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A Model of Influence on Trade Policy in a Computable General Equilibrium Model

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Preliminary version.

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Abstract:

This paper aims at making explicit the micro foundations of the government's preference function in an influence-driven political economy model. It also addresses the behavior functions of domestic and foreign firms in their attempts to gain policy favors. These favors are granted by means of subsidies. In our model, the government simultaneously chooses three interdependent policy instruments under the political influence of domestic and foreign firms. Thus, we create a political market characterized by utility-maximizing and profit-maximizing behaviors of its actors, which takes place in a computable general equilibrium model. Endowed with these features, this model fills a gap in the literature. However, our results demonstrate that the model is only valid under a reasonable set of constraints on its parameters. Finally, this paper formally shows the key role of the subsidy elasticity of political cost in limiting the distortions created by the influence of interest groups.

JEL classification: C68, D72, D78, F13, H32, P16.

Keywords: Lobbying, Public Policies, Computable General Equilibrium Model.

Résumé :

Ce papier se donne pour objectif de rendre explicite les micro-fondations de la fonction de préférence du gouvernement dans un modèle d'économie politique orienté sur la notion d'influence. Il traite aussi des fonctions de comportement des entreprises domestiques et étrangères dans leurs tentatives d'obtention de faveurs politiques. Ces faveurs sont accordées par l'intermédiaire de subventions. Dans notre modèle, le gouvernement choisit simultanément trois instruments politiques interdépendants sous l'influence politique des entreprises domestiques et étrangères. Ainsi, nous créons un marché politique caractérisé par les comportements de maximisation de l'utilité et de maximisation des profits de ses acteurs, qui prend place au sein d'un modèle d'équilibre général. Doté de ces caractéristiques, ce modèle comble un vide dans la littérature. Toutefois, nos résultats démontrent que le modèle est uniquement valide sous un ensemble raisonnable de contraintes portant sur ses paramètres. Enfin, ce papier démontre formellement le rôle clé de l'élasticité du coût politique à la subvention, dans la limitation des distorsions créées par l'influence des groupes d'intérêt.

Classification JEL: C68, D72, D78, F13, H32, P16.

Mots clés : Lobbying, Politiques Publiques, Modèle d'Equilibre General Calculable.

1- Introduction

Since the seminal work of Bentley (1908), numerous contributions have emphasized the role of interest groups in the political process and/or the calculus of consent made by politicians attempting to be elected. Amongst them, Downs' contribution (1957) is a striking example of the way to include economic reasoning in the political sphere. Downs was a pioneer in using a rational choice approach in the political-economic field. In this early analysis, the interest group only consists of the voters. His model assumes selfish and maximizing behavior from the politicians who are aiming to be elected, and maximizing behavior from the voters who vote for the political program that will bring them higher utility. This, however, ignores the fact that politicians can have strong beliefs and ideologies whilst being benevolent towards the population. More recent studies, of which the most famous is Grossman and Helpman's (1994) research, include these features. Empirical analysis has emerged to empirically validate this concept. The literature survey (Section 2) will give more details on this point and will discuss the alternative models available (election-oriented and influence-oriented) to represent the influence of interest groups on the policy making process.

When considering international trade, some facts are hard to explain with traditional economic models. Indeed, there is a widespread consensus amongst economists about the free trade superiority over protectionism on world economic efficiency. However, very few countries in the world apply full liberalization of their foreign trade in practice. A likely explanation could be that trade opening comes with income redistribution within stakeholders. Interest groups can then claim for a particular modality of opening that either improves their economic advantage or that reduces their costs if the trade opening gives rise to harmful consequences. The result is that the equilibrium in trade opening is not Pareto-optimal and, hence, differs from free trade. Existing models of political economy manage to include some elements of this nature to explain economic decisions but they suffer from different shortages (Section 2). The economic environment is often complex and fast changing, so partial equilibrium models can lead to mistaken predictions. In order to take these factors concerning complexity into account and to consider the behavior of economic agents within a changing environment, Computable General Equilibrium Models (CGEM) are useful. They allow several public policies, commitments to agreements, and the behavior of economic agents to be combined; the cross effects can also be taken into consideration. For instance, in the case of a negotiated trade opening, a government could intend to pursue policies of import substitution. This implies at least two initial shifts in the economic environment. Firstly, it implies a decrease in tariffs, which are often constrained in their targets and in the intensity of the framework of the talks. Secondly, there often exists a policy of sectorial support needed to meet the requirements of the economic policy pursued. In a standard economic model, these two features are determined exogenously. For the decrease in tariffs, the terms of the agreement might be so precise that it is easy for the modeler to input the data into the model. For the policy of import substitution, the modeler will likely run a set of simulations to predict the different effects of different measures. In contrast, in a political economy model, the modeler tries to determine these features endogenously. In this view, it is assumed that economic agents have economic interests at stake about the structure of the trade opening and the economic policy. For the decrease in tariffs, if the terms of the agreement are too precise, the modeler has no choice but to set it exogenously. As far as domestic economic policy is concerned, it is more delicate for the partner of the agreement or for the WTO to impose a particular policy response to accompany the trade opening. An endogenous formalization for that policy seems more

practicable. Therefore, shifts in the economy will impact upon the reactions of economic agents and upon the government that will shape the policy response.

By acknowledging that the situation above matches reality, we can address a gap in the literature by developing a political economy model in general equilibrium, which is influence-oriented and based on interdependent subsidies allocated by the government (Section 3). Indeed, the purpose of this paper is to introduce political consideration in a CGEM that could both guide and explain trade policies. The underlying research question is: what key parameters have to be considered to limit the distortions created by the political economy forces? We find that a key role is played by the subsidy elasticity of political cost in limiting the distortions created by the influence of interest groups. This result, in line with common sense, is formally demonstrated at the end of Section 3.

As far as the methodological approach is concerned, we mainly keep standard equations for the macroeconomic part of the CGEM. The notable exception is the labor market equilibrium condition that includes labor for lobbying that would be otherwise dedicated to production. For the microeconomic part of the model, the behavior of government and two kinds of interest groups (domestic producers and foreign producers) are formalized using maximization programs. In this model, the government taxes domestic consumption and uses the tax revenue to provide production, export and import subsidies to firms. Hence, the government balances the interests of the firms, who share part of the rents generated by the subsidies with policymakers, and the consumers who pay for those subsidies through higher prices. Interest groups can become applicants for indirect protection, commercial advantage, or accessibility to domestic markets.

While the granting of an economic advantage by means of tariffs is internationally visible by the WTO or by trade partners, subsidies are more discrete and are deemed to be a more efficient tool to resolve national economic issues. This policy tool is more direct for national purposes and more indirect in terms of foreign trade when compared to using tariffs. Even though decreases in subsidies are also negotiated in WTO rounds, the WTO recognizes that it can be sensitive, in terms of fairer trade, to ask its members to stop subsidies because the latter are required to address a number of concerns. The limitation of the constraints in that field is a question of the viability of the system of world trade governance; international organizations are sometimes accused of interference in, and disrespect of, national sovereignties¹. Indeed, subsidies can be used to pursue social objectives, to promote national security including food security, to build infrastructures, to foster research, to alleviate regional imbalances, to tackle rural depopulation, and to maintain cultural diversity. This does not constitute an exhaustive list of undeniable needs to address market failures. Meanwhile, these possibilities give space for lobbyists to vie for the advantages conferred on the sectors picked to implement chosen public policies.

All of these implementations do not necessarily involve subsidies. This is why our formalization below considers the other forms of government interventions through the notion of subsidy-equivalent. This notion takes its inspiration from the "producer subsidy equivalent" (Josling, 1973) notoriously used by OECD (Organization for Economic Co-operation and Development), which has

¹ Stiglitz (2003) explains that the IMF misled different countries during their period of crisis because the International Organization absolutely wanted them to adopt the rules of the Washington Consensus.

created its own indicator of this kind for the agricultural sector. The OECD defines this as an indicator used to quantify the domestic support for agricultural producers; it arises from policy measures, regardless of their nature, objectives or impacts. Our notion of subsidy-equivalent is the same for all the sectors and for all types of subsidies. The section that develops the model (Section 3) ends with an examination of the conditions in which to use the model.

In the discussion (Section 4), we draw parallels with the models built in the literature, discussing the value of the parameters and their underlying principles. We also give several insights for alternative features within the model.

Finally, we conclude (Section 5) by drawing some shortcomings and by proposing some possible applied uses of the model that we have presented.

