FIW – Working Paper

FIW Working Paper N° 126
August 2013

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Rudy Colacicco[1]

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JEL: D43; D51; F12; F13; L11; L13
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Author

[1] Department of Economic and Social Sciences, Marche Polytechnic University, Piazzale Martelli 8, 60121 Ancona, Italy;
E-mail: r.colacicco@univpm.it; tel.: (+39) 071 2207102

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by Rudy Colacicco†
Marche Polytechnic University

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*This paper is based on the second essay of my Ph.D. dissertation at the Marche Polytechnic University. I am deeply grateful to my supervisor, Luca De Benedictis, for invaluable guidance, encouragement, and discussions. I wish to thank Peter Neary for useful suggestions and stimulating discussions. I also appreciate comments from Bruno Chiarini, Andreas Hoefele, Gaetano Alfredo Minerva, Andrea Presbitero, seminar participants at the Marche Polytechnic University, Higher School of Economics (Moscow and Saint Petersburg) as well as participants at the 6th FIW Research Conference (Vienna), 12th GEP Annual Postgraduate Conference (Nottingham), and 13th RIEF Doctoral Meetings (Paris). Part of this work was carried out while I was guest researcher at the Kiel Institute for the World Economics (IfW) in 2012. I thank the IfW for kind hospitality and support during my stay, in particular Harmen Lehment. I am grateful to the *Deutsche Zentralbibliothek für Wirtschaftswissenschaften* for library facilities. Financial support from the *Ministero dell'Istruzione, dell'Università e della Ricerca* during the whole Ph.D. is gratefully acknowledged. Needless to say, any remaining error is my own responsibility.

†*Address for Correspondence*: Department of Economic and Social Sciences, Marche Polytechnic University, Piazzale Martelli 8, 60121 Ancona, Italy; e-mail: r.colacicco@univpm.it; tel.: (+39) 071 2207102.

1 Introduction

Since the works by Brander and Spencer (1985) and Spencer and Brander (1983), many models of strategic competition have shown how the government intervention may be beneficial for a country, by providing a strategic market advantage to domestic firms in a sector, extracting oligopoly rents from foreign firms. The traditional motivation for a strategic trade policy (henceforth STP) relies on the following argument. As long as there exists a strategic interaction between domestic and foreign firms, the (benevolent) government has an incentive to maximize welfare,[1] by using a credible pre-commitment on its policy (abstracting from foreign retaliation) before firms engage in a strategic competition. This gives to domestic firms the advantage of becoming Stackelberg leaders. Partial equilibrium analysis of STP has been quite comprehensive. It has provided numerous and interesting, even though contrasting, findings since the seminal contribution by Brander and Spencer (1981). This wide set of theoretical evidence has produced a good deal of interest, not only by governments of large economies, for policies influencing international competition. For example, within a third-market framework (viz., firms from two different countries export to a third country) with Cournot competition, STP aims to lower the domestic firms' costs by means of an export subsidy (Brander and Spencer, 1985).[2] Since outputs are strategic substitutes, foreign firms have to reduce their optimal output, inducing a shift of the oligopolistic rents from foreign to domestic firms. This leads to a rise in domestic profits, offsetting the cost of a policy implementation. For an import-competing country an opposite policy (i.e., an import tariff) should be set instead, under certain conditions though (Brander and Spencer, 1984b).

However, these findings may be partial, by overlooking possible general equilibrium feedbacks. STP is a stream of economic research that by its nature is based on the strategic interaction among economic actors.[3] Most of theoretical and empirical applications of oligopoly to international trade do not consider factor markets (e.g., by normalizing factor rewards to unity), putting the emphasis on purely partial equilibrium analysis, without considering the rest of the economy within a general equilibrium framework.[4] The STP literature has not been immunized

[1] For partial equilibrium models, welfare is given by the standard measures such as consumer surplus, production surplus, and trade policy revenue.

[2] This is valid under certain conditions. See, e.g., Dixit (1984) and Horstmann and Markusen (1986) for further details.

[3] See Helpman and Krugman (1989) and the well-known survey of the literature by Brander (1995).

[4] See Tirole (1988) and Vives (2001) for excellent studies on oligopoly theory. Neary (2003b; 2010) argues that oligopoly in international trade theory has not reached the same status of monopolistic competition, because it has not been embedded in a general equilibrium milieu.

from the pervasiveness of the partial equilibrium approach. Partial equilibrium frameworks implicitly assume that the sector under observation is the only one affected by STP, such that they take factor rewards and aggregate income as given, and pay no attention to interactions among markets. The partial equilibrium approach may be appropriate when the focus is on a single sector in the short run. If one would analyze features of the entire economy instead (e.g., changes in social welfare and income distribution between workers and entrepreneurs), the partial equilibrium approach shows its limit. In particular, if the STP affects a broad set of sectors, then it is likely that linkages among sectors matter. These linkages can arise when different sectors have to compete for scarce factors of production. There exists a large literature on trade policy with monopolistically competitive firms in general equilibrium. Despite offering important insights in a wide range of cases, none of those general equilibrium models can, however, address the nexus between strategic interdependence among economic actors (in many sectors) and factor markets, which is the central issue of this paper.

The aim of this paper is to model STP in a simple general equilibrium framework,[5] in which both domestic and foreign firms demand one scarce factor of production in their respective factor markets, and compete in the domestic country only (i.e., a home-market framework). I focus on the domestic country where consumers buy goods produced by both domestic and foreign firms, and where the government intervention affects the strategic competition between firms. A cross-sector STP is able to affect the competition within sectors, by indirectly influencing the demand for inputs and, in turn, general equilibrium feedbacks from factor markets can arise. Indeed, factor rewards will play a key role in bringing the main theoretical findings. Given the overwhelming empirical evidence on the dominance of few very large firms on many international markets (e.g., among others, Mayer and Ottaviano, 2008), it is likely that these firms imperfectly compete, and their oligopolistic rents are not negligible. Hence, analyzing cross-sector STP from a general equilibrium perspective seems to be useful and likely to offer important insights.

To better illustrate the source of general equilibrium feedbacks, take the following simple example from Dixit and Grossman (1986). Consider a country in which two sectors compete

[5] Brander and Spencer (1984b), as much of economic literature, claimed that their model of STP could be embedded in a general equilibrium framework. They invoked the use of an additional perfectly competitive sector producing a composite "outside" good, which is used as numéraire (whose price is often normalized to unity) absorbing all income effects. As pointed out by Leahy and Neary (2011), the fact that the "outside" good plays a large role in factor markets, relative to the oligopolistic sector under analysis, is not sufficient to move from a partial to a general equilibrium set-up. This is due to the assumed constancy in factor rewards (viz., the oligopolistic sector is not able to affect any factor market).

for a single inelastically supplied factor of production. An expansion in the production of one sector (due to the STP in favor of domestic firms in that sector) has to necessarily shrink the availability of the factor of production for domestic firms operating in the other sector. To put it differently, the factor reward increases due to the rise in factor demand coming from firms receiving the government intervention. The increase in factor reward might offset the positive effect on the market shares of some domestic firms, inducing a reduction in the market shares of other domestic firms, and reducing domestic firms' profits in both sectors. Hence, in general equilibrium, STP can potentially affect factor rewards and, via general equilibrium feedbacks, other economic variables of relevant interest for policies.

I revisit the issue of factor market linkages among sectors, highlighted by Dixit and Grossman (1986), using the general oligopolistic equilibrium (henceforth GOLE) approach (Neary, 2003b;c). The main feature of this approach is that of assuming a continuum of sectors, each with a small number of firms competing à la Cournot. Firms have market power in their sector, permitting them to affect the price of their output. Hence, they are able to strategically behave against their direct rivals in the sector. Neary's key insight is that *firms are large in their own sector, but small in the economy as a whole*. Hence, firms are not able to affect factor rewards because they are many (from different sectors) in demanding scarce inputs, and they take other good prices and national income as given.[6] This simple assumption permits to have a consistent theory of oligopoly in general equilibrium, by also addressing factor markets. The recent and growing stream of economic research using the GOLE approach has been focusing on multiple issues, much of them related to international trade.[7] None of these contributions has analyzed any STP issue though.

The key finding of Dixit and Grossman (1986) is that, within a third-country framework with many Cournot duopolies having constant marginal costs, free trade is optimal. Applying an export (or production) subsidy, as prescribed by Brander and Spencer (1985), to all sectors aiming to move all domestic firms towards a condition of Stackelberg leadership, gives no

[6]This means that monopsony power is assumed away. Furthermore, Ford effect is not taken into account, implying that pricing decisions of firms are not able to affect national income and, in turn, the demand functions they face.

