry. Such a policy forces the domestic firm to decrease its price in foreign currency, which induces also the other firms to do the same, reducing profits for all firms in the market. Actually, there is a strategic incentive to appreciate the currency, which induces the domestic firm to increase its own price in foreign currency and the other firms to do the same.[23]

When entry is free, the domestic firm does not obtain a strategic advantage when induced to increase its own price because this would promote entry in the foreign market. According to Prop. 3, there is a strategic incentive to devaluate the exchange rate. This would reduce the price of the domestic firm in the foreign currency. Foreign firms would not change their own prices, but fewer would enter in the market so that the market share of the domestic firm would expand. In this case, a devaluation has also a direct beneficial effect, since it increases revenues of the domestic firm in domestic currency; the positive direct and strategic effects of a devaluation should be compared with the costs in terms of a higher price of imports, which is beyond the scope of this discussion. What matters here, is that the usual claim that devaluations give a strategic

[22]Notice that a devaluation has always a direct positive effect on the profit of the domestic firm, since it increases revenues in domestic currency. At the same time, there are direct costs from a devaluation, for instance in terms of higher prices of imports. However, these are not the effects we are interested in, since the case for a strategic advantage for the domestic firm depends on the indirect effect on the equilibrium strategies.

[23]Again, this is just the strategic incentive for the government: an appreciation would also have a negative direct effect on profits, reducing the mark-up of the domestic firm, and finally, it will induce other effects for the society like a reduction in the price of imports. The comparison between these direct effects and the strategic effect provides the optimal unilateral policy, but the crucial point, here, is that there is not a strategic incentive to implement competitive devaluations when domestic firms export in markets with barriers to entry.

advantage to exporting firms is correct only for competitive foreign markets. Summarizing:

PROPOSITION 7. **Under price competition, a) when the number of firms is exogenous, there is a strategic incentive to appreciate the domestic currency, but b) when entry is free there is a strategic incentive for competitive devaluations.**

The bottom line is quite intuitive. Devaluations can be deleterious for exporting firms when they induce a war between international firms to reduce prices in foreign currency and this happens when there are clear barriers to entry. However, when entry is free, international firms cannot undertake such a war and the domestic firm can unilaterally decrease its price in foreign currency expanding its market share: only in this case there is a strategic incentive toward competitive devaluations.[24]

Finally, we can look at welfare in the foreign country. Under barriers to entry prices decrease after a devaluation, which unambiguously improves welfare since the number of firms is fixed and hence foreign consumers can have more of each good at a lower price. Under free entry, just the price of the domestic good decreases, while the others remain at the same level and some international firms exit the market. However, this is not likely to reduce foreign welfare. For instance, under isoelastic utility as in the Dixit-Stiglitz model, the price index remains the same before and after the devaluation, hence welfare does not change abroad.

Summing up, we have evaluated the strategic incentives to implement a competitive devaluation. Contrary to common wisdom, such a policy does not always give a strategic advantage to exporting firms: this happens when these firms operate in competitive foreign markets where entry is free, but not in markets where there are barriers to entry.

[24]We can understand better the implications of a devaluation if we look at the change in the foreign price of the domestic good after the devaluation. Focusing on the case with free entry, if we define $\phi \equiv -\left(\partial p_H^*/\partial E\right)\left(E/p_H^*\right)$ as the elasticity of this price with respect to the exchange rate, we can derive a simple expression:

$$\phi = \frac{\epsilon_H - 1}{\epsilon_H(2+\kappa) - \eta_H} > 0$$

where $\kappa \equiv -\left[D_2 + \epsilon_H p_H^* D_{12}\right] g'(p_H^*)/D_1 > 0$. The percentage reduction in the foreign price after a devaluation is smaller when demand is highly elastic (ϵ_H is large, or in other words when the mark up is small) and when it is not too convex (η_H is small). We can also have a clue on the size of this elasticity. For instance, if demand is approximately linear in the price, it is always below 50% and decreasing in the mark up: mark ups for the domestic firm up to 50% of the marginal cost imply $\epsilon_H \simeq 3$ and hence ϕ below a third. However, when demand is isoelastic (as in the Dixit-Stiglitz model) we have $\eta_H = 1 + \epsilon_H$, which implies levels of ϕ always above 50%.

4 Conclusion

In this paper I adopted a simple model to show the general optimality of unilateral export promotion policies in foreign markets where free entry holds. The implications for markets with price competition are strong: the opening up of such markets to entry of foreign firms would change the optimal unilateral trade policy from export taxation to export subsidization and would create new strategic incentives to implement competitive devaluations. Notice that limitations to the possibility of adopting export subsidies (due to international agreements) and of implementing competitive devaluations (as for countries joining monetary unions) would push toward other indirect forms of export promotion as investments in infratructures or R&D promotion to provide a competitive advantage to domestic firms in the international markets.

