Endogenous protection in a framework with a monopolistic competitive market

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Abstract

The author studies the determination of a specific tariff in a setting of monopolistic competition, which considers the G-H political-support approach. Several key insights arise from taking into account a monopolistic competitive market structure. Firstly, in a small economy, the political process induces to an inefficient over-taxation on imports that generates a deadweight loss for the society as a whole. Political variables affect the level of protection in a similar fashion as they do in a perfect competitive structure. Secondly, there is a positive relationship between the mark-up variable and the endogenous tariff. Thirdly, the optimal tariff tends to be smaller for varieties that are quite sensitive to changes in own prices. Finally, high product differentiation drives to lower level of protection.

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I. Introduction

It is well known that, in general, incumbent governments design economic policies taking into account not only the society’s well-being but also their own political interests. This fact might explain the discrepancy that sometimes arises between the policy that a policymaker actually sets and that of an economist would recommend. In this respect, Rodrik (1995, p. 1458) has emphasized that “perhaps no other area of economics displays such a gap between what policymakers practice and what economists preach as does international trade”. Possibly, this discrepancy has encouraged the theoretical and empirical research on political economy of trade during the last two decades. This branch has focused the study in analyzing the political process from which the structure of trade protection is determined.¹

Among the theoretical research, Grossman and Helpman (1994) has developed a prominent framework, which seeks to explain the formation of trade policy in a representative democracy. The political-support approach takes into account two kinds of players, an incumbent government and interest groups. The government cares about political contributions and society’s welfare, while lobby groups, which represent specific-factor owners, offer such political contributions in order to persuade the government to take an action that favors them. This approach has the interesting characteristic of providing microfundations to the player’s actions that are less formally specified in other political economy models. The political process is developed by considering an economic structure of perfect competition.

Chang (2005) and Gáname (2005) are first attempts to analyze the determination of trade policy in an alternative market structure. The models adopt the political process developed by Grossman and Helpman (1994), but they take into account monopolistic competitive markets. Though similar in nature, both papers rely on different models and pursue different aims. Chang (2005) relies on the Krugman-Dixit-Stiglitz monopolistic model to analyze how different policy instruments of ad-valorem nature are determined. Gáname (2005), on the bases of the Footloose Capital model (Martin and Rogers, 1995), studies the impact of an

¹ Rodrik (1995) reviews the literature on the political economy theory of trade while Gawande and Krishna (2002) provide a review of the empirical research.
endogenous tariff on the economic landscape. Recently, Facchini et al. (2009) have extended Grossman and Helpman (1994) model by allowing substitutability between domestically produced and import goods. The authors also provide an empirical study about trade protection in Latin American countries.

The aim of this paper is to analyze the formation of trade protection within a monopolistic competitive framework by taking into account an alternative model. The underlying setting in Chang (2005) and Gáname (2005) is the Dixit-Stiglitz monopolistic competition with iceberg trade costs, which presents some well-known problems. One of the main difficulties is the lack of identification, which restricts comparative static analysis. Other problem, which is present in Gáname (2005), is about model tractability and the impossibility of reaching a reduced expression for the equilibrium endogenous trade policy. Instead, the present paper relies on the Linear Footloose Capital model developed by Baldwin et al. (2003), which tackles these problems. Moreover, as trade policy is modeled like a specific tariff, the paper might provide insights about how a different type of policy instrument would affect the structure of protection.²

The paper is structured as follows. Section II presents the formal background where the economic structure and the political game are specified. Section III shows the results of the political game, the endogenous tariff that comes out, and presents the insights. Finally, section IV gives some concluding remarks.

II. Theoretical background

_Economic structure_

The economic structure is based on the Linear Footloose Capital Model presented by Baldwin, et al. (2003).³ The setting considers two regions, two sectors and two productive factors. Regions have similar tastes and technologies, though it is assumed that they are asymmetric, in the sense that one region is small (the home country) and the other is a large economy (the rest of the world). In each economy, sectors produce different goods, which are sold in different market structures. The industrial sector, which competes monopolistically, produces differentiated goods under increasing returns to scale. A monopolistic firm requires labor and capital to produce a variety \( i \), hence its cost function equals to:

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³ See also Ottaviano et al. (2002), who present an alternative monopolistic competition model, which is different from the Dixit-Stiglitz framework and is the based-model of the one presented in Baldwin, _et. al._ (2003).
\[ TC = \pi F + a_m wx_i \] (1)

where \( \pi \) is the reward of capital, \( F \) denotes units of capital input, \( a_m \) is the labor-output coefficient, \( x_i \) is the output of good \( i \) and \( w \) is the wage rate. Industrial goods are traded between regions facing trade costs, which are denoted by \( \tau \). The traditional sector produces a homogeneous good under constant returns to scale employing only labor. It requires one unit of labor to make one unit of this good, \( a_A = 1 \). The market is perfectly competitive and the homogeneous good is traded between regions without frictions. As a consequence, \( w = 1 \).