[7]See, for Ricardian trade models, Neary (2003a;b; 2009); for cross-border mergers, Neary (2007); for wage inequality and skill-premium, Bastos and Straume (2012) and Neary and Tharakan (2012); for multi-product firms, Eckel and Neary (2010) and Egger and Koch (2012); for unions and unemployment, Basile and De Benedictis (2008), Bastos and Kreickemeier (2009), Egger and Etzel (2012), Egger and Koch (2012), Egger and Meland (2012), and Kreickemeier and Meland (2012). See also Crettez and Fagart (2005) on the Pareto efficiency of the GOLE in case all of sectors are identical regarding the adopted technology; and Koska and Stähler (2011) for a different set-up employing Cobb-Douglas preferences and two production factors (viz., capital to establish firms and labor to produce commodities), focusing on factor prize equalization.

benefit to anyone. This policy would bid up the domestic factor reward of the inelastically supplied factor of production by the same amount of the subsidy. Dixit and Grossman (1986) suggested to select specific sectors with the strongest potential in improving domestic welfare and to discourage those sectors with the weakest potential. Hence, in absence of an efficient targeting criteria, it would appear that their work weakens the profit-shifting argument of STP. Indeed, as they emphasized, the difficulty to target sectors seems obvious.[8] This justifies the use of a more practical uniform trade policy across sectors. In the exercises of comparative statics that will follow, I evoke this difficulty to justify the restriction of attention to this simple (uniform) trade policy, for its manageability and clarity in confirming the substance of the intuition.

In the main part of their model, Dixit and Grossman (1986) worked up with an exogenously given foreign factor reward, so that foreign firms do not face any resource constraint. Their analysis focused on the domestic labor market. They admitted the lack of a linkage between the foreign factor reward and foreign production. In concluding their work, they briefly explained that extending the model to a full-fledge two-country framework, by considering the foreign labor constraint, would weaken further the profit-shifting motive for export subsidies. However, if a domestic trade policy is able to affect the production of both domestic and foreign firms, by means of general equilibrium feedbacks, then a framework with both domestic and foreign factor markets is more suitable to bring intuitions, as foreign firms modify their demands in the foreign labor market, in response to the domestic trade policy. If the foreign country is a symmetric counterpart of the domestic one, as usually assumed in international trade models, then one should explicitly consider a foreign labor market as well. This is one of the model ingredient I put forward in this paper, by simultaneously and endogenously deriving factor rewards in both countries, as firms face an economy-wide resource constraint.[9]

The main theoretical contribution of this paper is to derive a link between the trade policy instrument used by the domestic government (i.e., the import tariff, due to the focus on the import-competing country (Brander and Spencer, 1984b)) and the wage rates in both coun-

[8]This point was highlighted by Dixit and Grossman (1986, pp. 240-241), who wrote: "*[n]eedless to say, the correct calculation of the choices of industries for targeted subsidies involves some subtle reasoning and quite demanding information. [. . .] Empirical information [. . .] is unreliable even for established industries, and nonexistent for emerging high-technology industries. The danger of errors in practical implementation seems substantial.*"

[9]The paper by Glass and Saggi (1999) is close to mine for what concerns the model set-up. They extend Dixit and Grossman (1986)'s model and explicitly work up with both domestic and foreign wage rates as endogenous, to analyze the effects of FDI policies in general equilibrium.

tries. These links generate general equilibrium feedbacks on countrywide aggregate profits and social welfare. This paper, differently from the standard STP literature, does not focus on single-sector variables but on economy-wide ones. The model provides new and clear-cut theoretical findings, summarized as follows. Once wage rates are simultaneously determined, the *domestic wage rate is independent* of the domestic trade policy. I show how a simple trade policy design, represented by an import tariff applied to all sectors of the economy (independently of their welfare-enhancing potential), is able to unambiguously reduce the foreign factor reward. This general equilibrium feedback gives a *competitive advantage to foreign firms*. The economic intuition for this result relies on the fact that, after setting an import tariff, there will be a decrease (on average) in the outputs produced by foreign firms, reducing their total labor demand. Except for an extreme case, in which all sectors share the same technology, *domestic countrywide aggregate profits always benefit* from the cross-country (uniform) protectionism. Hence, the general equilibrium feedback on the foreign wage rate is not sufficient to reverse the rationale for STP in increasing the domestic countrywide aggregate profits. For a sufficiently low level of tariffs, this trade policy is *detrimental for the foreign countrywide aggregate profits*. These findings also have consequences for income distribution (i.e., total wage incomes versus countrywide aggregate profits) in both countries. This trade policy design has, however, a drawback for the domestic country: it is *harmful for social welfare*. This is due to the consequent rise in the variance of the good prices, which depends on the technological differences among sectors. This means that in some sectors the rise in import tariffs damages domestic firms whereas helps foreign ones. In general, this does not mean that a government would not apply such a trade policy. As I will sketch in the last part of the paper, political economy considerations are able to play a role in such a policy design within the GOLE framework. Therefore the GOLE approach provides a different viewpoint on the rationale for STP relative to previous works based on the standard partial equilibrium frameworks. Namely the GOLE approach is able to revert the clue of the theory of optimal tariff in partial equilibrium (Brander and Spencer, 1981; 1984b). Hence, a government ought not to overlook these general equilibrium effects in taking trade policy decisions.

The negative impact of a uniform cross-sector trade tariff on social welfare can be isomorphically interpreted as anything that restricts trade flows. The relevance of this paper's findings stand out in light of the heated debate over trade (and industrial) policy, which is experiencing a mild upsurge in popularity, at least in Europe, the U.S., Japan as well as some emerging

economies. This is a consequence of the global financial crisis in mid-2007, and the world economic slowdown in late 2008. As for the Great Depression of the 1930s, the temptresses of protectionism have emerged in response to the recession, by putting political pressure to governments. However, most of current tools to hedge domestic economic activities are consistent with the WTO rules, being *murky* tools (Baldwin and Evenett, 2009). Further protectionism cannot be ruled out until the global economy restores its pre-crisis level. The essential conclusion for policymakers is that one ought to tackle not only sector-specific trade-restricting measures, but also the (hidden) economy-wide protectionism, because it is counterproductive for an economy as a whole, *even without any foreign retaliation*.

The rest of this paper is organized as follows. In the next section, I give an overview of the main features of the model. In section 3, I embed the simplest possible model of STP within a GOLE framework. Section 4 conducts exercises of comparative statics offering theoretical intuitions. Section 5 briefly discusses possible political economy implications. In Section 6, I conclude by summarizing the contributions, discussing policy implications and caveats as well as suggesting some extensions of the model.

2 Overview

To begin with, since this is the first paper using the GOLE approach to analyze STP issues, I could choose any relevant paper on STP as a building block reference. The literature on STP has shown that the *optimal* trade policy may differ with price or quantity competition, changing from an export subsidy to an export tax (e.g., Eaton and Grossman, 1986), integrated or segmented markets (e.g., Markusen and Venables, 1988), and perfect or imperfect substitutability among goods (e.g., Cheng, 1988). Horstmann and Markusen (1986) look at the technology side of STP, by assuming increasing returns to scale and free entry. Many other features have been considered in literature, and I will come back to this point in Section 6, by suggesting some possible extensions. To convey the intuition, I opt for simplicity instead of generality, by abstracting from many realistic features. The main goal of this paper is to focus on general equilibrium feedbacks, which rely on the linkages between STP and factor markets.

Similar to many studies on oligopoly and in line with the GOLE approach, I assume that the competition within markets is à la Cournot, by permitting to have a framework that comes in handy for comparability. The two classical approaches to model STP are the third-country

framework, in which the importer (i.e., the third country) passively acts on imports, and Brander (1981)'s segmented-market (or its home-market variation) framework. The former, since Spencer and Brander (1983), abstracts from consumers' welfare, so that there exist neither domestic nor foreign consumptions, as domestic and foreign (competing) markets are not considered. This approach focuses on profit-shifting policies, by avoiding possible changes for consumer surplus in both exporting countries. Thus national welfare is simply given by the sum of profits, which are sometimes summed to the worth of trade policy revenue. The latter approach, introduced by Brander and Spencer (1984b) and Dixit (1984), considers domestic market and, in turn, domestic firms' profits, trade policy revenue as well as domestic consumer welfare. In such a framework the shifting in profits from foreign to domestic firms can be obtained through an import tariff (Brander and Spencer, 1984b).[10] For the paper's purpose, the latter approach appears to be suitable, as I aim to account for general equilibrium feedbacks from factor markets, which are linked to STP, on the domestic variables of interest, primarily social welfare in a broader sense, not simply given by firms' profits only. As pointed out by Helpman and Krugman (1989, p. 84), the third-country framework is inadequate (or using their words, *terrible*) to obtain indication of policy. Indeed, trade policy theory has been more involved to directly affect foreign firms by means of protectionist tools, such as tariffs than to use export subsidies. Hence, I integrate the home-market framework with the concerns raised by Dixit and Grossman (1986) on the competition for scarce factors of production, by means of the GOLE approach.