Our model could be relevant for trade between developed and developing countries whose markets open up. A spectacular example is given by China, whose huge market is starting to massively import from the Western world. China lacks many advanced industries and, in the near future, it will represent a crucial market for automobiles, high technology commodities, luxury goods, and so on. Our results suggest that the gains from promoting exports of these items from the Western world will be quite large and trade wars for the Chinese market may be behind the corner.

Further theoretical research could extend these results. On one side, one could study more complex models of interaction between firms and governments and introduce this set up in a standard two country framework of international trade. Moreover it would be interesting to extend the model of strategic trade policy for the domestic market in presence of free entry. On the other side, one could analyse of the strategic effects of devaluations in general equilibrium models and study the strategic effects of devaluations on both foreign and domestic markets. Finally, it would be interesting to fully characterize equilibria in trade wars based on export subsidization or in exchange rate wars.

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Appendix A: Proof of Proposition 2

To verify the comparative statics of the system (4)-(5)-(7) with respect to s, let us use the definitions where $\beta = (n-2)h(x) + h(z)$ and $\beta_H \equiv (n-1)h(x)$ to rewrite it in terms of the three unknown variables x, z and β_H:

$$\begin{array}{c} \Pi_1\left[x, h(z) - h(x) + \beta_H, 0\right] = 0 \\ \Pi_1^H\left[z, \beta_H, s\right] = 0 \\ \Pi\left[x, h(z) - h(x) + \beta_H, 0\right] = F \end{array} \tag{19}$$

The second equation provides an implicit relationship $z = z(\beta_H, s)$ with $\partial z/\partial \beta_H = -\Pi_{12}^H/\Pi_{11}^H$ and $\partial z/\partial s = -\Pi_{13}^H/\Pi_{11}^H > 0$. Substituting this expression we obtain a system of two equations in two unknowns, x and β_H:

$$\begin{array}{c} \Pi_1\left[x, h(z(\beta_H, s)) - h(x) + \beta_H, 0\right] = 0 \\ \Pi\left[x, h(z(\beta_H, s)) - h(x) + \beta_H, 0\right] = F \end{array}$$

Totally differentiating the system we have:

$$\begin{bmatrix} dx \\ d\beta_H \end{bmatrix} = -\frac{1}{\Delta} \begin{bmatrix} \Pi_2\left[1 + h'(z)\frac{\partial z}{\partial \beta_H}\right] & -\Pi_{12}\left[1 + h'(z)\frac{\partial z}{\partial \beta_H}\right] \\ \Pi_2 h'(x) & \Pi_{11} - \Pi_{12}h'(x) \end{bmatrix} \begin{bmatrix} \Pi_{12}h'(z)\frac{\partial z}{\partial s}ds \\ \Pi_2 h'(z)\frac{\partial z}{\partial s}ds \end{bmatrix}$$

where $\Delta \equiv \Pi_2\Pi_{11}\left[\Pi_{11}^H - \Pi_{12}^H h'(z)\right]\Pi_{11}^H > 0$ and $\Pi_{11} - \Pi_{12}h'(x) + \Delta/\Pi_{11} < 0$ to assume stability. It follows that $x = x(s)$, $\beta_H = \beta_H(s)$ and $z = z(\beta_H(s), s)$ are the equilibrium functions with:

$$\frac{dx}{ds} = 0 \qquad \frac{d\beta_H}{ds} = \frac{h'(z)\Pi_{13}^H}{\Pi_{11}^H - h'(z)\Pi_{12}^H} \lesseqgtr 0 \text{ if } \Pi_{13}^H \gtreqless 0 \qquad \frac{d\beta}{ds} = 0$$

$$\frac{dn}{ds} = \frac{d\beta_H}{ds}h(x)^{-1} \lesseqgtr 0 \text{ and } \frac{dz}{ds} = -\frac{\Pi_{13}^H}{\left[\Pi_{11}^H - h'(z)\Pi_{12}^H\right]} \gtreqless 0 \text{ if } \Pi_{13}^H \gtreqless 0$$

which proves the Proposition. *Q.E.D.*

Appendix B: The political economy of export promotion

Let us explicit a welfare function for the domestic country. Define $C(s) = C\left[z(s), \beta_H(s), s\right]$ as a reduced form for the social cost of the policy, which we assume increasing and convex: for instance, in case of subsidies, this is the tax revenue necessary to finance them. The the optimal policy of export promotion is:

$$s_H^* = \arg\max W(s) = \arg\max\left[\pi_H - C(s)\right]$$

which satisfies the first order condition:

$$SI + \Pi_3^H = C'(s_H^*) \tag{20}$$

In the text, we derived optimal export subsidies/taxes under both closed and competitive markets.