2- Literature

Political economy stress that economic policies are formulated in response to the demands of interest groups. The supply side, namely (i) policy makers and (ii) the institutional settings in which policies take place (Rodrik, 1995), propose policy outcomes in order to obtain favors from the interest groups organized in lobbies. The objects of the economic analyses are several periods within the political cycle. Two approaches and corresponding modeling dominate the literature. The first approach assumes that the time of the election has passed and the lobbies are trying to exercise their influence on the incumbents in charge of policy making or policy voting (Findlay and Welitz, 1982; Grossman and Helpman, 1994; Stoyanov, 2009). This is known as the influence-driven approach. The second approach assumes that the time of the election is coming and the lobbies are making contributions to increase the likelihood of the election of the candidate that better represents their interests (Hillman and Ursprung, 1988; Brock, Magee and Young, 1989; Das, 1990). We call this the election-driven approach. Both approaches create competitive situations among the pressure groups. In this brief survey of literature, we will assert why we adopt the first approach in our paper. It could be argued that the political regime is a crucial parameter to be taken into consideration in the analyses. In this paper, we will focus solely on the case of representative democracies².

Findlay and Welitz (1982) initiate the approach where a tariff level is endogenously determined by a function that reflects the competition between two lobbies for influence on trade policy. In this general equilibrium model, one lobby advocates free trade whereas the other argues for protection. Each lobby engages its resources in the lobbying process in terms of the labor factor in order to obtain favorable tariffs. The other production factors are sector specific. A Cournot-Nash equilibrium determines the equilibrium tariffs. In this model, the political decision process is a black box, since we just know that the policy maker changes the tariffs when he or she receives inputs. Our model will address this shortcoming by focusing on the government incentive to shift tariffs as we will propose a microfoundation for this.

In their famous model known as the GH model, Grossman and Helpman (1994) already address this shortcoming by adding a preference function for the government. This has two weighted components, namely (i) the contributions received from the lobbies and (ii) the aggregate welfare of the population. An interesting point is that the aggregate welfare equally contains the welfare of the

² For an analysis of a regime under direct democracy, see the leading approach of Mayer (1984).

individual members of lobbies as consumers so that protection can simultaneously increase the interests of the lobbies as a whole and decrease the utility of some of its individual members. The theoretical framework remains sector specific; the mobile labor factor constitutes the complementary input for specific factors in each sector within the production function. The model is developed with the lobbies struggling to maximize the aggregated utility of their members. The government then chooses the vector of policies that maximizes its preference function. Our paper equally proposes a preference function for the government but its components are very different. In the GH model, there is one instrument, namely, the contributions used by a homogeneous kind of lobbies to influence the government in choosing the level of a single public policy, the level of tariffs. In our model, the domestic firms shift some labor resources from the production process to influence the government, foreign firms lobbying is introduced, three interdependent policy instruments are available for the government, and all the sectors are organized to lobby. In addition, the consumer-voter component of the preference function for the government introduces a new interesting concept. It takes into account the shortsighted view of the consumer-voter on the cause of the shift of their wellbeing and the government takes this feature into consideration rather than directly using the welfare level of the consumer-voter given by a perfect information hypothesis.

In these previous models, one factor is mobile and the others are sector specific. In this case, the tariffs on the goods in a sector increase the relative revenue drawn from the sector specific factors due to the increase in scarcity relative to the mobile factor. On the contrary, the mobile factor moves toward the protected sector; the revenues from the other sector specific factors fall, due to a rise in the relative abundance of these specific factors. This forms a stimulating point for competition between lobbies; inertia, instead of being neutral, is in fact harmful.

In an earlier work, Becker (1983) had already accounted for the losses incurred by the community as a whole as a result of political decision making, specifically subsidies. This political decision is made in favor of a particular interest group. Indeed, Becker considers two kinds of lobbies. One pays taxes to finance the subsidies perceived by the other. This feature seems very useful in the context of general equilibrium modeling. It leads us to adopt it in our model. In addition, Becker shows that it is easier for small interest groups to obtain political favor because, the larger the interest group, the more free-riding (Olson, 1965) problems occur. Furthermore, subsidies for small groups have a very slight impact on the taxation of the larger community.

The GH model was extended notably by Stoyanov (2009) to include lobbying by foreign interest groups. In his article, which is both theoretical and empirical (including data for Canada), Stoyanov additionally stresses whether or not foreign lobbyists should be distinguished by the criteria of the Free Trade Agreement partners. The former foreign lobbyists fight for more protection in their sector in the domestic country since they benefit from the trade agreement. The latter foreign lobbyists from the rest of the world lobby for a decrease in protection, thus complying, in this particular case, with the mainstream of the literature including foreign lobbying. This view was previously argued by Gawande, Krishna and Robbins (2006) for the United States. They have equally used an extended Grossman and Helpman model to test this view econometrically.

Hillman and Ursprung's (1988) research constitutes a seminal work in including foreign lobbies in the models of trade policy determination. In this model, the domestic industries are import-competing. Two candidates, one of whom is rather protectionist and the other is rather liberal, compete for

political power. The lobbies try to favor the candidate who better represents their interests by means of contributions aimed at winning over voters. The underlying assumption is a positive link between the money that a candidate can spend on his or her political campaign and the number of votes he or she will gain. This forms the second major type of political economy model in the literature.

In a related work, Magee, Brock and Young (1989) implement a general equilibrium model in the Heckscher-Ohlin-Samuelson framework with two sectors, two factors, two parties, and two lobbies. They develop a model with numerous relationships in the economy, including the maximization behavior of voters, lobbies, and political parties. The two lobbies represent labor and capital; they are respectively for and against protection. The higher their political contributions, the more likely the election of their favored political party, but the cost of lobbying becomes higher. The equilibrium tariffs are the outcomes of the Nash game between the two competing lobbies. In our paper, the development of our general equilibrium model is deeply different from the structure of Magee, Brock and Young. Actually, we chose another conception of the influence which is presented at the beginning of this section. We are going to justify this choice thereafter.

A separate, more empirical, strand of the literature assesses the validity of political-economy models or the existence of an influence of lobbyists on political outcomes. Gawande and Bandyopadhyay (2000) tested the GH model econometrically using cross sectional non-trade barrier data for the US in 1983. They established that the GH model is reliable for both its predictions on the protection and the lobbying side. For the same period in the US, Goldberg and Maggi (1999) showed that the GH model is overall consistent with their data. Besides this, they underlined the very strong weight attached by the government to social welfare in comparison with the weight attached to the contributions from the lobbies. Econometrically, they found the former to be about 49 times higher than the latter. Eicher and Osang (2002), using a very close database, proved that the GH model and the Findlay and Wellisz model (1982) both perform well in an empirical sense. They also found that the GH model holds more explanatory power than the model of Findlay and Wellisz.

More broadly, Baldwin and Magee (2000) studied the votes for three important trade policies in the US Congress in 1993 and 1994. They estimated an econometric model wherein the votes are explained by the characteristics of consistency, the labor contributions, and the business contributions. The two latter groups form the lobbies in competition. Thus, they showed that contributions matter in the outcomes of the votes in the US Congress. In addition, Grossman and Helpman (1994) highlight the fact that three quarters of the PACs (Political Action Committees) contributions were given to incumbents in Congress in 1988 and 62% were given in the first 18 months of the election cycle. They drew the figures on PACs contribution from Magleby and Nelson (1990). Hence, on the one hand, the empirical literature shows that contributions are effective and, on the other hand, it shows that these contributions are made to influence the incumbent of political power rather than to influence the outcome of an election. The model proposed in this paper will take these observations into account and will adopt the political-economy influence functional form.

3- Model

This paper considers a two-country world with a domestic and a foreign economy. Most standard equations of the model are inspired by Decaluwé, Martens and Savard (2001); the model is then rearranged to include political-economy features (see the appendix for the full model). The m sectors of the domestic economy ($i = 1$ to m) produce m single goods (XS_i) with labor ($LD_{prod,i}$) and a sector-

specific capital factor (K_i) under a production system with Cobb-Douglas and Leontief functions such as:

$$XS_i = VA_i/v_i \quad (1)$$

where VA_i is the Value Added in the sector i and v_i is the Leontief's technical coefficient.

$$VA_i = A_i \cdot LD_{prod_i}^{\alpha_i} \cdot K_i^{(1-\alpha_i)} \quad (2)$$

where A_i is the scale parameter for sector i and α_i is the parameter of the contribution of the labor factor in the Value Added. Capital and labor are assumed to be immobile across national borders but labor is mobile across domestic sectors.

In this model, we include a political market based on the behavior of maximization by its actors.