The home region is populated by \( M \) individuals while foreign population equals to \( M^* \). Individuals have identical preferences though they may be owners of different endowments.\(^4\) The typical consumer of the small economy maximizes the following quasi-linear quadratic utility function:

\[ U = c_A + \alpha \int_{i=0}^{N} c_i d_i - \frac{\beta - \delta}{2} \int_{i=0}^{N} c_i^2 d_i - \frac{\delta}{2} \left( \int_{i=0}^{N} c_i \right)^2 ; \quad \alpha > 0 \quad \text{and} \quad 0 < \delta < \beta \] (2)

\( c_i \) is the consumption of variety \( i \), \( c_A \) is the consumption of the homogeneous good, which is chosen to be numeraire good. Parameter \( \alpha \) measures the intensity of preferences for differentiated goods; \( \beta > \delta \) expresses the love for varieties assumption, which implies that individuals are biased towards a dispersed consumption of differentiated goods, and \( \delta \) represents the degree of substitutability between them. High values of \( \delta \) denote that varieties are closer substitute. \( N = n + n^* \) is the total number of differentiated goods, for which \( n \)-goods are produced domestically and \( n^* \)-goods are produce abroad.

With a quasi-linear quadratic utility function, the optimal demand function of a variety \( i \), \( c_i \), is independent of the level of income:

\[ c_i = a + c_i \int_{j=0}^{N} p_j d_j - (b + cN) p_i \] (3)

\(^4\)This section describes only the economic structure of the home economy; the foreign economy presents similar equations. In general, foreign variables are denoted by \( (*) \).
where \( a = \alpha / \left[ \beta + (N - 1) \delta \right] \), \( b = \gamma \left[ \beta + (N - 1) \delta \right] \) and \( c = \delta / \left[ \beta - \delta \right] \left[ \beta + (N - 1) \delta \right] \). Parameter \( c \) captures each cross-price effect.\(^5\) High values of \( c \) account for a low degree of product differentiation among varieties. As equation (3) shows, the demand of variety \( i \), falls when its own price rises, not only in absolute terms (the own-price effect is given by \( b \)) but also in relatively terms.\(^6\) The optimal consumption choice for the numeraire good is \( c_A = E - \int_{j \neq i} c_i p_i d_i \). A typical individual spends all its income, which is denoted by \( E \).

The indirect utility function takes the form:

\[
V(p, E) = \frac{a^2 N}{2b} - a \int_{j = 0}^{N} p_j d_j - c \left[ \int_{j = 0}^{N} p_j d_j \right]^2 + \frac{(b + cN)}{2} \int_{j = 0}^{N} p_j d_j + E \tag{4}
\]

In equation (4) \( p \) denotes the domestic price vector of the \( N \) varieties. The consumer surplus that a typical individual derived from the consumption of differentiated goods is given by:

\[
S(p) = \frac{a^2 N}{2b} - a \int_{j = 0}^{N} p_j d_j - c \left[ \int_{j = 0}^{N} p_j d_j \right]^2 + \frac{(b + cN)}{2} \int_{j = 0}^{N} p_j^2 d_j \tag{5}
\]

The manufacturing market is assumed to be segmented; a typical firm maximizes operating profits neglecting its impact on the market but being aware that the market as a whole has a nonnegligible impact on its behavior. Hence, in the small economy, each firm maximizes its profit assuming that its price choice does not impact on the price indices that prevail at home and in the foreign economy.\(^7\) The profit maximization problem for local and foreign firms, gives the equilibrium prices of differentiated goods. The equilibrium prices prevailing at the home market are given by:

\[
p_i = \frac{2 \left[ a + a_m (b + cN) \right] + cN \tau}{2 (2b + cN)} \quad \text{and} \quad \bar{p}_i = p_i + \frac{\tau}{2} \tag{6}
\]

\(^5\) The sum of all cross-price effects equals \( cN \).