To highlight the role played by the STP on wage rates, countrywide aggregate profits, and social welfare in general equilibrium, I build the simplest possible model, by eliminating most of asymmetries between firms within any sector (viz., any domestic firm's productivity equals the foreign rival's one), and asymmetries among countries (e.g., same size). However, I continue to consider cross-sector differences in production technologies, as in Neary (2003b;c). This asymmetry plays, as I will show, a key role in the analysis. The model considers only one factor of production, say labor, with constant returns to scale (i.e., a simple Ricardian technology). Unlike Neary (2003b;c), I work up only with a continuum of monopolistic sectors in each country. As a result, in any sector there exists a duopoly once foreign firms are allowed to export and compete in the domestic country (i.e., one domestic firm and one foreign

[10]The revenue from the tariff and the increase in profits of domestic firms can more than offset the falling in imports due to the rise in consumer prices. As a result, a trade-off might arise. The import tariff is an optimal trade policy under some conditions (see also Brander and Spencer, 1984a). Specifically, a not "too" convex inverse demand function and constant marginal costs are required, as I assume in this paper.

firm). This is done because for the paper's purpose, it suffices to recognize strategic interaction among domestic and foreign firms, abstracting from strategic interaction among firms of the same country. Firms in any sector are assumed to produce a homogeneous good, as product differentiation is not central to this paper's focus. Given I work up with a home-market framework, I disregard the possibility for domestic firms to export, so that they sell all their outputs to domestic consumers only. To simplify, foreign firms export all their outputs to the domestic country.[11]

As standard in the literature, I focus on situations in which only the domestic government implements a trade policy. The foreign government passively behaves, as the focus of this paper is not on a policy strategic game among governments.[12] Trade policies are observed by both domestic and foreign firms. The game has two stages. Firstly, the domestic government takes the committing decision on setting trade policy on the outputs produced by foreign firms.[13] Secondly, domestic and foreign firms strategically compete, by taking the government trade policy as given. The game is solved, as usual, by backward induction. I remark that the goal of this paper is not that to establish the optimal trade policy for each sector: this is already well known from the voluminous past literature on STP (I further discuss this point in Section 4). The focus is shifted on the effects of an economy-wide STP on wage rates, countrywide aggregate profits, and social welfare. For ease of notation and tractability of findings, I work up with both linear inverse demand and cost functions, a benchmark for many oligopoly set-ups. This improves the understanding of the model and permits to have simple closed-form solutions.

[11]The reader could be concerned with a balance-of-trade issue. To put away this concern in a simple fashion, it would suffice to think of all sectors but one as manufacturing sectors demanding for labor, and to add a sector (e.g., the agricultural one) that does not require labor, in which the domestic country has a surplus with respect to the foreign country.

[12]Notice that without any foreign retaliation, the simpler home-market framework, which I adopt here, although it makes the model stylized, it suffices for the paper's aims. Indeed, introducing the possibility for domestic firms to export to the foreign country, as in a framework with segmented markets, does not qualitatively affect the model implication, as long as the foreign government passively acts. The same is true if one would add a representative foreign consumer that buys goods produced by not using labor (e.g., the produce). On this point, see also the previous footnote.

[13]Although in reality government intervention aiming to distort international trade, by means of import tariffs (or export subsidies), are prohibited, other forms of intervention are still applicable under specified conditions. For example, this is the WTO's position. Indeed, the World Trade Report 2012 (WTO, 2012) is dedicated to the growing importance of non-tariff measures. The model can isomorphically consider other trade barriers (e.g., custom procedures, licensing, red-tape barriers, or regulatory standards) aiming to reduce imports. For some of policy-oriented discussions regarding *murky* protectionism, see Baldwin and Evenett (2009).

3 Model

This section builds a simple model of STP and embeds it into a GOLE framework.[14] Before going into details of the model, I give a short informal description of the main ingredients. I assume that there are two symmetric countries, the domestic country and the foreign country, which trade homogeneous goods. For brevity, I will focus on the domestic country's equations, in the understanding that similar equations would hold for the foreign country, given the assumption of symmetry. Asterisked variables refer to foreign ones, which are used when there is the need. On the demand side, I assume a representative consumer having preferences over two homogeneous varieties of a continuum of goods in a linear demand structure.[15] On the supply side, in each sector one domestic firm competes with its foreign rival. I consider a linear technology with constant marginal costs, common to domestic and foreign firms operating in the same sector. After having specified the demand side of the model, I set up a static Cournot oligopoly model, by presenting the standard equilibrium outcomes for a single sector. The model considers only an inelastically supplied factor of production, say labor, whose market is competitive in both countries. As I will argue below, no "outside" good is used to pin down the wage rates in both countries. I embed this single-sector building block into a GOLE framework, by giving equilibrium closed-form solution to both wage rates, which are endogenously and simultaneously determined. Wage rates allow for deriving closed-form solutions of countrywide aggregate profits and social welfare in general equilibrium in term of exogenous variables. Continuity and differentiability in relevant arguments are assumed for the introduced functions up to the necessary order. In the next section, I use this apparatus to conduct exercises of comparative statics.

3.1 Demand side

The domestic country is populated by a representative consumer endowed with L units of labor, inelastically supplied (for a positive wage rate) to a perfectly competitive labor market.[16] Preferences are represented by a utility function additively separable over a continuum of goods

[14] A file for most of mathematical derivations is available from the author upon request.

[15] The GOLE approach is, however, isomorphic to a model in which a single sector involves a continuum of industries using labor as a *specific* factor of production, in line with Dixit and Grossman (1986). Following the GOLE literature, I refer to country-label variables.

[16] The perfect competition in labor markets is plausible if many, or better a continuum of, sectors compete by demanding for workforce.

(sectors) of unit mass, indexed by $z \in [0,1]$. The utility function is strictly increasing and strictly concave, given by

$$U\left[\{X(z)\}\right] = \int_0^1 u\left[X(z)\right] dz\,, \tag{1}$$

assuming $u'[\cdot] > 0$ and $u''[\cdot] < 0$. Quadratic sub-utility functions involve two homogeneous varieties of each good, given by

$$u[X(z)] = aX(z) - \frac{b}{2}\left[X(z)\right]^2\,, \tag{2}$$

with $a > 0$ and $b > 0$. In Eqs. (1) and (2), $X(z) = x(z) + x^*(z)$. Let $x(z)$ and $x^*(z)$ denote the consumption of the good produced in sector z by the domestic firm and foreign firm, respectively. The good produced in each sector is not substitutable with goods produced in other sectors.[17]

The representative consumer maximizes her utility function given by Eq. (1) subject to the budget constraint:

$$\max_{X(z)\in\mathbb{R}_+,\, z\in[0,1]} \quad U[\{X(z)\}] \quad s.t. \quad \int_0^1 p(z)X(z)dz \leq I\,, \tag{3}$$

with I the national income or total expenditure in the economy, and $p(z)$ the price of the good produced in sector z. Since goods are homogeneous within each sector, the price of (or the demand for) any domestic variety equals that of the foreign one, thus $p(z) = p^*(z)$ for every $z \in [0,1]$.

For the time being, I focus on a representative sector z, which forms the building block for the general equilibrium framework. Solving the representative consumer's problem[18] in Eq. (3)

[17] This kind of preferences provides linear demand functions in own prices and quantities. Hence, these preferences are able to approximate market outcomes around their equilibriums, and allow to work with simple closed-form solutions. Yet, this preference structure guarantees existence and uniqueness of the equilibrium within sectors, providing downward-sloping reaction functions of firms in quantity space (viz., the quantities are strategic substitutes, as required by Cournot competition). Quadratic preferences are quasi-homothetic being a case of Gorman (1961) polar form, so that they can be aggregated across individuals with different incomes if they share the same demand parameter b, implying linear and parallel Engel curves (Neary, 2003c; 2009). This latter feature justifies the representative consumer approach. Notice that the demand parameter a is assumed to be constant both within and between sectors. This means that the model abstracts from any difference in product quality (i.e., vertical differentiation), so that all inverse demand functions share the same intercept. This is done to avoid including an unnecessary source of heterogeneity.

[18] Since sub-utility functions are strictly concave, first-order conditions for utility maximization are both necessary and sufficient.

gives the linear inverse demand function for the interior optimal consumption of $X(z)$:

$$\lambda p(z) = a - bX(z)\,, \tag{4}$$

where λ stands for the Lagrangian multiplier of the budget constraint, which is interpretable as the marginal utility of national income. I assume throughout that $p(z) > 0$ and non satiation (that is, $\lambda > 0$), so that there exists a strictly positive demand for each good. Hence, all goods are essential at any (finite) positive price. This set-up guarantees interior solutions.

For the sake of brevity and as I will use the marginal utility of national income as numéraire, I do not derive the closed-form expression for λ.[19] It suffices to notice that λ is endogenous and depends on the economy-wide variables only: good prices distribution (i.e., good prices in all sectors) and national income (for further discussion and details, see Neary (2003b;c)). This completes the demand side of the model. I turn next to analyze firms' behaviors, technology, and partial equilibrium outcomes.