Here I want to extend the model to take into account the lobbying activity of the exporting firm, which Grossman and Helpman (1994) have shown to be one of the main determinants of export policy, since exporters represent a minoritarian but well organized part of the society. The easiest way to endogenize lobbying is to imagine that the government chooses its policy to maximize a weighted average of welfare and firm's profits:

$$s = \arg\max\left[(1-\lambda)W(s) + \lambda\pi_H\right] = \arg\max\left[\pi_H - (1-\lambda)C(s)\right]$$

where λ is the weight given to the profits of the firm because of lobbying activity. Given λ, the equilibrium policy will satisfy the first order condition:

$$SI + \Pi_3^H = (1-\lambda)C'(s) \tag{21}$$

which delivers a policy $s_H(\lambda)$ increasing in λ, that is in the weight given by the politician to the firm's profits in its objective function, and equal to the optimal one if this weight is zero ($s_H(0) = s_H^*$). We will derive an example of a politico-economic equilibrium policy in the next section. Notice that the strategic incentive to adopt export promoting policies is the same undel lobbying, just the costs of the policy changes. If we define $C[s_H(\lambda)]$ as the social cost of lobbying, this is clearly increasing in the lobbying activity.

As an example, let us look at lobbying for export subsidies in the model with Cournot competition. Under free entry and perfectly substitute goods, assuming that marginal costs are increasing enough and defining $\sigma = c''(z)z/c'(z)$ as the elasticity of marginal cost, the politico-economic equilibrium specific subsidy can be derived as:

$$s_H(\lambda) = s_H^* \left[\frac{1 + \lambda + \lambda\sigma(1-\varepsilon)/\varepsilon}{1 - \lambda - \lambda\sigma} \right]$$

which is clearly increasing and even convex in the weight that politicians give to the profits of the exporting firm λ. Moreover, the equilibrium subsidy is unambiguously increasing in σ but, contrary to the optimal subsidy, decreasing in ε for λ or σ large enough.

Finally, the lobbying activity by the exporting firm determines λ, and this framework provides a simple way to understand the benefits of lobbying for this firm. If the cost of the lobbying activity to obtain a weight λ in the objective function of politicians is $L(\lambda)$, which is assumed increasing and convex, the investment in lobbying will select: λ to maximize $\Pi^H - L(\lambda)$, whose first order condition is $\left(SI + \Pi_3^H\right) s'_H(\tilde{\lambda}) = L'(\tilde{\lambda})$. Using the first order condition above we can derive a more informative expression for the equilibrium lobbying:

$$\tilde{\lambda} = 1 - \frac{L'(\tilde{\lambda})}{C'[s_H(\tilde{\lambda})]s'_H(\tilde{\lambda})} \tag{22}$$

whose right hand side contains the ratio between the marginal cost of lobbying for the exporting firm, and the product of the marginal cost of subsidization with the derivative of the policy with respect to λ, which is just the social marginal cost of lobbying. The bottom line is that even if there is a strategic incentive to export promotion, lobbying activity induces excessive export promotion.[25] If this distortion is strong, a commitment to free trade may be optimal for domestic welfare.[26]

Appendix C: Supporting demand and reducing costs

Many different policies can affect the profits of exporting firms. Imagine some policy which increases demand for the domestic product and makes it more rigid relative to the demand for foreign firms. Under quantity competition, the profit of the domestic firm would be:

$$\Pi^H(z, \beta_H, s) = zp(z, \beta_H, s) - c(z)$$

[25]However, notice that, if other groups are lobbying the equilibrium may imply a policy closer to the optimal one, since its costs are born by the all society.