\(^6\) Equation (3) can be written as \( c_i = a - cN \left( p_i - \frac{P}{N} \right) - b p_i \); where \( P = \int_{j = 0}^{N} p_j d_j \) and \( \frac{P}{N} \) is the average price that prevails at home. Hence, \( (b + cN) \) captures the impact of the own price not only in absolute but also in relative terms.

\(^7\) Prices must satisfy price indices definitions, \( P \) and \( P^* \), which prevail at the home and foreign economies respectively.
\( p_i \) denotes the domestic price of a differentiated good that is produced at home, while \( \bar{p}_i \) represents the domestic price of a variety which is produced abroad. Prices of differentiated goods are positively affected by the degree of desirability of varieties with respect to the homogeneous good (parameter \( a \)) and by the degree of product differentiation (parameter \( c \)). Domestic prices are also affected by \( \tau \); domestic firms may charge higher prices when trade costs are high. The distribution of firms across regions affects the level of prices; a fierce competition at home, denoted by a small \( n^* = N - n \), prevents local firms to charge high domestic prices. Finally, as can be noticed from (6), foreign firms absorb part of trade costs.

As local firms may set their production at home and in foreign markets, operating profits comprise benefits that are obtained by selling the product at the local market and those of that are earned by selling the differentiated good abroad. The rental rent earned by capital owners is obtained by evaluating operating benefits at equilibrium prices:

\[
\pi = (p_i - a_m)c_i(M) + (\bar{p}_i - \tau - a_m)c_i^*(M^*)/F \\
= (b + cN)\left[ (p_i - a_m)^2 M + (\bar{p}_i - \tau - a_m)^2 M^* \right]/F \quad (7)
\]

where \( p_i \) is the price of a domestic variety that prevails at the foreign market; \( \tau^* \) is the foreign trade barrier that faces a local firm when sells its product abroad and \( c_i^* \) is the demand of a foreign consumer for a domestic differentiated product.

Trade costs consist of a wide range of barriers that restrict trade between countries. In general, transport costs, all sorts of trade policy as well as cultural and communicational impediments comprise the set of these barriers. The model allows for different level of trade cost between regions, \( \tau^* \) and \( \tau \). In this framework, the foreign trade cost, \( \tau^* \), is an exogenous variable. At home, for simplicity, trade costs only take the form of a specific tariff. Particularly, local government charges a tariff to those imports of differentiated goods that come from the rest of the world. The revenue derived from this policy, in per-capita terms, amounts to:

\[
r(p) = \tau \int \bar{c}_i d_i \quad (8)
\]
where $\bar{c}_i$ denotes the individual demand of a foreign variety. As in Grossman and Helpman (1994), it is assumed that the local government redistributes uniformly among individuals the revenue that collects from the tariff imposition.

As it was mentioned above, individuals, as owners’ factor, may be heterogeneous. Like in Grossman and Helpman (1994), it is assumed that all individuals are endowed with labor; however only some individuals are owners of capital. Individuals perceive different level of incomes, $E$, according to different sources. Besides, each individual receives an equal fraction of tariff revenue from government redistribution.

In the small economy, aggregate gross welfare equals the sum of aggregate income, tariff revenue and total consumer surplus:

$$W(p) = l + K\pi_i + M[r(p) + S(p)]$$ (9)

Since wage rate equals one, $l$ is the total labor income of the population, whereas $\prod = K\pi_i$ is the total capital rent, and $K$ is the total capital stock of the domestic economy.

**The political game**

Grossman and Helpman (1994) have developed a model which aims to explain the equilibrium structure of trade protection that emerges from a political process. The formal framework is based on an economic setting in which capital-specific sectors produce goods under constant returns to scale technology and compete perfectly. The political process is described through a game in which different players interact, namely the incumbent government and different interest groups. Lobby groups, representing the interest of capital-specific owners, intend to persuade the government to implement a trade policy that favors them. Each lobby offers political contributions to the government, which are related to different trade policies. The incumbent officeholder sets the policy considering these offers as well as the well-being of the society. That is, the interaction between lobbies and the government takes the form of a *menu auction* in the sense of Bernheim and Whinston (1986).