3.2 Supply side and partial equilibrium in home-market sub-games

The government is able to commit its trade policy in the first stage, before firms engage in competition. Hence, in each sector a two-stage game is involved. As usual, by means of the backward induction, I begin from the second stage. As most of oligopolistic frameworks, in each sector I assume away both firm entry-and-exit process and any capacity constraint. Firms play a static one-stage game, in which they have complete information, do not cooperatively compete à la Cournot in their sector, by choosing their own profit-maximizing output, taking as given the direct rivals' outputs, factor rewards, and the trade policy set by the domestic government.

The key assumption of the GOLE approach is that *firms are large in their own sector but small with respect to the economy as a whole* (Neary, 2003b;c). This implies that firms take λ as given in their production decisions, as each firm is not able to affect the good prices distribution, factor rewards, and, in turn, national income. Namely each firm *perceives* its inverse

[19] Dixit and Grossman (1986) included a low-technology "aggregate" sector, whose good plays the role of numéraire and is produced by only unskilled workers in a perfectly competitive market. Since the unit requirement for unskilled labor in the numéraire sector is normalized to unity, and the good price in that sector is also normalized to unity, the wage rate for unskilled workers equals the unity too. Hence, in their model, unlike here, all income effects are neglected, as they flow into the numéraire good.

demand function as linear within a neighborhood of the equilibrium (Negishi, 1961).[20] For this reason, I can set $\lambda = 1$, so that the Lagrangian multiplier will play the role of numéraire.[21] In general equilibrium all nominal variables should be interpreted as relative to the inverse of the marginal utility of national income (i.e., *real at the margin*). This is standard in the GOLE literature to simplify the exposition without affecting the analysis, as the absolute value of λ is undetermined in the real world.[22]

Labor, L, the sole factor of production, is free to move across all sectors without any cost, so that both wage rates are fixed at country level. However, labor is not able to cross national borders.[23] Firms in any sector operate under a common technology with constant returns to scale, therefore cost functions, $c(z)$ and $c^*(z)$, are linear in the output (viz., firms use a simple Ricardian technology). There may exist sufficiently high fixed costs that induce the oligopolistic market structure within sectors, but as the number of firms is exogenously given, fixed (sunk) costs have no role (as long as firms make positive profits, as I assume). Hence, I set fixed costs to zero, so that across sectors firms differ with respect to their marginal (i.e., variable) costs.

I work up with a home-market framework. Specifically, in each sector the domestic and foreign firms produce only for consumption in the domestic country. Domestic export and foreign consumption are not involved. In addition, all foreign firms export to the domestic country only. This set-up is well known from the partial equilibrium literature (see, e.g., Brander and Spencer (1984b) and Brander (1995)), which has highlighted how imposing an import tariff (to single sectors) would be welfare-enhancing for domestic social welfare, in case of a linear demand structure and constant marginal costs, as assumed here. For simplicity, no transport cost is considered, so that prices charged by domestic and foreign firms in each domestic market are the same (i.e., there exists no arbitrage possibility, as all inverse demand functions share the same intercept). I model the import tariff as specific (viz., an amount $t(z) \geq 0$ per each unit of good that is produced in sector z by the foreign firm, and exported to the domestic

[20] Neary's insight permits to avoid the well-known problem of monopsony power in embedding oligopoly in general equilibrium.

[21] Gabszewicz and Vial (1972) is a key reference on the numéraire problem in oligopolistic models in general equilibrium.

[22] Real variables are homogeneous of degree zero in factor rewards, the inverse of the marginal utility of national income, and the trade policy instrument. This fact solves the numéraire problem, as scale effects are negligible (for further discussion, see Neary (2003b;c; 2009)). Variables at the margin behave like real variables and this suffices to obtain fairly intuitions from the analysis. In what follows, I refer to real variables in the understanding that they are real at the margin. To put it differently, during the exercises of comparative statics, the variations in the variables of interest are in term of real-income impact.

[23] Production factors are likely to be less free to cross national borders than goods. This is standard in international trade literature.

country).[24] Even though for the moment I model the import tariff as a sector-specific one, in the exercises of comparative statics I focus on the more practical case of an import tariff common to all sectors (i.e., a uniform import tariff), following Dixit and Grossman (1986)'s argument on the difficulty to target sectors.

Each domestic firm maximizes its own profits subject to the (perceived) inverse demand function in Eq. (4), by taking the direct rival's output, the government trade policy, and both domestic and foreign wage rates as given:[25]

$$\max_{y(z)\in\mathbb{R}_+\,,\,z\in[0,1]} \pi(z) \equiv [p(z) - c(z)]y(z)\,, \tag{5}$$

with $y(z)$ the output of the domestic firm in sector z to be sold in the domestic market. Similarly, each foreign firm solves

$$\max_{y^*(z)\in\mathbb{R}_+\,,\,z\in[0,1]} \pi^*(z) \equiv [p(z) - c^*(z) - t(z)]y^*(z)\,, \tag{6}$$

subject to the Eq. (4), with $y^*(z)$ the output of the foreign firm in sector z to be exported to the domestic market.[26]

I assume that each domestic firm's marginal cost depends on the economy-wide, endogenously determined, and competitive wage rate $w > 0$ ($w^* > 0$ for each foreign firm), and on a sector-specific unit labor requirement $\beta(z)$. Firms with a unit labor requirement equal to $\beta(z)$ have to use $\beta(z)$ labor units to produce one unit of output. Assuming that in each sector the domestic and foreign firms share the same unit labor requirement, one can write firms' unit costs in sector z as $c(z) = w\beta(z) > 0$ and $c^*(z) = w^*\beta(z) > 0$. The continuum of sectors can be ordered in terms of unit labor requirements and, for a later purpose, I normalize the lowest unit labor requirements, so that one unit of labor is exactly needed to produce one unit of output (viz., for any sector z one has that $\beta(z) \geq 1$).

Imposing the market clearing condition and deriving the first-order conditions from firms'

[24] In general, specific and ad valorem trade policies are not equivalent under imperfect competition. See, e.g., Brander and Spencer (1984b) and Helpman and Krugman (1989) for further discussions. In the present model, however, an ad valorem tariff does not permit to go further with the modeling, as it implies that both domestic and foreign firms' outputs become independent of the policy instrument, once wage rates are endogenously determined. See footnote 32 for further details.

[25] Since firms take the marginal utility of national income as given, they do not consider in their own production decisions both national income and the other good prices.

[26] Since goods are homogeneous, firms cannot pass-through trade costs on consumption prices. As a result, *in partial equilibrium* trade barriers reduce profits of every foreign firm. As I will show, this is not always the case in general equilibrium for a cross-sector trade policy, which, in some sectors, is able to help foreign firms.

problems in Eqs. (5) and (6) yields the best response function for each firm in any sector.[27] I omit some simple derivations, as they are standard. Solving the given system of first-order conditions yields the Cournot–Nash equilibrium outputs for any domestic firm and foreign firm to be sold in the domestic market:

$$y(z)^{CN} = \frac{a - 2w\beta(z) + w^*\beta(z) + t(z)}{3b} \tag{7}$$

and

$$y^*(z)^{CN} = \frac{a + w\beta(z) - 2w^*\beta(z) - 2t(z)}{3b}\,. \tag{8}$$

The superscript CN refers to Cournot–Nash equilibrium outcomes. The linearity in the inverse demand and cost functions guarantee the stability, and therefore the uniqueness of the Cournot–Nash equilibrium in pure strategies, in which no firm has any incentive to deviate from the equilibrium. I move now to the labor markets and general equilibrium part of the model.

3.3 Labor markets and general equilibrium

Assume that, without any loss of generality, total wage income and countrywide aggregate profits are costlessly distributed to the representative consumer (e.g., she provides all labor force in the domestic country and holds the shares of all domestic firms), who uses them for the current consumption. Assume further that the import tariff revenue is returned to the representative consumer as a lump sum. Thus national income is given by $I = wL + \Pi + T + S$, with $\Pi \equiv \int_0^1 \pi(z)dz$ the domestic countrywide aggregate profits, and $T \equiv \int_0^1 t(z)y^*(z)dz$ the total tariff revenue from all sectors.[28] The last term, $S \equiv w^*L + \Pi^* - T$, is the surplus of the domestic country with respect to the foreign country. It has been added to have a consistent model, in which national income in the domestic country equals its aggregate expenditure for both domestic and foreign products. Hence, once one adds an "outside" sector (say agriculture) not

[27] In this set-up, it is easy to check that second-order conditions for interior solutions are satisfied, as profits are strictly concave functions in the outputs.