We consider lobbies organized by sectors that try to obtain government favors in the form of subsidies. We assumed two elements of strategy from two kinds of different players. Firstly, if a government is closely monitored by other members of the World Trade Organization, it will find a discrete way to ensure that influential sectors obtain the equivalent of the amount provided with a subsidy. For instance, it will provide this as public goods, facilities or infrastructures that mainly serve the desired sector. Secondly, we assume that firms think in terms of relative competitive advantage and estimate to be more efficient in influencing policymakers on their behalf rather than trying to influence policymakers to lower the advantage granted to their competitors. The rationale for this assumption is an information asymmetry that affects the efficiency of the lobbying. The interest group has better information on the relation that it maintains with policymakers rather than the relationship between its competitors and the policymaker. In addition, the advantage obtained on its behalf is, de facto, multilateral and not competitor-specific.

Let F be the degree of (real or purported) political favor granted to the lobby of the sector i and let y be the set that characterizes the nature of the subsidy that one is analyzing; production, import and export subsidies, respectively, $y = \{pi, mi, xi\}$:

$$F_y = S_y^{\varepsilon_{Fy}} \quad (3)$$

where S_y is the rate of subsidy granted to the sector i . Thus ε_{Fy} is the y -type subsidy elasticity of political favor granted to sector i . If $F_y(S_y)$ is a convex and growing function then $\varepsilon_{Fy} > 1$.

For each unit of political effort granted, lobby in sector i provides the government with X_{1i} units of labor (LDS_{pi}) as a counterpart to obtain its production subsidies so that these units of labor are diverted from the production process such that:

$$LDS_{pi} = X_{1i} \cdot F_{pi} \quad (4)$$

In other words, LDS_{pi} is the total amount of labor used in the lobbying process for getting the production subsidy. At this preliminary step, by considering only the lobbying for one kind of subsidy, we then have:

$$LD_i = LD_{prod_i} + LDS_{pi} \quad (5)$$

where LD_i is the total labor demand of the sector i and LD_{prod_i} is the labor demand for the production process. We assume full employment where LS is the total labor supply in such a way that:

$$\sum_i LD_i = LS \quad (6)$$

The government sources of satisfaction are then:

$$X_{1i} \cdot F_{pi} = X_{2i} \cdot S_{pi}^{EFpi} \quad (7)$$

Subsidies are funded with an increase in the rate of Value Added Tax on the overall consumption of goods so that this creates a political cost, PC_y , for the government to grant subsidies:

$$PC_y = S_y^{P_y} \quad (8)$$

where P_y is the subsidy elasticity of political cost in sector i . If $PC_y(S_y)$ is a convex and growing function then $P_y > 1$. This cost is weighted by the effect that the subsidy will have on the relative variation of the wellbeing of the consumers. The better the level of wellbeing in the situation before the introduction of the subsidy (wb_1) related to the level of wellbeing after the introduction of subsidy (wb_2), the higher the increase in the political cost. The final political cost to grant a production subsidy (FC_{pi}) equally depends on the government's own objectives measured by X_2 . In other words, X_2 is a measure of how much the government cares about the impact of the production subsidies on the wellbeing of the consumers.

$$FC_{pi} = S_{pi}^{P_{pi}} \cdot \left(\frac{wb_1}{wb_2}\right) \cdot X_{2i} \quad (9)$$

With a simple mathematical development we obtain:

$$\left(\frac{wb_1}{wb_2}\right) = (1 + \Delta wb)^{-1} \quad (10)$$

In our paper, the level reached by the wellbeing function depends on the level of consumption within the population. A more elaborate wellbeing function could also be used.

$$\Delta wb = \frac{\prod_i C_{i2}^{\zeta_i} - \prod_i C_{i1}^{\zeta_i}}{\prod_i C_{i1}^{\zeta_i}} \quad \text{with} \quad \sum_i \zeta_i = 1 \quad (11)$$

where C_{i1} and C_{i2} are respectively the quantities of goods from sector i purchased by consumers before and after the introduction of the subsidy and its VAT (Value Added Tax) counterpart.

Technically, we hold constant the revenue of the government (YG) which is the sum of the different taxes collected in the economy minus the amount of subsidies granted. The adjustment variable is the amount of VAT (TI_i) collected on the value of non-exported production and imports (M_i), that is to say the domestic consumption.

$$TI_i = tx_i \cdot (p_i \cdot XS_i - pe_i \cdot EX_i) + \frac{tx_i}{1 + tx_i} \cdot pm_i \cdot M_i \quad (12)$$

where tx_i is the rate of the VAT on products, p_i is the price to producer and pm_i is the all-tax included price of the imported good. The implementation inspired by Viroleau (2015) consists of using an endogenous variable τ , the homogeneous rate of increase in the VAT to modify the exogenous initial rate of the VAT (txx_i) up to the required level.

$$tx_i = txx_i \cdot \tau \quad (13)$$

This formalization captures the general equilibrium effects of the subsidies on the economy since if subsidies have positive or negative spillovers on other components of the revenue of the government, these spillovers are taken into account in the calculus of the amount of VAT required to meet the status-quo level of the revenue for the government.

We then assume that voter-consumers know the amount of each subsidies granted by the government by means of the transparency in the democratic process. In addition, we assume that voter consumers attribute the shift in their wellbeing to the subsidies granted to interest groups in a non-proportional fashion. This view matches with the feeling of the population against a particular kind of subsidy and it determines the value of P_y . So there is a dichotomy between (i) the real and intricate macroeconomic effects on consumer wellbeing due to a specific subsidy granted to interest groups and (ii) the voter-consumer feeling of these effects. The latter is important for the policy maker because the voters base their assessment of the government action on it. This mechanism describing the consumers view is an important point of the reasoning of the model because it introduces interdependence between coveted subsidies. In fact, the more a competitor asks for subsidies in any type, the harder it becomes to obtain new subsidies because the consumer prices rise and impact the consumer-voter wellbeing.

The level of production subsidies (S_{pi}) granted by the government comes from its maximization program. With (7) and (9), government welfare function (WG) is defined as:

$$WG = \sum_i [X_{1i} \cdot S_{pi}^{\varepsilon_{Fpi}} - X_{2i} \cdot S_{pi}^{P_{pi}} \cdot (\frac{wb_1}{wb_2})] \quad (14)$$

Using logarithms and rearranging the terms, the first order condition of optimization leads to:

$$S_{pi} = [\frac{\varepsilon_{Fpi} \cdot X_{1i}}{P_{pi} \cdot X_{2i} \cdot (\frac{wb_1}{wb_2})}]^{\frac{1}{P_{pi} - \varepsilon_{Fpi}}} \quad (15)$$

The mathematical conditions in which this formulation is consistent with reality are shown below.

Let us now make explicit export subsidies (S_{xi}) for sector i . All parameters are likely to change but the previous reasoning applies and leads to:

$$S_{xi} = [\frac{\varepsilon_{Fxi} \cdot X_{3i}}{P_{xi} \cdot X_{4i} \cdot (\frac{wb_1}{wb_2})}]^{\frac{1}{P_{xi} - \varepsilon_{Fxi}}} \quad (16)$$

Where lobby i has to provide the government with $(\varepsilon_{Fxi} \cdot X_{3i})$ units of labor (LDS_{xi}) and where X_4 is a measure of how much the government cares about the wellbeing of the consumers following the implementation of export subsidies (S_{xi}).

We then introduce foreign lobbies whose efforts are aimed at obtaining import subsidies (S_{mi}). As this study assumes that the latter do not employ domestic labor in their production processes, the price

to pay for gaining political favor is not a labor diversion. It is rather a monetary contribution (CF) to the government. Following the same reasoning:

$$S_{mi} = \left[\frac{\varepsilon_{Fmi} \cdot X_{5i}}{P_{mi} \cdot X_{6i} \cdot \frac{wb_1}{wb_2}} \right] P_{mi}^{-\varepsilon_{Fmi}} \quad (17)$$

Where lobby i has to provide the government with $(\varepsilon_{Fxi} \cdot X_{5i})$ units of monetary contribution (CF) and where X_6 is a measure of how much the government cares about the wellbeing of the consumers following the implementation of import subsidies (S_{mi}).

The second order conditions are subject to the signs of the minor determinants of the Hessian matrix (**HM1**). Since crossed-derivatives are equal to zero, one can simplify the matrix:

$$\mathbf{HM1} = \begin{bmatrix} \frac{\partial^2 WG}{\partial S_{pi}^2} & 0 & 0 \\ 0 & \frac{\partial^2 WG}{\partial S_{mi}^2} & 0 \\ 0 & 0 & \frac{\partial^2 WG}{\partial S_{xi}^2} \end{bmatrix} \quad (18)$$

If one wants the government optimization program to lead to a maximization of its welfare, the minor determinant of order 1 ($= \frac{\partial^2 WG}{\partial S_{pi}^2}$) has to be negative, the minor determinant of order 2 ($= \frac{\partial^2 WG}{\partial S_{pi}^2} \cdot \frac{\partial^2 WG}{\partial S_{mi}^2}$) has to be positive and determinant **HM1** has to be negative.