This paper follows the Grossman and Helpman’s approach and considers that the local incumbent government and a single lobby play the political game briefly described above. The model is based on a different economic structure. In this background, capital owners share a common interest in obtaining protection, since one source of their income, the rental rate, is positively affected by the tariff, $\tau$ (see equation 7). Capital-factor owners, which are
involved with the manufacturing sector, join to do political activity. It is assumed that they can
overcome the free rider problem and organize themselves into an interest group. The interest
group makes political contributions contingent on the tariff imposed by the government. The
lobby chooses the optimal level of the contribution maximizing its total net
welfare, \( V_{IG} = W_{IG}(\rho) - C_{IG}(\rho) \), where \( C_{IG}(\rho) \) is the contribution schedule offered by the
interest group. The interest group’s gross welfare is equal to:

\[
W_{IG}(\rho) = l_{IG} + K\pi_i + \alpha_{IG}M\left[r(\rho) + S(\rho)\right]
\]

(10)

\( l_{IG} \) denotes the total labor supply of capital owners, \( \alpha_{IG} \) is the share of the voting population
that owns capital and belongs to the interest group; hence \( \alpha_{IG}M\left[r(\rho) + S(\rho)\right] \) account for
the tariff revenue that capital owners receive from the government and the total consumer surplus they derive.

As in Grossman and Helpman (1994), the government is interested in both the level of
contributions and in the well being of the society. The incumbent officeholder cares about the
total amount of contributions because they are a potential source of economic funds to
finance campaign spending or they may provide other sort benefits. Also the well being of the
society is of government’s concern due to the fact that individuals, as voters, are more likely
to re-elect a government that has taken actions to improve their standard of living. Grossman
and Helpman proposed a linear objective function that reveals these preferences:

\[
G = C_{IG}(\rho) + \theta W(\rho)
\]

(11)

where \( \theta \) denotes the weight that government attaches to the society’s well being, \( W(\rho) \),
relative to the amount of lobby’s contributions.

The political model consists of a two-stage non-cooperative game in which the lobby chooses
its political contribution in the first stage and the government sets the trade policy in the
second. The equilibrium comprises the optimal level of contribution and the optimal tariff.

Following Grossman and Helpman (1994), it is assumed that the contribution function is
differentiable and the equilibrium price maximizes both the welfare of the particular lobby and
the government’s objective function. Then, the interest group may choose a contribution that is
locally truthful. Such a contribution schedule has the interesting property that a marginal
change in the contribution mirrors the marginal change in the lobby’s welfare when both
changes are caused by a marginal change in the tariff, that is:
In equilibrium, truthful contributions induce the government to behave as if it were maximizing $\theta W + W_{ig}$. In this case, the objective function of the government is characterized by a social-welfare function that weights differently the members of society. Lobby’s members receive a weight of $(1 + \theta)$ and individuals that are not organized receive a smaller weight of $\theta$ (Grossman and Helpman, 1994). The first order condition of this problem is:

$$\nabla W_{ig}(\rho) + \theta \nabla W(\rho) = 0 \quad (13)$$

Equation (13) characterizes the equilibrium domestic tariff, and consequently the equilibrium of domestic prices of all varieties, supported by the differentiable contribution function. The effect of a marginal tariff change on interest group’s welfare is given by the sum of the marginal changes in profits, the lobby’s tax revenue, and lobby’s aggregate consumer surplus; that is:

$$\frac{\partial W_{ig}(\rho)}{\partial \tau} = \frac{\partial \Pi}{\partial \tau} + \alpha_{ig} M \left[ \frac{\partial r(\rho)}{\partial \tau} + \frac{\partial S(\rho)}{\tau} \right] \quad (14)$$

The marginal tariff change positively impacts on profits, while negatively on lobby’s aggregate consumer surplus. Tariff change impacts on lobby’s tariff revenue, through two well known effects: the positive direct effect and the indirect negative effect.

Similarly, the effect of a tariff marginal change on society’s well being is given by:

$$\frac{\partial W(\rho)}{\partial \tau} = \frac{\partial \Pi}{\partial \tau} + M \left[ \frac{\partial r(\rho)}{\partial \tau} + \frac{\partial S(\rho)}{\tau} \right] \quad (15)$$

III. The resultant tariff

The endogenous tariff emerges after substituting equations (14) and (15) into equation (13):

$$\tau^* = \left[ \frac{1 + \theta}{\theta + \alpha_{ig}} \right] \frac{2nc_i \partial p_i / \partial \tau}{n \left( b \partial p_i / \partial \tau + cn/2 \right)} + \frac{n^i \tilde{c}_i/2 - c \partial p_i / \partial \tau}{n \left( b \partial p_i / \partial \tau + cn/2 \right)} \quad (16)$$
where \( c_i = (p_i - a_m)(b + cN), (p_i - a_m) \) is the difference between the price of a domestic variety set by firm \( i \), and the marginal cost of producing it, i.e. the mark-up, and \( C = nc + n^* \bar{c} \) denotes a quantity index of varieties.