[28] As standard in the STP literature, I assume that the revenue from the government trade policy has the same weight in the national income as total wage income and countrywide aggregate profits. Hence, I abstract from distribution and efficiency considerations related to the government. However, for the paper's purpose this assumption plays no role, because in this paper welfare is not given by the national income, as in a standard partial equilibrium framework. See, for example, Neary (1994) for a model considering a different weight of government trade policy revenue in the welfare function.

using labor as factor of production, trade would be balanced, with a part of worldwide output that goes to the foreign country. To keep matters simple, I do not explicitly consider foreign consumption (of agricultural goods), because no use is made of it in the following analysis.[29]

I close the model by deriving the domestic wage rate in general equilibrium as a function of exogenous variables only. Full employment in the labor market implies that the exogenous inelastic labor supply equals the total labor demand coming from all sectors:

$$L = \int_0^1 \beta(z) y(z) dz \,. \tag{9}$$

Substituting in Eq. (9) for the Cournot–Nash equilibrium domestic firm's production from Eq. (7), and solving for the wage rate, w, after integrating, yields

$$w = \frac{a\mu_1^\beta + cov(t,\beta) - 3bL}{2\mu_2^\beta} + \frac{w^*}{2} \,, \tag{10}$$

where

$$\mu_1^\beta \equiv \int_0^1 \beta(z) dz \,, \quad \mu_2^\beta \equiv \int_0^1 [\beta(z)]^2 \, dz \,, \quad cov(t,\beta) \equiv \int_0^1 t(z)\beta(z) dz \,.$$

The first two terms above are the first and second uncentred moments of the distribution across sectors of unit labor requirements in each sector, respectively. The third term is the cross-sector "uncentred covariance" between import tariffs and unit labor requirements.[30]

Given the assumption of symmetry between the two countries, so that $L = L^*$, one can similarly obtain the equilibrium foreign wage rate by plugging Eq. (8) into Eq. (9), by considering $y^*(z)$ instead of $y(z)$. This yields

$$w^* = \frac{a\mu_1^\beta - 2cov(t,\beta) - 3bL}{2\mu_2^\beta} + \frac{w}{2} \,. \tag{11}$$

One can observe that each wage rate depends on the other one. Hence, I can simultaneously solve Eqs. (10) and (11). The solution gives the two equilibrium wage rates in terms of exoge-

[29] In the present set-up the domestic demand equals the world-wide one for each good (viz., all consumers in the world are located in the domestic country). Therefore, the national income in the domestic country equals the world-wide income as well as the marginal utility of national income in the domestic country equals the world-wide marginal utility of income. An akin interpretation would be that of a closed economy, in which there are two domestic firms that strategically compete in each sector. On this point, see also footnote 11.

[30] Notice that $cov(t,\beta) \geq 0$, being the sum (i.e., the integral) of the products of two terms, which can be either positive or null (viz., $t(z) \geq 0$ and $\beta(z) \geq 1$), for every sector z.

nous variables and policy instrument only:

$$w = \frac{a\mu_1^\beta - 3bL}{\mu_2^\beta} \tag{12}$$

and

$$w^* = \frac{a\mu_1^\beta - 3bL - cov(t,\beta)}{\mu_2^\beta} = w - \frac{cov(t,\beta)}{\mu_2^\beta} \leq w\,. \tag{13}$$

The domestic wage rate is independent of the domestic government policy instrument. This result is due to the fact that, the direct effect of the tariff is countered by the indirect effect of the general equilibrium feedback on the foreign wage rate. I do not claim that this result is a complete description of the effect of a uniform import tariff on the domestic wage rate. Indeed, clearly different demand or cost functions could allow such a trade policy to affect the domestic wage rate. However, this finding serves as a useful first approximation. The foreign wage rate negatively responds to a more protectionist policy, as proxied by a rise in $cov(t,\beta)$, which is positively linked to a rise in any $t(z)$ (though this would have a negligible impact) as well as to a rise in each $t(z)$ across all sectors, as I will consider in the next section.[31] Hence, protectionism places a wedge between the two wage rates, by damaging foreign workers. This is due to the decrease in the sum of foreign productions (to be exported to the domestic country), which reduces the total labor demand in the foreign labor market, when the domestic country becomes more protectionist. Therefore, for a fixed labor supply, the foreign wage rate has to decrease to restore the equilibrium in the foreign labor market. One would have wage equalization without any trade policy, so that $t(z) = 0$ in all sectors and, in turn, $cov(t,\beta) = 0$. Hence, the foreign wage rate, by incorporating the domestic trade policy influence, is able to bring its effects to the countrywide aggregate profits in both countries, and to social welfare in the domestic country, as I will argue in more detail in the next section.

[31] One might be tempted to equalize immediately the domestic and foreign wage rates, given the assumption of symmetry between the two countries. In general, however, in each sector domestic production is different from the foreign one, due to the import tariff. Equalizing wage rates would lead to a contradiction once labor markets are considered. In other words, setting $w = w^*$ in Eqs. (7) and (8), and calculating the endogenous values for both wage rates, by means of the labor market clearing conditions, as that in Eq. (9), would lead to different wage rates, contradicting the initial wage equalization. The home-market framework is a distinguishing feature of this model with respect to the previous ones in the GOLE literature (analyzing different issues from those in this paper), that uses the segmented-market framework, in which domestic and foreign wage rates are equalized. See Bastos and Kreickemeier (2009), Bastos and Straume (2012), and Kreickemeier and Meland (2012). Notice that, however, the potential asymmetric result on wages is due to the unilateral trade policy, not due to the home-market framework. With free trade, both wage rates (and both countrywide aggregate profits too) equalize.

4 Comparative statics

I now analyze the first stage of the game, in which the domestic government can set the trade policy. To simplify further, I will go on in assuming throughout a uniform import tariff across all sectors, that is $t(z) = t$ for each $z \in [0,1]$, and therefore $cov(t,\beta) = t\mu_1^{\beta}$.[32] Hence, I disregard first-best policy solutions for each sector. There is a fairly natural reason for this simplification. Of course, unlike firms, the government can be regarded as an agent that is big with respect to the economy as a whole. Therefore, theoretically, it should be able to internalize the effects of trade policy on economy-wide variables and, in turn, to set sector-specific tariffs. However, it is hard to imagine the real possibility for the government to acquire all the necessary (and demanding) information about the structure of each single sector of the economy, to discriminate trade policies by sector (Dixit and Grossman, 1986). Thus the domestic government would opt for a one-size-fits-all policy. Hence, t is the variable of interest in deriving the consequences of a marginal rise in cross-sector STP on wage rates, countrywide aggregate profits, and social welfare. A marginal rise in t is coherent with the fact that few, if any, countries aim to halt the foreign competition altogether. However, no country aims a full free trade. Notice that a uniform import tariff does not shift all domestic firms towards their own respective Stackelberg leadership positions. This means that the government's goal in this paper is to increase the domestic countrywide aggregate profits, not that to apply an *optimal* trade policy for each domestic sector.

Having determined the solutions for both wage rates, it is now possible to give closed-form solutions in general equilibrium to the endogenous variables of interest, namely countrywide aggregate profits and social welfare. Throughout the analysis, I implicitly assume an interior solution in each sector, so that the domestic government applies sufficiently low tariffs. Hence, after the raising in trade barriers, all domestic and foreign firms remain active as well as the po-

[32] In case of a uniform import tariff across sectors, even though an ad valorem form appears to be more appropriate, I retain the specific form because ad valorem tariffs would lead both domestic and foreign firms' outputs in any sector to be independent of the policy instrument. For example, for a cost-based uniform tariff (Dixit and Grossman (1986) adopted a cost-based uniform subsidy), it is easy to show that domestic and foreign equilibrium firms' outputs in any sector are

$$y(z)^{CN} = \frac{a - 2w\beta(z) + w^*\beta(z)(1+t)}{3b} \quad , \quad y^*(z)^{CN} = \frac{a + w\beta(z) - 2w^*\beta(z)(1+t)}{3b} ,$$

with

$$w = \frac{a\mu_1^{\beta} - 3bL}{\mu_2^{\beta}} \quad , \quad w^* = \frac{a\mu_1^{\beta} - 3bL}{\mu_2^{\beta}(1+t)} .$$

Hence, in case of a uniform ad valorem tariff, a rise in t is able to (negatively) affect the foreign wage rate only, without any further implications for outputs and, in turn, profits.

sitivity of the foreign wage rate continues to hold.[33] In what follows, I mostly restrict attention to the situation moving from a free trade scenario, in which $t = 0$.

4.1 Countrywide aggregate profits and income distributions

The Cournot–Nash equilibrium profits for each domestic firm are given by the standard result in Cournot competition: $\pi(z)^{CN} = b\left[y(z)^{CN}\right]^2$. This result clearly applies to each foreign firm as well. I begin by considering the effect of a rise in the uniform import tariff across all sectors on the countrywide aggregate profits, which, in the Cournot–Nash equilibrium, are given by

$$\Pi^{CN} = \int_0^1 b\left[y(z)^{CN}\right]^2 dz = \int_0^1 \frac{(a - 2w\beta(z) + w^*\beta(z) + t)^2}{9b} dz\,. \tag{14}$$

By substituting for Eqs. (12) and (13) into Eq. (14) yields Π^{CN} in terms of exogenous variables only:

$$\Pi^{CN} = \int_0^1 \frac{\left(a - 2\frac{a\mu_1^\beta - 3bL}{\mu_2^\beta}\beta(z) + \frac{a\mu_1^\beta - 3bL - t\mu_1^\beta}{\mu_2^\beta}\beta(z) + t\right)^2}{9b} dz\,. \tag{15}$$

One can observe the impact of the general equilibrium feedback coming from the foreign wage rate, which is negatively affected by a rise in the uniform import tariff. As a result, the domestic trade policy gives an indirect advantage to foreign firms, by decreasing the foreign labor cost. The question is whether this indirect effect is able to overcome the direct and negative effect on foreign firms that relies on the rise in the uniform import tariff. The analysis that follows will cast more light on this point.