The first condition, $\frac{\partial^2 WG}{\partial S_{pi}^2} < 0$ leads to:

$$\frac{P_{pi}(P_{pi}-1)}{\varepsilon_{Fpi}(\varepsilon_{Fpi}-1)} > \frac{X_{1i} \cdot S_{pi}^{\varepsilon_{Fpi}}}{X_{2i} \cdot S_{pi}^{P_{pi}} \cdot \left(\frac{wb_1}{wb_2}\right)} \quad (19)$$

With (14), we notice that $(X_{1i} \cdot S_{pi}^{\varepsilon_{Fpi}})$ has to exceed $(X_{2i} \cdot S_{pi}^{P_{pi}} \cdot \left(\frac{wb_1}{wb_2}\right))$ otherwise it would mean that the government get a negative welfare contribution on a particular type of subvention granted. Therefore, in (19) the right hand side term is upper than 1. We draw from that the necessary condition $P_{pi} > \varepsilon_{Fpi}$.

Let Δ_{pi} be the difference $(P_{pi} - \varepsilon_{Fpi})$ that satisfies $\frac{\partial^2 WG}{\partial S_{pi}^2} < 0$, then:

$$\frac{(\varepsilon_{Fpi} + \Delta_{pi}) \cdot (\varepsilon_{Fpi} + \Delta_{pi} - 1)}{\varepsilon_{Fpi}(\varepsilon_{Fpi} - 1)} > \frac{X_{1i}}{X_{2i} \cdot S_{pi}^{\Delta_{pi}} \cdot \left(\frac{wb_1}{wb_2}\right)} \quad (20)$$

The left hand side term increases when Δ_{pi} increases. For the right hand side term, two situations are conceivable depending on the value of S_{pi} .

Firstly, if S_{pi} is upper than 1, then the right hand side term decreases when Δ_{pi} increases. In that configuration, given the positive sign of Δ_{pi} , the hardest conditions to satisfy (20) are when Δ_{pi} tends toward zero. In that case, we obtain:

$$1 > \frac{X_{1i}}{X_{2i} \cdot \left(\frac{wb_1}{wb_2}\right)} \Leftrightarrow X_{2i} \cdot \left(\frac{wb_1}{wb_2}\right) > X_{1i} \quad (21)$$

Therefore, this leads to a contradiction with the assumption made above. So, we demonstrate that a sufficient condition can be deduced for values of Δ_{pi} beginning from 1:

$$\varepsilon_{Fpi} > \frac{X_{1i} + X_{2i} \cdot \left(\frac{wb_1}{wb_2}\right) \cdot S_{pi}}{X_{1i} - X_{2i} \cdot \left(\frac{wb_1}{wb_2}\right) \cdot S_{pi}} \quad (22)$$

Hence, if S_{pi} is upper than 1, a sufficient condition is (22) and that $P_{pi} \geq \varepsilon_{Fpi} + 1$.

Secondly, if S_{pi} is lower than 1, then the right hand side term in (20) increases when Δ_{pi} increases. In that configuration, given the positive sign of Δ_{pi} , the hardest conditions to satisfy (21) are when Δ_{pi} tends toward infinite. In that case, we obtain:

$$\lim_{\Delta_{pi} \rightarrow \infty} \left((\varepsilon_{Fpi} + \Delta_{pi}) \cdot (\varepsilon_{Fpi} + \Delta_{pi} - 1) \cdot S_{pi}^{\Delta_{pi}} \right) = 0 \quad (23)$$

Therefore, this leads to a contradiction because as considering (20), it means that a ratio of positive economic terms should be lower than 0. So, we demonstrate that a sufficient condition can be deduced for value of Δ_{pi} beginning from 1 and not too large. Thus, the higher Δ_{pi} , the harder to satisfy the conditions in (20).

As $\frac{\partial^2 WG}{\partial S_{pi}^2}$ and $\frac{\partial^2 WG}{\partial S_{mi}^2}$ are analogous in their formulation, similar conditions are required to obtain a negative sign for $\frac{\partial^2 WG}{\partial S_{mi}^2}$ in order for the minor determinant of order 2 ($= \frac{\partial^2 WG}{\partial S_{pi}^2} \cdot \frac{\partial^2 WG}{\partial S_{mi}^2}$) to be positive.

The third required condition to define the optimum of WG as a maximum is to obtain a negative sign for determinant **HM1** ($= \frac{\partial^2 WG}{\partial S_{pi}^2} \cdot \frac{\partial^2 WG}{\partial S_{mi}^2} \cdot \frac{\partial^2 WG}{\partial S_{xi}^2}$). By considering the two previous conditions as satisfied, this means to obtain a negative sign for $\frac{\partial^2 WG}{\partial S_{xi}^2}$. As already mentioned above, analogies in the formalization of the derivatives of degree 2 for the different kinds of subsidies allow us to use the previous results.

To sum up, if we consider the most polyvalent conditions (valid for both S_y lower and greater than 1), a sufficient set of constraints required is called A such as:

$$A \left\{ \begin{array}{l} \frac{(\varepsilon_{Fpi} + \Delta_{pi}) \cdot (\varepsilon_{Fpi} + \Delta_{pi} - 1)}{\varepsilon_{Fpi}(\varepsilon_{Fpi} - 1)} > \frac{X_{1i}}{X_{2i} \cdot S_{pi}^{\Delta_{pi}} \cdot \left(\frac{wb_1}{wb_2}\right)} \text{ and } \varepsilon_{Fpi} + L > P_{pi} \geq \varepsilon_{Fpi} + 1 \text{ where } L \text{ is a large number} \\ \frac{(\varepsilon_{Fmi} + \Delta_{mi}) \cdot (\varepsilon_{Fmi} + \Delta_{mi} - 1)}{\varepsilon_{Fmi}(\varepsilon_{Fmi} - 1)} > \frac{X_{5i}}{X_{6i} \cdot S_{mi}^{\Delta_{mi}} \cdot \left(\frac{wb_1}{wb_2}\right)} \text{ and } \varepsilon_{Fmi} + L > P_{mi} \geq \varepsilon_{Fmi} + 1 \text{ where } L \text{ is a large number} \\ \frac{(\varepsilon_{Fxi} + \Delta_{xi}) \cdot (\varepsilon_{Fxi} + \Delta_{xi} - 1)}{\varepsilon_{Fxi}(\varepsilon_{Fxi} - 1)} > \frac{X_{3i}}{X_{4i} \cdot S_{xi}^{\Delta_{xi}} \cdot \left(\frac{wb_1}{wb_2}\right)} \text{ and } \varepsilon_{Fxi} + L > P_{xi} \geq \varepsilon_{Fxi} + 1 \text{ where } L \text{ is a large number} \end{array} \right.$$

Under this set of constraints, the Hessian Matrix is negative definite. Thus, WG is a concave function and its optimization program is a maximization program. We note that the set of constraints for a local maximum is simpler, namely $P_y > \varepsilon_{Fy}$.

Thus there are restrictions on the parameters when using the model. Likewise, the maximization program of the other stakeholders could introduce additional restrictions. We are going to demonstrate that a configuration exists that is compatible with all the required restrictions.

The level of contributions brought by the foreign lobbyists (CF_i) is determined in order to maximize their profits (π_{Fi}):

$$\pi_{Fi} = pwm_i \cdot M_i + S_{mi} \cdot (pwm_i \cdot M_i) - Cr_i \cdot M_i - CF_i \quad (24)$$

where pwm_i is the international price of the goods produced by sector i , M_i is the quantity of goods i sold in the domestic market by foreign firms, and Cr_i is the production cost of goods i for foreign firms.

The first order conditions lead to:

$$CF_i = \frac{pwm_i \cdot M_i \cdot S_{mi}}{P_{mi} - \epsilon_{Fmi}} \quad (25)$$

And the second order conditions imply:

$$\frac{\partial^2 \pi}{\partial CF_i^2} < 0 \Leftrightarrow \left[-\frac{pwm_i \cdot M_i \cdot S_{mi}}{(P_{mi} - \epsilon_{Fmi}) \cdot CF_i^2} \right] < 0 \quad (26)$$

In the developed form in (26) all economic variables are positive. Considering the negative sign before the equation, the term is positive if $(P_{mi} - \epsilon_{Fmi})$ is positive ; this results in the following condition:

$$P_{mi} > \epsilon_{Fmi} \quad (27)$$

This condition does not bring unexpected additional constraints to our restriction bundle.