[26]One could also study issues of international policy coordination in this framework (see Alesina, Angeloni and Etro, 2005, and Etro, 2006, for a recent related work). I will not pursue this here.

with $p_3(z, \beta_H, s) > 0$ and $p_{13}(z, \beta_H, s) < 0$. Hence, $\Pi^H_{13} = p_3 + zp_{13}$ is positive only if the export promoting policy does not make demand too rigid: in such a case, when entry is free, by Prop. 3, overinvestment in export promotion is optimal and makes the domestic firm more aggressive abroad. Notice that overinvestment could emerge even when the number of firms is exogenous, but only under strategic substitutability, by Prop.1 (and not in presence of too many domestic firms). Things are however different under price competition. In this case, we have:

$$\Pi^H(z, \beta_H, s) = \left(\frac{1}{z} - c\right) D\left(\frac{1}{z}, \beta_H, s\right) = (p_H - c) D(p_H, \beta_H, s)$$

with $D_3(p_H, \beta_H, s) > 0$ and $D_{13}(p_H, \beta_H, s) > 0$. Since $\Pi^H_{13} = -p_H^2 [D_3 + (p_H - c)D_{13}] < 0$, according to Prop. 3, we always have a tendency toward underinvestment in export promoting policies, which again induces an aggressive behaviour of the domestic firm abroad. Notice that the opposite result would emerge with barriers to entry according to Prop. 1. Summarizing:

Proposition A1. When export promotion increases demand for domestic goods without making it too rigid: under quantity competition, overinvestment in export promotion is optimal a) only under strategic substitutability when the number of firms is exogenous, b) always under free entry; under price competition, a) overinvestment in export promotion is optimal when the number of firms is exogenous, and b) underinvestment is optimal under free entry.

In a trade context, transport costs are crucial since the marginal cost of exports depends on them. The government can implement policies to reduce transport costs for all exporting firms. A main example is given by investments in infrastructures for international communication networks, but more indirect examples include the establishment of easier business connections with other countries, reduction of bureaucracy for export duties and even the development of trade and currency unions to reduce import tariffs and uncertainty costs related with the exchange rate. The following analysis can be applied to policies to promote cost reducing investment (process R&D).

Consider a policy which can reduce the marginal costs of the domestic firm through a reduction in transport costs. Assume that marginal costs are constant for the domestic firm and equal to $c(s)$ with $c(0) = c$, which is the same level faced by international firms, and $c'(s) < 0$: the higher is the investment the smaller is the marginal cost. Under quantity competition we have the profit of the domestic firm:

$$\Pi^H(z, \beta_H, s) = z[p(z, \beta_H) - c(s)]$$

which implies $\Pi^H_{13} = -c'(s) > 0$. Under price competition we have:

$$\Pi^H(z, \beta_H, s) = \left(\frac{1}{z} - c(s)\right) D\left(\frac{1}{z}, \beta_H\right) = (p_H - c) D(p_H, \beta_H)$$

which also implies $\Pi_{13}^H = p_H^2 c'(s) D_1 > 0$. The consequence is immediate from Prop. 1 and Prop. 3: while there may or may not be a strategic incentive to reduce transport costs when there are barriers to entry abroad, under free entry, this incentive always exists:

Proposition A2. When the number of firms is exogenous, there is (not) a strategic incentive to reduce transport costs under strategic substitutability (complementarity), but when there is free entry there is always a strategic incentive to reduce transport costs.

Clearly the result applies also when the cost function is not linear but the policy can reduce the marginal cost of transport. Moreover, the result naturally extends to any form of export promotion which reduces some kind of costs for the exporting firms, for instance labour cost, financial costs or taxation.

Appendix D: Optimal export subsidy under price competition

In this Appendix I will show how to solve for the optimal trade policy in a model of price competition with a demand function *a la* Dixit and Stiglitz (1977) with and without barriers to entry. Imagine a demand function for good i, $D_i = (p_i/P)^{-\frac{1}{1-\theta}}$, where $P \equiv \left(\sum_{j=1}^n p_j^{-\frac{\theta}{1-\theta}}\right)^{-\frac{1-\theta}{\theta}}$ is the price index. This can be derived from a utility function (or a production function) where $1/(1-\theta)$ is the elasticity of substitution between goods (inputs). Different firms produce the differentiated goods and engage in price competition. To re-express this model in terms of our variables, let us set $x_i \equiv 1/p_i$ and $h(x_i) = x_i^{\frac{\theta}{1-\theta}}$ so that, in presence of a specific subsidy we have:

$$\Pi(x_i, \beta_i, s_i) = \left[x_i^{\frac{\theta}{1-\theta}} - (c - s_i) x_i^{\frac{1}{1-\theta}}\right] [h(x_i) + \beta_i]^{-\frac{1}{\theta}} \tag{23}$$

It follows that $\Pi_{12} > 0$ at the optimal point satisfying $\Pi_1 = 0$, which implies strategic complementarity, as customary under competition in prices, and $\Pi_{13} > 0$. This is not by chance, since (23) can be seen as a particular case of (3).