Squaring the numerator in Eq. (15), integrating over all sectors, and rearranging gives

$$\Pi^{CN} = \frac{bL^2}{\mu_2^\beta} + \frac{v^2(a+t)^2}{9b\mu_2^\beta}\,, \tag{16}$$

with $v^2 \equiv \mu_2^\beta - \left[\mu_1^\beta\right]^2$ the variance across sectors of the technology distribution. Namely one can think of v^2 as an index of technological diversification across sectors (Neary, 2003b;c).

[33] Stating this condition in a more formal way implies that the level of t, before any further small rise of it, is such that $t < \widehat{t} \equiv \min\{t|y(z)^{CN} > 0\,\forall z \in [0,1], t|y^*(z)^{CN} > 0\,\forall z \in [0,1], t|w^* > 0\}$.

Partially differentiating Eq. (16) with respect to t and valuating it at $t = 0$ yields

$$\left.\frac{\partial \Pi^{CN}}{\partial t}\right|_{t=0} = \left.\frac{2v^2(a+t)}{9b\mu_2^{\beta}}\right|_{t=0} = \frac{2v^2 a}{9b\mu_2^{\beta}} \geq 0\,. \tag{17}$$

From Eq. (17), the domestic Cournot–Nash countrywide aggregate profits at $t = 0$ are strictly increasing in t only if $v > 0$. Hence, starting from a situation of free trade, a rise in t in all sectors enhances the domestic countrywide aggregate profits (this result also holds, however, when the derivative is valued at $t > 0$). In addition, as the domestic wage rate is not affected by trade policy, it is easy to see that a rise in t is also able to affect the income distribution by means of the rise of the ratio between the domestic countrywide aggregate profits and the domestic total wage income:

$$\left.\frac{\partial \left(wL/\Pi^{CN}\right)}{\partial t}\right|_{t=0} = -\left.\frac{18bL\left(a\mu_1^{\beta} - 3bL\right)(a+t)v^2}{(9b^2L^2 + (a+t)^2v^2)^2}\right|_{t=0} = -\frac{18bL\left(a\mu_1^{\beta} - 3bL\right)av^2}{(9b^2L^2 + a^2v^2)^2} \leq 0\,.^{34} \tag{18}$$

An interesting case is that in which $v = 0$, which is called by Neary (2003b;c) as the *featureless economy*. In this extreme case, all sectors use the same technology. Hence, if $v = 0$, then there exists no role for a cross-sector trade policy aiming to increase the domestic countrywide aggregate profits. Therefore from Eq. (18) no effect is shown for the domestic income distribution between profits and wages.[35] This is similar to what happens in Dixit and Grossman (1986)'s model, in which if all sub-sectors (i.e., industries) are symmetric, then there is no advantage to target anyone of them. As for competition policy in Neary (2003b;c)'s model, the general equilibrium viewpoint is able to provide a better understanding of the effects of trade policy, when applied to all sectors of the economy.

One can also analyze the trade policy effects from the perspective of the foreign country, where reverse implications (under a parameter condition though) hold for the foreign countrywide aggregate profits. Taking similar calculations by using Eq. (8) yields

$$\Pi^{*CN} = \frac{bL^2}{\mu_2^{\beta}} + \frac{v^2(a-2t)^2}{9b\mu_2^{\beta}}\,, \tag{19}$$

[34] The term $(a\mu_1^{\beta} - 3bL)$ at the numerator of Eq. (18) is strictly positive, given the positivity of the domestic wage rate.

[35] I omit to comment further on the comparative statics concerning v^2 and its effects on both countrywide aggregate profits and (as shown in the next subsection) social welfare, as this is easy to check and already discussed, in a different model though, by Neary (2003b;c).

and partially differentiating Eq. (19) with respect to t and valuating it at $t = 0$ yields

$$\left.\frac{\partial \Pi^{*CN}}{\partial t}\right|_{t=0} = \left.\frac{-4v^2(a-2t)}{9b\mu_2^{\beta}}\right|_{t=0} = \frac{-4v^2 a}{9b\mu_2^{\beta}} \leq 0\,. \tag{20}$$

Eq. (20) is strictly negative at $t = 0$ only if $v > 0$.[36] This highlights the profit-shifting effect due to the cross-sector uniform import tariff by the domestic government. The model presented here provides a rent extracting argument at an economy-wide level. In other words, this is not a profit-shifting effect regarding *each* single sector, as one might expect from the standard STP literature in partial equilibrium (Brander and Spencer, 1981; 1984b). Indeed, as noted by Dixit and Grossman (1986), within a third-country framework, one cannot help all domestic sectors of the economy when resource constraints matter. There exists room, however, for an *economy-wide profit-shifting* effect, for an import-competing country, as highlighted by this model. As for the domestic country, in the special case of the featureless economy, a rise in the uniform import tariff has no effect on the foreign countrywide aggregate profits. However, as domestic government has no incentive to be protectionist in the featureless economy (to raise the domestic countrywide aggregate profits), the negative effect of a rise in the uniform import tariff on foreign workers remains an ad-hoc case, presented for the sake of completeness. A final consideration is in order for the income distribution in the foreign country, when $v > 0$. As already stated, a rise in t is always negative for the foreign wage rate.[37] In this case, as just seen, foreign countrywide aggregate profits are also reduced by a rise in t (for $0 \leq t < a/2$) as well as foreign total wage income, which shrinks when t raises. The net effect depends on which variation is greater. To see this, as for the domestic country, it is sufficient to calculate the partial derivative of the ratio between the foreign total wage income and foreign countrywide aggregate profits with respect to t, given by

$$\frac{\partial\left(w^* L/\Pi^{*CN}\right)}{\partial t} = -\frac{9bL\left[9b^2L^2\mu_1^{\beta} + (a-2t)v^2\left((a-2t)\mu_1^{\beta} - 4(a\mu_1^{\beta} - 3bL - t\mu_1^{\beta})\right)\right]}{(9b^2L^2 + (a-2t)^2v^2)^2}\,. \tag{21}$$

[36] Notice that at a generic value of $t > 0$, the comparative statics on the foreign countrywide aggregate profits is a bit more complex. This is due to the term $(a - 2t)$ in Eq. (20). For $0 < t < a/2$ the partial derivative is always negative (or zero if $v = 0$). For $t = a/2$ the partial derivative is always zero, independently whether v is positive or zero. Finally, and more surprisingly, for $t > a/2$ and $v > 0$ the partial derivative is positive. This last case is due to the general equilibrium feedback (coming from the decrease in the foreign wage rate), which is stronger than the negative effect due to the uniform import tariff, inducing an expansion in the sum of foreign productions. Notice further that this last case would also put aside domestic government's concerns regarding the possibility of foreign retaliation. Throughout the paper I am mostly interested in situations in which t is relatively small or zero (i.e., free trade), therefore to the cases in which $0 \leq t < a/2$, though I also discuss the other situations.

[37] Notice that $\partial w^*/\partial t = -\mu_1^{\beta}/\mu_2^{\beta}$. For the featureless economy (i.e., for $v = 0$) one has that $\partial w^*/\partial t = -1/\mu_1^{\beta}$.

For the featureless economy (i.e., for $v = 0$), the partial derivative is strictly negative when valued at $t \geq 0$. For the more interesting case in which sectors are technologically heterogeneous, the denominator of Eq. (21) is positive whereas the numerator depends on the specific values of the exogenous variables. For $0 \leq t < a/2$ no clear-cut sign can be derived.[38] A factor that contributes to this indeterminacy relies on the fact that both wage rates (as thus total wage incomes) are linear functions of t, whereas countrywide aggregate profits are concave functions of t.

Table 1 summarizes the findings of the exercises of comparative statics discussed thus far.

[Table 1 about here]

I turn next to the normative side of the analysis, by considering the effect of a rise in t on social welfare.