By replacing the value of CF_i find with (25) in (17) we obtain the equilibrium value of S_{mi} :

$$S_{mi} = \left[\frac{pwm_i \cdot M_i \cdot S_{mi}}{(P_{mi} - \epsilon_{Fmi}) \cdot P_{mi} \cdot X_{6i} \cdot \frac{wb_1}{wb_2}} \right]^{\frac{1}{P_{mi} - \epsilon_{Fmi} - 1}} \quad (28)$$

The equilibrium value of CF_i is then obtained with (17) or (25):

$$CF_i = \left[\frac{(pwm_i \cdot M_i)^{P_{mi} - \epsilon_{Fmi}}}{(P_{mi} - \epsilon_{Fmi})^{P_{mi} - \epsilon_{Fmi}} \cdot P_{mi} \cdot X_{6i} \cdot \frac{wb_1}{wb_2}} \right]^{\frac{1}{P_{mi} - \epsilon_{Fmi} - 1}} \quad (29)$$

The point of splitting labor into three categories, namely productive labor, labor used to lobby for obtaining production subsidies, and export subsidies, is a more complex issue. The domestic producers will make their choices by means of their profit (π_i) maximization:

$$\pi_i = p_i \cdot XS_i + S_{pi} \cdot (p_i \cdot XS_i) + S_{xi} \cdot (pe_i \cdot EX_i) - r_i \cdot K_i - w(LDS_{prod_i} + LDS_{p_i} + LDS_{x_i}) - pc_i \cdot CI_i \quad (30)$$

where p_i is the sales price of production, pe_i is the sales price of exportations (EX_i), r_i is the remuneration of capital, w is the remuneration of the labor factor, and pc_i is the composite price of the intermediate consumption (CI_i).

We have to bear in mind that this optimization is done under the constraint of a finite quantity of labor (LS) available in the economy. This implies constraints for each sector i :

$$LD_i = LD_{prod_i} + LD_{spi} + LD_{sxi} \quad (31)$$

But firstly, let's study the conditions under which the profit function of domestic producer is concave. The first order conditions of optimization for π_i without including, by now, the constraint in (31) lead to:

$$LD_{prod_i} = \alpha_i \cdot p_i \cdot XS_i \cdot (1 + S_{pi}) \cdot w^{-1} \quad (32)$$

For the diverted labors we obtain (33) and (34):

$$LD_{spi} = p_i \cdot XS_i \cdot S_{pi} \cdot w^{-1} \cdot (P_{p_i} - \varepsilon_{Fp_i})^{-1} \quad (33)$$

$$LD_{sxi} = p e_i \cdot EX_i \cdot S_{xi} \cdot w^{-1} \cdot (P_{x_i} - \varepsilon_{Fx_i})^{-1} \quad (34)$$

The second order conditions are subject to the signs of the minor determinants of the Hessian matrix (**HM2**). Since some derivatives are equal to zero, one can simplify the matrix:

$$\mathbf{HM2} = \begin{bmatrix} \frac{\partial^2 \pi}{\partial LD_{prod_i}^2} & \frac{\partial^2 \pi}{\partial LD_{prod_i} \partial LD_{spi}} & 0 \\ \frac{\partial^2 \pi}{\partial LD_{spi} \partial LD_{prod_i}} & \frac{\partial^2 \pi}{\partial LD_{spi}^2} & 0 \\ 0 & 0 & \frac{\partial^2 \pi}{\partial LD_{sxi}^2} \end{bmatrix} \quad (35)$$

If one wants the optimization program to lead to a maximization, the minor determinant of order 1 ($= \frac{\partial^2 \pi}{\partial LD_{prod_i}^2}$) has to be negative, the minor determinant of order 2 ($= \frac{\partial^2 \pi}{\partial LD_{prod_i}^2} \cdot \frac{\partial^2 \pi}{\partial LD_{spi}^2} - \frac{\partial^2 \pi}{\partial LD_{spi} \partial LD_{prod_i}} \cdot \frac{\partial^2 \pi}{\partial LD_{prod_i} \partial LD_{spi}}$) has to be positive, and determinant **HM2** has to be negative.

The first condition, $\frac{\partial^2 \pi}{\partial LD_{prod_i}^2} < 0$ leads to:

$$-\frac{\alpha_i \cdot p_i \cdot XS_i \cdot (1 + S_{pi})}{LD_{prod_i}^2} < 0 \quad (36)$$

This inequality is always satisfied since we have a negative sign before a ratio of positive economic values.

If one wants the minor determinant of order 2 to be positive then it leads to:

$$(P_{p_i} - \varepsilon_{Fp_i} - 1) + S_{pi} \cdot (P_{p_i} - \varepsilon_{Fp_i} - 1) > \alpha_i \cdot S_{pi} \quad (37)$$

Since $0 \leq \alpha_i \leq 1$, a sufficient condition to satisfy (37) is $P_{p_i} \geq \varepsilon_{Fp_i} + 2$.

The third condition to satisfy is subject to the sign of the determinant of the Hessian matrix (**HM2**):

$$\text{Det HM2} = \frac{\partial^2 \pi}{\partial \text{LDS}_{xi}^2} \begin{bmatrix} \frac{\partial^2 \pi}{\partial \text{LD}_{prod_i}^2} & \frac{\partial^2 \pi}{\partial \text{LD}_{prod_i} \partial \text{LDS}_{pi}} \\ \frac{\partial^2 \pi}{\partial \text{LDS}_{pi} \partial \text{LD}_{prod_i}} & \frac{\partial^2 \pi}{\partial \text{LDS}_{pi}^2} \end{bmatrix} \quad (38)$$

If one wants the domestic firm's optimization program to lead to a maximization of the profit, determinant **HM2** has to be negative. By considering that (37) is satisfied, this means a negative value for:

$$\frac{\partial^2 \pi}{\partial \text{LDS}_{xi}^2} = - \frac{(P_{xi} - \varepsilon_{Fxi} - 1)}{(P_{xi} - \varepsilon_{Fxi})^2} \cdot \frac{pe_i \cdot EX_i \cdot S_{xi}}{\text{LDS}_{xi}^2} \quad (39)$$

Since a ratio of two positive economic variables results necessarily in a positive sign, the only first term is to consider determining the sign in (39). The denominator of the first term is always positive. In that case, it becomes obvious that the sign of $\frac{\partial^2 \pi}{\partial \text{LDS}_{xi}^2}$ is strictly negative when $P_{xi} > \varepsilon_{Fxi} + 1$.

Thus, the second order conditions for the maximization program of the domestic producers implies new restrictive constraints on parameters. It remains, however, compatible with the constraints required by the maximization program of other stakeholders.

To sum up, the use of this model is subject to the following set of constraints (A') on the parameters:

$$A' \begin{cases} \frac{(\varepsilon_{Fpi} + \Delta_{pi}) \cdot (\varepsilon_{Fpi} + \Delta_{pi} - 1)}{\varepsilon_{Fpi}(\varepsilon_{Fpi} - 1)} > \frac{X_{1i}}{X_{2i} \cdot S_{pi}^{\Delta_{pi}} \cdot (\frac{wb_1}{wb_2})} \text{ and } \varepsilon_{Fpi} + L > P_{pi} \geq \varepsilon_{Fpi} + 2 \text{ where } L \text{ is a large number} \\ \frac{(\varepsilon_{Fmi} + \Delta_{mi}) \cdot (\varepsilon_{Fmi} + \Delta_{mi} - 1)}{\varepsilon_{Fmi}(\varepsilon_{Fmi} - 1)} > \frac{X_{5i}}{X_{6i} \cdot S_{mi}^{\Delta_{mi}} \cdot (\frac{wb_1}{wb_2})} \text{ and } \varepsilon_{Fmi} + L > P_{mi} \geq \varepsilon_{Fmi} + 1 \text{ where } L \text{ is a large number} \\ \frac{(\varepsilon_{Fxi} + \Delta_{xi}) \cdot (\varepsilon_{Fxi} + \Delta_{xi} - 1)}{\varepsilon_{Fxi}(\varepsilon_{Fxi} - 1)} > \frac{X_{3i}}{X_{4i} \cdot S_{xi}^{\Delta_{xi}} \cdot (\frac{wb_1}{wb_2})} \text{ and } \varepsilon_{Fxi} + L > P_{xi} > \varepsilon_{Fxi} + 1 \text{ where } L \text{ is a large number} \end{cases}$$

We demonstrate that under these conditions, the domestic producers profit is concave since the Hessian Matrix is negative definite. If we add a linear constraint such that (31) to the domestic producers program, it does not modify the concavity of the function. So it is to say, the Lagrangian (\mathcal{L}) is concave.

$$\mathcal{L}_i = \pi_i - \lambda_{Li} \cdot (\text{LD}_i - \text{LD}_{prod_i} + \text{LD}_{spi} + \text{LD}_{sxi}) \quad (40)$$