Equation (16) reveals that the equilibrium tariff that results from a political process in a small economy is positive, since \( \left[ \frac{n^* \bar{c}}{2 - C} \partial \partial \tau \right] \geq 0 \). Moreover, this tariff is higher than the one that emerges as a result of only maximizing general welfare, i.e. \( \tau^w \). Gross (1987), Flam and Helpman (1987), Helpman and Krugman (1989) have emphasized the result of a positive optimal tariff in a small economy for sectors that competes monopolistically in case that an incumbent maximizes society’s welfare. In this framework, a partial opportunistic government, which is interested in both contributions and social welfare, will generally choose an inefficient policy that generates a deadweight loss, in terms of welfare, when \( \left[ \frac{1 + \theta}{\theta + \alpha_{ig}} > 1 \right. \). This result is also consistent with those found by Chang (2005) and Gáname (2005).

In this imperfect competitive model, political variables, \( \theta \) and \( \alpha_{ig} \), impact on the endogenous specific tariff in a similar fashion as they affect the ad-valorem tariff that emerges under perfect competition. Firstly, when the government has a remarkable concern on the well-being of the society (\( \theta \) is high), the endogenous tariff will be low. Secondly, as \( \alpha_{ig} \) increases, the level of tariff diminishes. When \( \alpha_{ig} = 1 \), i.e. all population belongs to the interest group, the optimal tariff coincides with the level of tariff that maximizes general welfare. The reason why is that, as \( \alpha_{ig} \) approximates to one, the aggregate consumer loss starts to outweigh the gain on profits; for a level of tariff above \( \tau^w \), both the welfare of the interest group and the aggregate welfare, diminish as \( \alpha_{ig} \rightarrow 1 \), hence \( \tau^o \rightarrow \tau^w \). Grossman and Helpman (1994) have stated how theses political variables interact in determining the endogenous trade policy. They give someone different explanation for the negative relationship between \( \alpha_{ig} \) and \( \tau^o \), which is based on the existing competition among different interest groups for obtaining protection.

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8 A sufficient condition for this is that \( n < n^* \).

9 Annex B presents the optimal tariff when a benevolent government maximizes the general welfare in a small economy in which the industrial sector competes imperfectly.
Equation (16) shows there is negative relationship between the optimal endogenous tariff and parameter \( b \), which measures the absolute own-price effect. The optimal tariff tends to be smaller for varieties that are quite sensitive to changes in own prices. In this case, deviations from \( r^* \) will be costly for the government due to the relevant deadweight loss that an excessive tariff would create. Hence, a government that also cares on general well-being will avoid political and economic costs by choosing a low tariff. As parameter \( b \) is a component of price elasticity definition, this insight is consistent with the modified Ramsey-rule, which also has been emphasized by Grossman and Helpman (1994). The Ramsey-rule also applies in the framework developed by Gáname (2005). Unlike these authors, Chang (2005) does not find a definite relationship.

Interestingly, the cross-price effects also impact on the tariff level. When varieties present a low degree of product differentiation (parameter \( c \) is high), the tariff level, which is politically determined, is high. Recently, Facchini et al. (2009) have found evidence for Latin American countries that goes in this direction. The authors have extended Grossman and Helpman (1994) model by allowing substitutability between domestically produced and import goods. Their empirical study suggests that Chinese imports are on average closer substitutes to those goods that are produced in Latin American countries than those of which are produced in the rest of the world.\(^{10}\) Moreover, the greater substitutability between “made in Latin America” vs. “made in China” explains the higher tariff levels that China faces in those sectors in which Chinese imports are more important.

Other economic variable, which is present in monopolistic competitive frameworks and impacts on the optimal tariff, is the mark-up that is charged by domestic firms, i.e. \( (p_i - a_m) \). \textit{Ceteris paribus}, the higher the difference between the domestic price and marginal cost, the higher the optimal tariff. Gáname (2005) have found a negative relationship between the mark-up and a proxy of the level of protection in an alternative model of monopolistic competition. Such a difference on this theoretical result may be explained by the fact that the modeling strategies adopted are different. Gáname (2005) considers the Footloose Capital model, which relies on Dixit-Stiglitz monopolistic competition and iceberg trade costs. In this framework, the mark-up is a multiplicative term of the marginal cost, which only depends on the constant elasticity of substitution, \( \sigma \). Parameter \( \sigma \) is an inverse measure of returns to scale also. As it is well known, one of the problems of Dixit-Stiglitz and iceberg costs modeling strategy is the lack of identification, which makes difficult the comparative static analysis, since is not possible to disentangle the effects of different exogenous variables on

\(^{10}\) Facchini et al. (2009) also found mixed evidence for imports of India.
the endogenous ones.\footnote{See Baldwin \textit{et al}. (2003) for a discussion of the Dixit-Stiglitz modeling strategy.} Moreover, in Gáname (2005) is not able to find a reduced expression for the endogenous optimal tariff. On the contrary, in the present model, the mark-up variable enters additively. The linear model has the advantage of being able to decompose the economic meaning of various parameters, thus leading to clear cut comparative static results.