Consider first the case of barriers to entry and an exogenous number of firms n. In the exact solution, the price of the foreign firms $p = p(s)$ and of the domestic firm $p_H = p_H(s)$ solve the system of equilibrium conditions:

$$\left[\theta p_H^{-\frac{1}{1-\theta}} - (c-s) p_H^{-\frac{2-\theta}{1-\theta}}\right] \left[(n-1) p^{-\frac{\theta}{1-\theta}} + p_H^{-\frac{\theta}{1-\theta}}\right] = \left[p_H^{-\frac{1+\theta}{1-\theta}} - (c-s) p_H^{-\frac{2}{1-\theta}}\right] \tag{24}$$

$$\left[\theta p^{-\frac{1}{1-\theta}} - c p^{-\frac{2-\theta}{1-\theta}}\right] \left[(n-1) p^{-\frac{\theta}{1-\theta}} + p_H^{-\frac{\theta}{1-\theta}}\right] = \left[p^{-\frac{1+\theta}{1-\theta}} - c p^{-\frac{2}{1-\theta}}\right] \tag{25}$$

and we know that both prices must be decreasing in both the subsidy and the number of firms (since strategic complementarity holds). The optimal trade policy maximizes:

$$W(s)=\frac{p_H(s)^{-\frac{1}{1-\theta}}\left[p_H(s)-c\right]}{\left[(n-1)p(s)^{-\frac{\theta}{1-\theta}}+p_H(s)^{-\frac{\theta}{1-\theta}}\right]^{\frac{1}{\theta}}}-F$$

A closed form solution for this problem does not exist, but one can derive an approximate solution in the case firms choose their prices ignoring their impact on the price index, which is reasonable for n big enough. In this case we have the equilibrium prices $p=c/\theta$ and $p_H=(c-s)/\theta$. Substituting in the welfare function we have:

$$W(s)=\frac{\left(\frac{c-s}{\theta}\right)^{-\frac{1}{1-\theta}}\left[c-s-c\theta\right]}{\theta\left[(n-1)\left(\frac{c}{\theta}\right)^{-\frac{\theta}{1-\theta}}+\left(\frac{c-s}{\theta}\right)^{-\frac{\theta}{1-\theta}}\right]^{\frac{1}{\theta}}}-F$$

whose maximization delivers the optimal negative export subsidy as:

$$s_H^*(n)\simeq-\frac{c-s_H^*-\theta}{\theta\left[1+(n-1)\left(\frac{c-s_H^*}{c}\right)^{\frac{\theta}{1-\theta}}\right]}<0 \tag{26}$$

Let us now solve for the exact optimal export subsidy under price competition and free entry. The price of the foreign firms $p(s)$ and of the domestic firm $p_H(s)$, and the number of firms $n(s)$ solve the system of equilibrium conditions (24), (25) and the free entry condition:

$$\left[(n-1)p^{-\frac{\theta}{1-\theta}}+p_H^{-\frac{\theta}{1-\theta}}\right]^{\frac{1}{\theta}}F=\left[p^{-\frac{\theta}{1-\theta}}-cp^{-\frac{1}{1-\theta}}\right] \tag{27}$$

From (25) and (27) one can derive the price of the other international firms implicitly defined by the smallest root of:

$$p=\frac{c}{\theta}+\frac{F^{\theta}\left(p-c\right)^{1-\theta}p^{\frac{1}{1-\theta}}}{\theta}$$

which is independent of s. The optimal subsidy maximizes:

$$W(s)=\frac{p_H(s)^{-\frac{1}{1-\theta}}\left[p_H(s)-c\right]}{\left[[n(s)-1]p^{-\frac{\theta}{1-\theta}}+p_H(s)^{-\frac{\theta}{1-\theta}}\right]^{\frac{1}{\theta}}}-F=\frac{p_H(s)^{-\frac{1}{1-\theta}}\left[p_H(s)-c\right]F}{\left[p^{-\frac{\theta}{1-\theta}}-cp^{-\frac{1}{1-\theta}}\right]}-F$$

where I used (27) in the second line. It is immediate to verify that the optimal subsidy must satisfy the first order condition $p_H(s)=c/\theta$. Substituting for p_H in the equilibrium condition (24) one obtains the optimal subsidy:

$$s_H^*=\frac{\left(\frac{c}{\theta}\right)^{\frac{1+\theta}{1-\theta}}-c}{1+\left(\frac{c}{\theta}\right)^{\frac{\theta}{1-\theta}}\left(p^{-\frac{\theta}{1-\theta}}-cp^{-\frac{1}{1-\theta}}\right)^{\theta}F^{-\theta}}>0 \tag{28}$$

which can be rewritten as (16).