Taking into consideration constraint (31) strengthens the interdependence between the different nature of labor and the different kinds of subsidies. Indeed, the first order conditions of optimization for \mathcal{L}_i lead to:

$$\text{LD}_{prod_i} = \frac{\alpha_i \cdot p_i \cdot XS_i \cdot (1 + S_{pi}) \cdot (P_{pi} - \varepsilon_{Fpi}) \cdot (P_{xi} - \varepsilon_{Fxi})}{p_i \cdot XS_i \cdot (P_{xi} - \varepsilon_{Fxi}) \cdot [\alpha_i \cdot (P_{pi} - \varepsilon_{Fpi}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \varepsilon_{Fpi})} \cdot \text{LD}_i \quad (41)$$

For the diverted labors we obtain (42) and (43):

$$\text{LD}_{spi} = \frac{p_i \cdot XS_i \cdot S_{pi} \cdot (P_{xi} - \varepsilon_{Fxi})}{p_i \cdot XS_i \cdot (P_{xi} - \varepsilon_{Fxi}) \cdot [\alpha_i \cdot (P_{pi} - \varepsilon_{Fpi}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \varepsilon_{Fpi})} \cdot \text{LD}_i \quad (42)$$

$$LD_{sx_i} = \frac{pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{p_i} - \varepsilon_{Fp_i})}{p_i \cdot XS_i \cdot (P_{x_i} - \varepsilon_{Fx_i}) \cdot [\alpha_i \cdot (P_{p_i} - \varepsilon_{Fp_i}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{p_i} - \varepsilon_{Fp_i})} \cdot LD_i \quad (43)$$

All kinds of labor have the same denominator. We can make analytical predictions thanks to the numerators reasoning in relative terms. For the diverted labors, when P_y , the subsidy elasticity of political cost in sector i for one kind of subsidy grows, it increases the quantity of labor diverted in order to obtain the other kind of subsidies. The inverse shift is noticed for ε_{Fy} , the subsidy elasticity of political favor granted to sector i . As expected, the greater a subsidy, the more labor diverted to obtain it. The relative share of the labor used in the production process equally finds a logical explanation. The higher α_i , the parameter of the contribution of the labor factor in the Value Added, the higher the share of labor dedicated to the production process. In addition, this share rises when the diverted quantities of labor are deterred by high P_y and low ε_{Fy} . Finally, we underline that the height of the production subsidy has a positive effect on the relative quantity of labor used in the production process. Indeed, it gives an incentive to produce more since it relates to an increase in the price of the product. This illustrates the tradeoff for the producer to choose between a high subsidy on a small production and a low subsidy on a bigger production.

Thus, our results show the importance of the elasticities P_y and ε_{Fy} in determining the diverted quantities of resources. As far as P_y is concerned, an important role is given to the voter-consumers who can deter the diversion of resources by refusing that sectors receive high subsidies. This implies high values for P_y in the model that create an increasing political cost to grant subsidies. On the other hand, if the government assesses their political efforts to grant subsidies as a worthy action that deserves a growing counterpart from lobbies (high ε_{Fy}), it receives a large amount of resources which are diverted from the production process.

These results are drawn from an analytical analysis but the great interest of developing a CGEM of this kind will be to work with a real economy and to obtain numerical results. In that case, the equilibrium of the model will then be found in the framework of the CGEM, which will adjust the vector of relative prices in such a way that all the markets are supposed to clear.

4-Discussion

The model displayed leads to competition among interest groups. However, this is different from the situation in Findlay and Welitz (1982), in which lobbies struggle with the same object, notably the height of the tariff barriers. In our model, there is indirect competition amongst lobbies, since each subsidy granted by the government has a VAT counterpart similar to Becker (1983). However, Becker does not specify the nature of the taxes. Therefore, it becomes harder and harder to obtain a subsidy while consumer prices are climbing with each government grant. We need to remember here that the loss of wellbeing, based on a decrease in consumption, acts as a brake on the function that determines the amount of subsidies received by sectors. In this way, and for the wellbeing functional form to be retained, the price elasticities of consumption for the different goods available in the economy play an important role in this model.

The links between sectors depend on the configuration of the sectorial input-output parts of the Social Accounting Matrix (SAM). To recap, a CGEM is composed of equations describing the links between the variables of the model and a SAM that represents all the flows of transactions in an economy and constitutes its baseline state. Hence, a part of the SAM is dedicated to the sectorial

inputs-outputs. This means that some sectors can benefit from the good health of other sectors and vice versa due to upstream and downstream links between sectors. This could result in cross-sectoral contributions in order to influence the government to help another sector that creates economics spinoffs for the contributors. To simplify the model, it is more convenient to assume that the sectors only make contributions to influence the government for their own direct benefits. Rationales for that include (i) the fact that cross-contributions could be considered as less efficient in terms of returns on investments and (ii) a risk-inversion effect could appear since very indirect economic mechanisms generate uncertainty in the returns on investments. Finally, even though the cross-sectorial contributions are not applied in the model, the cross-sectorial effects of the political economy behaviors are expected in this model. This is a strength of the CGEM.

Another important point is the results we obtain for the government preference function. From (14) and comments that followed, we have implicitly augmented this function. Let us make the final form explicit:

$$WG = \sum_i \sum_{n=1}^3 X_{2n-1} \cdot S_y^{\varepsilon F y} - X_{2n} \cdot \frac{wb1}{wb2} \cdot S_y^{P y} \quad (44)$$

Our specification of government preference is consistent with Grossman and Helpman (1994) since the government is enabled to care about the wellbeing of civil society. This feature is important in view of Goldberg and Maggi's (1999) results exposed above. The weight of this benevolence is measured by the parameter X_{2n} in our model. In an extreme view of the political process, X_{2n} could equal 0. In that case, the government must conduct a transactional relationship with civil society and has to regard its political mandate as ephemeral. Conversely, a high value for X_{2n} is compatible with a lasting relationship. It characterizes governments with a real willingness to be reelected and/or with a strong ideology. Besides, X_{2n-1} is the weight of the price to pay to obtain political favors. This matches with the appetite of the government's members in taking advantage of the situation or in being convinced of the difficulties.

The model allows for the possibility of differentiating between the assessment of the government, not only by sectors, but equally by the nature of the interest group and by its type of demand. For instance, it could be easier for the domestic agricultural sector or the domestic textile industry to gain political favor; it might be easier for them to obtain such favors in the form of production subsidies. This part constitutes the object of the setting of the different elasticities in the model.

In this development of the model, to take into account the concerns of the society, the government objective function was indirectly based on consumption. However, different specifications are compatible with the model. One can for example cite other means to measure wellbeing, like the quantity of net job creations when a subsidy sustains a sector, or the willingness of the government to be accountable for their campaign pledges. The latter is past-oriented, therefore it could be more relevant and up-to-date to include, in this second part of the government preference function, indicators linked with the political agenda. Thereby, it captures the subjects on which people, politics, and the media are focusing. A weighted combination of economic indicators could then be thought to match as much as possible to the political agenda. If the government were caring to such a point that it was willing to sacrifice a part of its popularity, the second part of the government preference function could then include indicators of purely economic objectives. This would allow for the evaluation of the effects of unpopular but benevolent policy measures.

We have found that it was more realistic to work with subsidies for the reasons evoked in part 1, but it is possible to slightly rearrange the model in order to work with tariff barriers (tm_i). In that case, the rearrangement is simpler for sectors asking for protection. In the general case described by equation (3), S_i should then be replaced with tm_i and a new parameter of elasticity should replace ε_{Fxi} . The steps should be repeated for the equations that follow. For sectors asking for free trade, which could be the case if the sector exports a lot and fears trade retaliations, it is not that direct. In our model, such a sector could have prioritized the attempt to obtain export subsidies if their costs were sufficiently lower than the production subsidies³. It does that thanks to the allocation of the workforce between the different categories of labor and, particularly here, by allocating more resources in the labor diverted from the production process in order to lobby for export subsidies. If we talk about lowering tariffs, the cost part of the government preference function might be inefficient to act as a brake in the marginal actions of the sectors. Indeed, the loss of government revenue due to the lowering of tariffs will be financed by an increase in VAT. However, this will not necessarily create a loss of wellbeing for consumers, since imported goods meanwhile become cheaper. In this way, the behavior of the model depends more greatly on the relative weight of wellbeing elasticities to goods in the sectors. To ensure that all the demands for lower tariffs barriers do not systematically lead the tariffs concerned to zero, the cost part of WG would have to be rearranged. Different suggestions to modify this part have been discussed above.