4.2 Social welfare

Since I adopt the representative consumer approach with quasi-homothetic preferences, social welfare can be obtained through the indirect utility function. Inverting Eq. (4) yields the direct demand function for each good. Then, by plugging these direct demand functions into Eq. (2), and integrating over all sectors yields the indirect utility function. I use a transformed version of the indirect utility function (abstracting from constants) given by $V = -\mu_2^p$, with $\mu_2^p \equiv \int_0^1 [p(z)]^2$, which is the uncentred second moment of the price distribution across sectors. This means that the representative consumer dislikes differences in prices across sectors. I express μ_2^p in terms of the exogenous variables only. To do so, I substitute the formulations for the Cournot–Nash equilibrium outputs given by Eqs. (7) and (8) into Eq. (4). Then, by using the endogenous formulations for both wage rates, given by Eqs. (12) and (13), squaring, and integrating over all sectors, yields

$$V = -\frac{\left(2bL - a\mu_1^\beta\right)^2}{\mu_2^\beta} - \frac{v^2\,(a+t)^2}{9\mu_2^\beta}. \tag{22}$$

[38] However, it is easy to see that for $t \geq a/2$ the sign of the right-hand side of Eq. (21) is always negative. This is clear: for $t = a/2$ only the negative effect of a rise in t on the foreign total wage income matters; for $t > a/2$ the negative effect of a rise in t on the foreign total wage income is strengthened by the rise in the foreign countrywide aggregate profits. Notice that the term $(a\mu_1^\beta - 3bL - t\mu_1^\beta)$ in Eq. (21) is strictly positive, given the positivity of the foreign wage rate. Hence, it is easy to see that the second term within the square brackets at the numerator of Eq. (21) is the product of two negative terms (and a positive one, v^2) for $t > a/2$.

It is immediate to see from Eq. (22) that social welfare monotonically falls (though not strictly) as t raises:

$$\left.\frac{\partial V}{\partial t}\right|_{t=0} = \left.-\frac{2v^2(a+t)}{9\mu_2^\beta}\right|_{t=0} = -\frac{2v^2 a}{9\mu_2^\beta} \leq 0\,. \tag{23}$$

This result also holds when the derivative in Eq. (23) is valued at $t > 0$. Notice furthermore that the right-hand side of Eq. (23) would be zero only if $v = 0$. Hence, having assumed that t cannot be negative, a domestic (benevolent) government aiming to maximize social welfare should set $t = 0$, opting for free trade for all sectors.[39]

The rationale behind this finding, which goes against the imposition of any import tariff, relies on the fact that a rise in t increases good prices in some sectors and decreases good prices in other sectors. Since the measure of social welfare depends on the uncentred second moment of the price distribution, it is clear that a more protectionist policy across all sectors raises the heterogeneity in the good prices, with a negative effect on social welfare. In the subsection that follows, I explain in more detail the nature of this result, which runs counter to the findings of the literature on STP in partial equilibrium (Brander and Spencer, 1981; 1984b).

4.3 The underlying mechanism: sectors technologically heterogeneous

To better understand the origin of the finding on social welfare exposed in the previous subsection, it is sufficient to check what happens to the total production (i.e., the domestic production plus the foreign one) in any sector with a rise in t. In sector z one has that

$$\frac{\partial\left(y(z)+y^*(z)\right)}{\partial t} = \frac{1}{3b}\left(\beta(z)\frac{\mu_1^\beta}{\mu_2^\beta} - 1\right)\,. \tag{24}$$

The partial derivative in Eq. (24) can be either positive, zero, or negative. The sign depends on the value of $\beta(z)$ with respect to the two moments of the technological distribution. For relatively high values of $\beta(z)$ (viz., for $\beta(z) > \mu_2^\beta/\mu_1^\beta$), namely in sectors with a relatively high labor demand per unit of output (or, from another viewpoint, in relatively inefficient sectors), the sign is positive. This means that in sectors with a relatively high unit labor requirement, the prices would fall with a rise in t. Conversely, for relatively low values of $\beta(z)$ (viz., for $\beta(z) < \mu_2^\beta/\mu_1^\beta$), namely in sectors with a relatively low labor demand per unit of output (or

[39] Notice that without any constraint on t, social welfare, V, would be maximized at $t = -a$, namely by adopting a uniform import subsidy. See also the discussion in footnote 42.

in relatively efficient sectors), the sign is negative. Hence, in sectors with a relatively low unit labor requirement, the prices would increase with a rise in t. Lastly, for $\beta(z) = \mu_2^\beta/\mu_1^\beta$, the right-hand side of Eq. (24) is zero, therefore total production (and thus its price) would not change.[40]

I remark that there is no room for any comparative advantage argument. There are differences in the unit labor requirements only across sectors. Within sectors, any domestic firm and the foreign rival use the same technology.[41] This means that in some sectors the government intervention, by means of a small rise in t, would help the foreign firms at the expense of the domestic ones, as one would expect by following the line of reasoning from the partial equilibrium literature. However, the opposite is true in other sectors, as one would not expect at the first sight. Specifically, it is easy to see that in high-labor-requirement sectors, the government intervention generates a reduction of the domestic production, which, however, is more than offset by the increase of the foreign production, inducing a rise in the total production in the sector. Hence, in those sectors the general equilibrium feedback, coming from the foreign wage rate, is larger than the direct and negative effect of the import tariff levied by the domestic government, by giving a net advantage to the foreign firms.[42] Reversely, in low-labor-requirement sectors, the government intervention expands the domestic production, which, however, is more than offset by the decrease of the foreign production, inducing a decrease of the total production in the sector. In this second case, the general equilibrium feedback is smaller than the effect of the import tariff, therefore a net advantage accrues to the domestic firms.[43] As a result, a small rise

[40] It is easy to show that there always exist some unit labor requirements smaller than, and some others larger than μ_2^β/μ_1^β, for $v > 0$. Having normalized the lowest unit labor requirement to unity, let $\beta_{min} = 1$ be this specific unit labor requirement. It is immediate to notice that $\beta_{min} < \mu_2^\beta/\mu_1^\beta$. Next, let β_{max} be the highest unit labor requirement. Writing $\beta_{max} > \mu_2^\beta/\mu_1^\beta$ is equivalent to $\beta_{max} > \int[\beta(z)]^2 dz / \int \beta(z) dz$ or, with a straightforward step, to $\int \beta(z)[\beta_{max} - \beta(z)]dz > 0$, which is always verified, as $[\beta_{max} - \beta(z)] \geq 0$ for any z, by definition. Both lower and upper bounds of integrals have been omitted for convenience.

[41] Even though domestic and foreign firms competing in the same sector face different production costs, due exclusively to (potential) differences in wage rates, the oligopolistic competition can prevent firms to leave the market in case of a relatively small cost disadvantage.

[42] In high-labor-requirement sectors, applying an import tariff reduces domestic firms' profits. Although I have limited the analysis to nonnegative import tariffs, an opposite policy should be applied. This is similar to Dixit and Grossman (1986)'s model implications, in which sectors with low profit-shifting potential should be taxed. However, in the model here a reverse policy would be a bit outlandish, because it involves to affect directly foreign firms, not the domestic ones. In other words, this would call for the application of an import subsidy. This means to help directly foreign firms, so that to increase their total labor demand in the foreign labor market, bidding up the foreign wage rate and indirectly penalize them. This appears a rather unconventional policy and implies a targeted trade policy, which requires demanding information, as already discussed. One might theoretically imagine to help foreign firms, but this policy would carry the problem connected to a very onerous public financing. Furthermore, a uniform policy of import subsidies across all sectors would reduce the domestic countrywide aggregate profits, even though it would improve social welfare (see footnote 39). Indeed, this implication is due to the fact that a cross-sector policy of import subsidies can be thought of as a substitute for a cross-sector competition policy.

[43] In general, the impact of a small rise in t on any foreign firm's output is always twice (with the opposite

in t induces a reallocation of labor from high- to low-labor-requirement sectors in the domestic country, whereas in the foreign country the labor moves from low- to high-labor-requirement sectors.

Behind these underlying mechanisms, the technological heterogeneity across sectors plays a prominent role in bringing the theoretical implications. For the featureless economy, the labor reallocation among sectors is nullified. This is similar to what Neary (2003b;c; 2009) highlights for the inefficacy of competition policy for the featureless economy. Then, integrating across all sectors the right-hand side of Eq. (24) yields

$$\int_0^1 \left[\frac{1}{3b}\left(\beta(z)\frac{\mu_1^\beta}{\mu_2^\beta}-1\right)\right]dz = \frac{1}{3b}\left(\frac{\left[\mu_1^\beta\right]^2}{\mu_2^\beta}-1\right) \leq 0\,. \tag{25}$$

The right-hand side of Eq. (25) is negative only if $v > 0$. In fact, except for the featureless economy, one always has that $\left[\mu_1^\beta\right]^2/\mu_2^\beta < 1$, implying that the sum of changes of total productions across all sectors shrinks with a rise in t. Since any good price is linked linearly and negatively with the aggregate production in any sector, reverse implications hold for aggregate price indexes, as that of the inverse utility function, V, that is μ_2^p. Namely, when t raises μ_2^p increases, reducing social welfare, which is given by $V \equiv -\mu_2^p$. The finding that more protectionism is able to hit social welfare in the domestic country has political economy implications, as I briefly discuss in the next section. The only case in which t does not negatively affect V is the special case of the featureless economy, with $v = 0$, and therefore $\left[\mu_1^\beta\right]^2/\mu_2^\beta = 1$, implying that the sum of changes of total productions across all sectors goes to zero with a rise in t. In this extreme situation, as already discussed, the right-hand side of Eq. (23) would be always zero, for $t \geq 0$.