Finally, another economic variable of interest that affects the structure of protection is the level of domestic product. As equation (16) shows, the higher the level of domestic product, the higher the optimal tariff is. In relative terms, the relationship is also positive, i.e. the inverse of import penetration is positively related with the level of protection. This theoretical result is consistent with those found in Grossman and Helpman (1994) and Chang (2005). As remarked by Grossman and Helpman (1994), the political power of a sector is revealed by the ratio of domestic product to imports; when domestic product is relevant, the monopolistic sector have much to earn from a tariff that increases domestic prices of varieties.

IV. Concluding remarks

The author analyses the determination of a specific tariff in a setting of monopolistic competition which considers the political-support approach of Grossman and Helpman (1994). In this setting, an incumbent government sets trade policy by considering political contributions, which are offered by an interest group, and the society's well-being. The economic structure is based on the setting developed by Baldwin \textit{et al}. (2003), which has the advantage of being fully tractable and more parameterized than those models which rely on Dixit-Stiglitz monopolistic competition and iceberg trade costs.

In the present paper, political variables affect the level of tariff in a similar fashion as they do in a market structure of perfect competition. All else given, a relevant government’s concern about the welfare of the general electorate will predict a positive tariff that approximates to the one that arises when political considerations are not present. Also, as the share of voters who are members of the interest group increases, the level of protection diminishes. These findings were noted by Grossman and Helpman (1994).

Several key insights arise from taking into account a monopolistic competitive market structure. Firstly, in a small economy, the equilibrium tariff that results from a political process is positive and generally higher than that of a benevolent government would choose. Hence, the political process induces to an inefficient over-taxation of import varieties that generates a
deadweight loss for a society as a whole. Secondly, the possibility of firms to charge a price that is higher than the marginal cost, affects the level of protection. The higher the mark-up, the higher the optimal tariff is.

The consideration of an alternative monopolistic model that does not rely on Dixit-Stiglitz monopolistic competition and iceberg trade costs provides a definite relation between the level of protection and own-price effects. The optimal tariff tends to be smaller for varieties that are quite sensitive to changes in prices. This prediction is consistent with the modified Ramsey-rule. Moreover, cross-price effects also affect the tariff endogenously determined. Interestingly, when differentiated goods are closer substitutes, the level of protection set by the incumbent government is high.

Finally, it seems that the qualitative results that are obtained in these papers do not depend on the nature of the instrument that the incumbent selects to protect. Grossman and Helpman (1994), Chang (2005) and Gáname (2005) model trade policy as an ad-valorem measure, while the present paper introduces and specific tariff. However, further study has to be made in this direction.

V. References


ANNEX A

Expressions for the foreign economy

Maximization problem for a foreign firm:

$$\Pi^* = (p_i^* - a_m) c_i^* (M^*) + (\bar{p}_i^* - \tau - a_m) c_i (M) \quad (A1)$$

Equilibrium prices at the foreign market are:

$$p_i^* = \frac{2[a + a_m (b + cN)] + cn\tau^*}{2(2b + cN)} \quad \text{and} \quad \bar{p}_i = p_i^* + \frac{\tau^*}{2} \quad (A2)$$

Foreign rental rate:

$$\pi^* = (b + cN) \left[ \left( p_i^* (\tau^*) - a_m \right)^2 M^* + \left( \bar{p}_i^* (\tau) - \tau - a_m \right)^2 M \right] / F \quad (A3)$$

ANNEX B

General welfare equals:

$$W(p) = l + K\pi + M \left[ r(p) + S(p) \right] \quad (B1)$$

When a benevolent government maximizes general welfare, the optimal tariff equals to:

$$\tau^w = \frac{[2nc - C] \hat{\partial}p_i / \hat{\partial}\tau + n^2 \hat{c}_i / 2}{n^2 \left( b\hat{p}_i / \hat{\partial}\tau + cn^2/2 \right)} \quad (B2)$$