5- Conclusion

In this paper, we have proposed a model of political economy based on the rational choices of the different stakeholders. From their assumed expectations in terms of subsidies for foreign and domestic firms and in terms of counterparts for the political effort granted by the government, we have brought a micro-foundation to the functional functions of the political market. Nevertheless, a set of constraints, named as A' above, has to be complied with in order to adopt the model.

It stems from the above that two elasticities are key parameters that influence the quantities of resources diverted and thereby the level of distortions. On the one hand, P_y , the subsidy elasticity of political cost in sector i acts as a brake for the subvention S_y in favor of the sector i . Its level is related to increasing discontent and frustration among the population when subsidies are growing. On the other hand, ε_{Fy} , the subsidy elasticity of political favor granted to sector i stimulates resources diversion since it determines the height of the counterpart that lobbies have to provide when receiving a subsidy; this counterpart being an incentive to grant subsidies as a source of satisfaction for the government.

If one wishes to struggle against distortion, a first recommendation can then be a much greater awareness on the part of the population about the bad effects of distortion on the state of the economy. A second recommendation can be to place importance on the personality of the candidates to elections, not only on their campaign program. However, the point is delicate since decision makers are not necessarily designated by votes.

³ For the same price, a given rate of production subsidies always dominates the same given rate of exports subsidies, since the former procures its effects not only on the value of exports but also on the value of domestic sales.

There are some caveats in the model proposed. A first shortcoming of the model might be the role given to the consumers. They are passive in the model in the sense that they do not actively try to influence the government. This should, however, be put into perspective since they do indirectly influence the government through the benevolence and the sense of duty of the latter. This choice of modeling comes from the acknowledgement that consumers are not often organized in a unique and powerful lobby. They are more prone to divergent claims that divide their political power. However, in some countries, consumers as workers have a common claim, namely to defend their purchasing power. Unions can then be considered as their interest groups. Another point that explains the role of the consumers is the fact that we have chosen an influence-driven model. It leaves less space for consumers to actively move against the government because, in this kind of model, we consider the election as being over. Actions for influencing are then undertaken toward the incumbents.

A second shortcoming of the model lies in the restriction bundle. The results of the model are supposed to be unsecured if the difference between P_y and ε_{Fy} is a large number. We were not able to determine exactly from which number the difference is considered to be a large number. However, the modeler can lessen the inconvenience by including an automatic check of the condition A' in its program code.

In this model, we have sought to orientate the model toward trade policy features. The reason for this is the prominence gained by international trade during the last few decades. According to the WTO (2015), the growth in the volume of world trade has been approximately 5% annually during the period 1990-2014, whereas the real GDP growth for the world has been approximately 2.5% a year in the same period. However, recent data on the sub-period 2012-2014 has shown a slowdown in this differential, since the average annual growth has been slightly below 2.5% for both the volume of world trade and the real GDP. We should here stress the flexibility of the model since it accepts different features. It can be augmented particularly concerning the subsidies of different kinds. In such a way, the model can be rebalanced toward more nationally specific concerns. For each kind of subsidy added, the modeler has to think about creating a new category of diverted labor.

Numerous uses of the model are possible. To give an example in the context of foreign trade, it can be used to see the impacts of a trade agreement on the equilibrium of the economy. One could think that the protection lost in the framework of the agreement could be offset against public policies in favor of the sectors that underwent the losses. The model is able to check such an assumption.

In a normative purpose, if the selected goal is to maximize the population's wellbeing, the model can show if the current configuration of political power among interest groups allows a target level of wellbeing in the economy. Therefore, it can help to decide if lobbying should be fought, supported, or if it is not worth using resources to intervene in cases of the non-significant impact of influence.

Appendix : Computable General Equilibrium Model of Influence on Trade Policy

I-Sets

$i=j$ {agriculture; industry; service} for the sectors
 y { ρ_i ; m_i ; x_i } for the nature of the subsidies

II-Parameters

A_i scale parameter in value added in sector i
 α_i share of the labor factor in value added in sector i
 $a_{i,j}$ input-output coefficients
 Z_i Leontief 's technical coefficients
 v_i Leontief 's technical coefficients
 pms average propensity to spare
 β_{Ci} coefficient of the distribution of household consumption
 β_{Ii} coefficient of the distribution of investment
 β_{Vi} coefficient of the distribution of the value added
 λ share of the revenue from capital perceived by households
 λ_w share of the revenue from capital paid by the rest of the world
 b_{ti} scale parameter in the CET function of destination of the production
 ρ_{t_i} parameter that implies the elasticity of transformation of the CET function of destination of the production (σ_{t_i}) such as $\rho_{t_i} = (\sigma_{t_i}-1)/ \sigma_{t_i}$
 σ_{t_i} elasticity of transformation of the CET function of destination of the production
 δ_{t_i} share of factors in the CET function of destination of the production
 b_{s_i} scale parameter in the CES function of local-imported product
 ρ_{s_i} parameter that implies the elasticity of substitution in the CES function of local-imported product (σ_{s_i}) such as $\rho_{s_i} = (1 - \sigma_{s_i})/ \sigma_{s_i}$
 σ_{s_i} elasticity of substitution of the CES function of of local-imported product
 δ_{s_i} share of factors in the CES function of local-imported product
 ϵ_{Fmi} import subsidy elasticity of political effort in sector i
 ϵ_{Fpi} production subsidy elasticity of political effort in sector i
 ϵ_{Fxi} export subsidy elasticity of political effort in sector i
 P_{mi} import subsidy elasticity of political cost in sector i
 P_{pi} production subsidy elasticity of political cost in sector i
 P_{xi} export subsidy elasticity of political cost in sector i
 X_{2i} parameter that measures of how much the government cares about the impact of the production subsidies on the wellbeing of the consumers
 X_{4i} parameter that measures of how much the government cares about the impact of the export subsidies on the wellbeing of the consumers
 X_{6i} parameter that measures of how much the government cares about the impact of the import subsidies on the wellbeing of the consumers

III-Variables

Production and Factors

XS_i production
 VA_i value added
 CI_i total intermediate consumption of the branch i
 $DI_{i,j}$ intermediate demand of good i by the branch j
 X_{1i} variable that indicates the height of compensation to supply in return for political effort on production subsidies
 X_{3i} variable that indicates the height of compensation to supply in return for political effort on export subsidies

X_{Si} parameter that indicates the height of compensation to supply in return for political effort on import subsidies

K_i capital

LD_{prod_i} labor demand for production process

Influence

LD_{spi} labor demand in order to influence on the level of production subsidies

LD_{sxi} labor demand in order to influence on the level of export subsidies

CF_i contributions in order to influence on the level of import subsidies

Sp_i rate of production subsidy granted to the sector i

Sx_i rate of export subsidy granted to the sector i

Sm_i rate of import subsidy granted to the sector i

Wb_t Wellbeing of the households

Δwb Change in wellbeing between before ($t=1$) and after ($t=2$) the introduction of subsidies

Income and Saving

YH total household income

YDH disposable income

SH household saving

YE total income of firms

SE firms saving

DIV dividend

TEW transfer of the domestic firms to the rest of the world

TG transfer of the government to the households

Government

WG government welfare

YG revenue of the government

SG government saving

G government spending

Tl_i Value Added Tax on products

tx_i rate of the Value Added Tax (VAT) on products

t_{xx_i} initial VAT rate

τ homogeneous rate of increase in the VAT

TIM_i revenue from tariff barriers

tm_i rate of the tariff barrier

TD household income tax

ty rate of the household income tax

TDE tax of the incomes of the firms

tye rate of the tax of the incomes of the firms

TXS_i amount of the production subsidies granted by the government

TIE_i amount of the export subsidies granted by the government

TMS amount of the import subsidies granted by the government

Demand

C_i household consumption for the good i

INV_i investment in the good i

DIT_i total intermediate demand of good i

Prices

p_{va_i} price of the value added

p_i price to producer

pc_i price of the compounded good

pd_i price of the domestic good

pl_i price of the good destined to the local market

$pindex$ general price index

w rate of wage

r_i capital rate of return
 pm_i price of the imported good
 pwm_i world price of the imports
 e nominal exchange rate
 pe_i price of exports
 pwe_i world price of the exportations

International trade

EX_i exportations
 D_i demand of domestic good i
 Q_i compounded product
 M_i importations
 CA balance of the current account