5 Political economy implications in a nutshell

Thus far the theoretical results have shown that the gains from an active trade policy by the domestic government, through a uniform import tariff across all sectors of the economy, accrue to the domestic countrywide aggregate profits only, even though some domestic firms are damaged. At the same time, this type of trade policy reduces social welfare in the domestic

sign) the impact on the direct rival (i.e., the domestic firm). In fact, in any sector one has that $\partial y(z)/\partial t = \left\{\left(-\beta(z)\mu_1^\beta/\mu_2^\beta\right)+1\right\}/3b$ and $\partial y^*(z)/\partial t = 2\left\{\left(\beta(z)\mu_1^\beta/\mu_2^\beta\right)-1\right\}/3b$.

country. Hence, free trade would be the (Pareto) efficient trade policy to be achieved. What cross-sector trade policy will a government design? The model's implications fit with the political economy literature of trade policy. In this section I briefly justify the call for a political economy explanation of the why governments would use such a cross-sector protectionism. Indeed, on the one hand, domestic firms have an incentive (at an economy-wide level though, not all domestic firms) to carry on lobbying (or advocacy) activities, to persuade the incumbent government to be protectionist. On the other hand, the representative consumer, who forms the electorate, has the possibility to exert the right to vote against the government that limits free trade and, in turn, leads to a higher heterogeneity in prices across sectors, generating consumer's dissatisfaction. If, for instance, the government places different weights on different groups (i.e., the representative consumer and entrepreneurs), then it is in a trade-off situation.

One can think of a stylized political economy model of trade protection, along the lines of Hillman (1982; 1989). Consider a domestic government aiming to maximize its own objective function. Although related to the function of social welfare, V, as previously defined, the government's objective function is different from it. The government's problem is given by

$$\max_{t} \quad G \equiv \alpha f(V) + (1-\alpha) g(\Pi)\,,$$

potentially subject to some constraints (e.g., domestic political objectives, internal law, and international trade agreements). Let $0 \leq \alpha \leq 1$ be the government's care for the representative consumer that acts as a weight in the government's objective function, G. Let $V = V(P)$, with $\partial V/\partial P < 0$, and $P \equiv \mu_2^p$ the price index. Let $f(\cdot)$ and $g(\cdot)$ be monotonic functions of social welfare and countrywide aggregate profits, as previously defined, respectively. The former would be linked with the number of votes whereas the latter would be linked with financial support during political campaign in coming elections. Let $\partial f(\cdot)/\partial P = (\partial f(\cdot)/\partial V)(\partial V/\partial P) < 0$ and $\partial g(\cdot)/\partial \Pi > 0$. Of course, both P and Π are functions of t, with $\partial P/\partial t > 0$ and $\partial \Pi/\partial t > 0$. Hence, $\partial f(\cdot)/\partial t < 0$ and $\partial g(\cdot)/\partial t > 0$. With $\alpha = 0$, the government does not take into consideration consumer's well-being, therefore it has an incentive to set a positive import tariff. With $\alpha = 1$, the (benevolent) government cares of consumer's well-being only, and it would intuitively choose free trade, by setting $t = 0$. For intermediate values of α, a small tariff would be set, by justifying a politically motivated active intervention of government in the markets. Notice furthermore that there also exists room for an *appetite-comes-with-eating* context. Indeed, considering Eqs. (16) and (22), it is easy to observe that the incentive to pursue

political pressure on the domestic government to raise t is stronger the higher the actual level of tariffs, though the damage for domestic social welfare is larger the higher the actual level of tariffs too (viz., for $v > 0$, one has that $\partial^2 \Pi^{CN}/(\partial t \partial t) = -(\partial^2 V/(\partial t \partial t))/b > 0$).

This prototype specification (e.g., no timing has been considered) could incorporate the admittedly more interesting case of conflicting lobbying activities, which aim to obtain asymmetric sector-specific trade policy (given the technological heterogeneity and, in turn, different profit margins among sectors) as, for example, in Grossman and Helpman (1994). However, the GOLE approach, focusing on the aggregate variables of the economy, provides a different viewpoint on lobbying activities. One could assume the existence of an interest group only, an "aggregate lobbyist", representing all firms in the economy (e.g., the National Association of Manufactures in the U.S., the Keidanren in Japan, or the BusinessEurope in the E.U.). In this case, domestic firms do not cooperatively compete with their foreign direct rivals, but they cooperatively compete (say act) across sectors against all foreign firms, by playing on such a lobbyist in influencing the domestic government towards policies threatening foreign competition. One can think of more complex and realistic political economy specifications to consider such scenarios, but a complete modeling goes beyond the spirit of the present paper, which simply crystallizes the underlined insights of embedding STP in a GOLE milieu.

6 Concluding remarks

This paper has offered a simple model of strategic trade policy (STP) within a general oligopolistic equilibrium (GOLE) framework. The aim has been that to analyze how an active cross-sector trade policy, set by a domestic government, is able to affect wage rates, country-wide aggregate profits, and social welfare. The standard literature on STP focuses on single markets, without taking into account factor markets and how they are affected by these policies. Governments ought to look at general equilibrium scenarios to better understand trade policy effects on the economy as a whole, as firms in many markets are likely to compete strategically. A first attempt in literature was done by Dixit and Grossman (1986) for a third-country framework, analyzing the effects of export subsidies. In this paper, I have addressed a different and complementary scenario, in which an import-competing country is able to use cross-sector import tariffs or, isomorphically, other protectionist tools. I have focused on the domestic country, by using a home-market framework, to directly consider the consumption

side. I have embedded this scenario in the recently available theoretical apparatus, provided by the GOLE approach (Neary, 2003b;c). Hence, this paper is a first attempt to shape the GOLE literature towards STP issues.

Domestic and foreign wage rates have been endogenously and simultaneously derived in general equilibrium. The model is able to explore the effect of a small increase in the degree of protection across all sectors, when the domestic government aims to increase countrywide aggregate profits relative to a free trade scenario, with domestic firms that are in strategic competition with the foreign direct rivals. The main theoretical findings advance the existing literature by showing that the domestic wage rate is not affected by a rise in the uniform import tariff, whereas the foreign wage rate is always reduced, by partially giving an advantage to foreign firms. However, this general equilibrium feedback does not suffice to reverse the rationale for the government intervention to increase domestic countrywide aggregate profits. This kind of trade policy, however, has a drawback. It always reduces social welfare in the domestic country. Hence, this paper reverses the much-quoted result of the optimal tariff, obtained in the partial equilibrium literature (Brander and Spencer, 1981; 1984b). This finding naturally calls for a political economy extension of the model, as I have briefly suggested in the previous section.

Some caveats are in order on the previous results. First, in the interest of analytical tractability and in line with the existing GOLE literature, the model admittedly rests on simple specifications of demand and cost functions. Further investigations are needed to fully address other relevant features missing in this paper. Here I indicate four additional research avenues, besides the political economy extension. Firstly, one could explicitly model asymmetric technologies among domestic and foreign sectors, as in Neary (2009)'s Ricardian model of international trade, giving room for possible interactions between comparative advantage and STP. Secondly, I have assumed a passive foreign government. Since the STP analyzed here reduces the foreign countrywide aggregate profits, an extension considering foreign retaliation (helping foreign firms to export) is worth highlighting the robustness of policy (and political economy) implications of the model, although, in this case, the negative effect on social welfare in the domestic country is expected to be even worse. Thirdly, I have worked up with perfect competition in labor markets. There is an increasing literature using the GOLE approach to address labor market imperfections (e.g., unemployment and unions) in open economy. It would be interesting to study STP with these labor market issues in a GOLE framework. These three missing characteristics represent limits in interpreting the model implications. I have no excuse

for this except that to keep simplicity. These additional features are, however, important and interesting, but considering them here goes beyond this paper's scope. Nevertheless I hope the model presented here has offered new and useful insights for the STP literature. Finally, as a further suggestion for future research, the model could be modified to take into account strategic environmental policy in open economy within a general equilibrium framework.

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Table 1: The effect of a small rise in t (that is, d$t > 0$) on domestic and foreign wage rates, countrywide aggregate profits, and income distributions.[a]

$v^2 > 0$					
w	Π^{CN}	wL/Π^{CN}	w^*	Π^{*CN}	w^*L/Π^{*CN}
$0\,(0)$	$+\,(+)$	$-\,(-)$	$-\,(-)$	$-\,(?^{b})$	$?\,(?^{c})$
$v^2 = 0$					
w	Π^{CN}	wL/Π^{CN}	w^*	Π^{*CN}	w^*L/Π^{*CN}
$0\,(0)$	$0\,(0)$	$0\,(0)$	$-\,(-)$	$0\,(0)$	$-\,(-)$

[a] A '$+$', a '$-$', and a '0' indicate a positive, negative, and no change, respectively. Values outside parenthesis for partial derivatives valued at $t = 0$ whereas values within parenthesis for partial derivatives valued at $t > 0$.

[b] $-$ if $0 < t < a/2$; 0 if $t = a/2$; $+$ if $t > a/2$.

[c] $?$ if $0 < t < a/2$; $-$ if $t = a/2$; $-$ if $t > a/2$.