Macroeconomic

LD_i labor demand in sector i
 LS total labor supply
 IT total investment

Control

CONTROL variable to check the Walras' law

IV-Equations

Production and factors $XS_i = \frac{VA_i}{v_i}$ (M1)

$$VA_i = A_i \cdot LD_{prod_i}^{\alpha_i} \cdot K_i^{(1-\alpha_i)} \quad (M2)$$

$$CI_j = z_j \cdot XS_j \quad (M3)$$

$$DI_{i,j} = a_{i,j} \cdot CI_j \quad (M4)$$

$$LDS_{pi} = X_{1i} \cdot S_{pi}^{\epsilon_{Fpi}} \quad (M5)$$

$$LDS_{xi} = X_{3i} \cdot S_{xi}^{\epsilon_{Fxi}} \quad (M6)$$

$$CF_i = X_{5i} \cdot S_{mi}^{\epsilon_{Fmi}} \quad (M7)$$

$$LD_{prod_i} = \frac{\alpha_i \cdot p_i \cdot XS_i \cdot (1 + S_{pi}) \cdot (P_{pi} - \epsilon_{Fpi}) \cdot (P_{xi} - \epsilon_{Fxi})}{p_i \cdot XS_i \cdot (P_{xi} - \epsilon_{Fxi}) \cdot [\alpha_i \cdot (P_{pi} - \epsilon_{Fpi}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \epsilon_{Fpi})} \cdot LD_i \quad (M8)$$

Influence $LD_{spi} = \frac{p_i \cdot XS_i \cdot S_{pi} \cdot (P_{xi} - \epsilon_{Fxi})}{p_i \cdot XS_i \cdot (P_{xi} - \epsilon_{Fxi}) \cdot [\alpha_i \cdot (P_{pi} - \epsilon_{Fpi}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \epsilon_{Fpi})} \cdot LD_i$ (M10)

$$LD_{sxi} = \frac{pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \epsilon_{Fpi})}{p_i \cdot XS_i \cdot (P_{xi} - \epsilon_{Fxi}) \cdot [\alpha_i \cdot (P_{pi} - \epsilon_{Fpi}) \cdot (1 + S_{pi}) + S_{pi}] + pe_i \cdot EX_i \cdot S_{xi} \cdot (P_{pi} - \epsilon_{Fpi})} \cdot LD_i \quad (M11)$$

$$CF_i = \left[\frac{(pwm_i \cdot M_i)^{P_{mi} - \epsilon_{Fmi}}}{(P_{mi} - \epsilon_{Fmi})^{P_{mi} - \epsilon_{Fmi}} \cdot P_{mi} \cdot X_{6i} \cdot \frac{wb_1}{wb_2}} \right]^{\frac{1}{P_{mi} - \epsilon_{Fmi} - 1}} \quad (M12)$$

$$S_{pi} = \left[\frac{\epsilon_{Fpi} \cdot X_{1i}}{P_{pi} \cdot X_{2i} \cdot \left(\frac{wb_1}{wb_2}\right)} \right]^{\frac{1}{P_{pi} - \epsilon_{Fpi}}} \quad (M13)$$

$$S_{xi} = \left[\frac{\epsilon_{Fxi} \cdot X_{3i}}{P_{xi} \cdot X_{4i} \cdot \left(\frac{wb_1}{wb_2}\right)} \right]^{\frac{1}{P_{xi} - \epsilon_{Fxi}}} \quad (M14)$$

$$S_{mi} = \left[\frac{pwm_i \cdot M_i \cdot S_{mi}}{(P_{mi} - \epsilon_{Fmi}) \cdot P_{mi} \cdot X_{6i} \cdot \frac{wb_1}{wb_2}} \right]^{\frac{1}{P_{mi} - \epsilon_{Fmi} - 1}} \quad (M15)$$

$$Wb_t = \prod_i C_{it}^{\alpha_i} \quad (M16)$$

$$\Delta wb = \frac{\prod_i C_{i2}^{\alpha_i} - \prod_i C_{i1}^{\alpha_i}}{\prod_i C_{i1}^{\alpha_i}} \quad (M17)$$

Incomes and Saving $YH = w \cdot \sum_i LD_i + TG + \lambda \cdot \sum_i r_i \cdot K_i + DIV$ (M18)

$$YDH = YH - TD \quad (M19)$$

$$SH = pms \cdot YDH \quad (M20)$$

$$YE = (1 - \lambda - \lambda_w) \cdot \sum_i r_i \cdot K_i \quad (M22)$$

$$SE = YE - DIV - TDE - TEW \quad (M22)$$

Government

$$WG = \sum_i \sum_{n=1}^3 X_{2n-1} \cdot S_y^{\epsilon_{Fy}} - X_{2n} \cdot \frac{wb1}{wb2} \cdot S_y^{Py} \quad (M23)$$

$$YG = \sum_i TI_i + \sum_i TIM_i - \sum_i TIE_i - \sum_i TXS_i - \sum_i TMS_i + TD + TDE \quad (M24)$$

$$SG = YG - G - TG \quad (M25)$$

$$TI_i = tx_i \cdot (p_i \cdot XS_i - pe_i \cdot EX_i) + \frac{tx_i}{1 + tx_i} \cdot pm_i \cdot M_i \quad (M26)$$

$$TIM_i = tm_i \cdot e \cdot pwm_i \cdot M_i \quad (M27)$$

$$TIE_i = Sx_i \cdot pe_i \cdot EX_i \quad (M28)$$

$$TD = ty \cdot YH \quad (M29)$$

$$TDE = tye \cdot YE \quad (M30)$$

$$TXS_i = Sp_i \cdot p_i \cdot XS_i \quad (M31)$$

$$TMS_i = Sm_i \cdot pwm_i \cdot e \cdot M_i \quad (M32)$$

$$tx_i = txx_i \cdot \tau \quad (M33)$$

Demand

$$C_i \cdot pc_i = \beta_{c_i} \cdot YDH \quad (M34)$$

$$INV_i \cdot pc_i = \beta_{i_i} \cdot IT \quad (M35)$$

$$DIT_i = \sum_j a_{i,j} \cdot Cl_j \quad (M36)$$

Prices

$$pv_i \cdot VA_i = p_i \cdot XS_i - \sum_j pc_j \cdot DI_{i,j} \quad (M37)$$

$$R_i \cdot K_i = (pv_i \cdot VA_i - w \cdot (LD_{prod_i} + LD_{sp_i} + LD_{sx_i})) \quad (M38)$$

$$pd_i = (1 + tx_i) \cdot pl_i \quad (M39)$$

$$pm_i = (1 + tx_i) \cdot (1 + tm_i) \cdot e \cdot pwm_i \quad (M40)$$

$$pe_i = e \cdot pwe_i \quad (M41)$$

$$pc_i \cdot Q_i = (pd_i \cdot D_i + pm_i \cdot M_i) \quad (M42)$$

$$p_i \cdot XS_i = (pl_i \cdot D_i + pe_i \cdot EX_i) \quad (M44)$$

$$PINDEX = \sum_j \delta_{v_i} \cdot pv_i \quad (M44)$$

International trade

$$XS_i = b_{t_i} \cdot (\delta_{t_i} \cdot EX_i^{\rho_{t_i}} + (1 - \delta_{t_i}) \cdot D_i^{\rho_{t_i}})^{\frac{1}{\rho_{t_i}}} \quad (M45)$$

$$EX_i = \left(\frac{[pe_i \cdot (1 + S_{x_i} + S_{p_i})]}{[pl_i \cdot (1 + S_{p_i})]} \right)^{\sigma_{t_i}} \cdot \left(\frac{(1 - \delta_{t_i})}{\delta_{t_i}} \right)^{\sigma_{t_i}} \cdot D_i \quad (M46)$$

$$Q_i = b_{s_i} \cdot (\delta_{s_i} \cdot M_i^{-\rho_{s_i}} + (1 - \delta_{s_i}) \cdot D_i^{-\rho_{s_i}})^{\frac{1}{\rho_{s_i}}} \quad (M47)$$

$$M_i = \left(\left(\frac{\delta_{s_i}}{1 - \delta_{s_i}} \right)^{\sigma_{s_i}} \cdot \left(\frac{pd_i}{pm_i} \right)^{\sigma_{s_i}} \right) \cdot D_i \quad (M48)$$

$$CA = e \cdot \sum_i pwm_i \cdot M_i + \lambda_w \cdot \sum_i r_i \cdot K_i + TEW - e \cdot \sum_i pwe_i \cdot EX_i \quad (M49)$$

Macroeconomic

$$Q_{agr} = DIT_{agr} + C_{agr} + INV_{agr} \quad (M50)$$

$$Q_{ind} = DIT_{ind} + C_{ind} + INV_{ind} \quad (M51)$$

$$\sum_i LD_i = LS \quad (M52)$$

$$LD_i = LD_{prod_i} + LD_{sp_i} + LD_{sx_i} \quad (M53)$$

$$IT = SH + SE + SG + CA \quad (M54)$$

Control

$$CONTROL = Q_{serv} - DIT_{serv} - C_{serv} - INV_{serv} \quad (M55)$$

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