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Industrial Policy and Lobbying:

can weak government correct market failures?

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This paper is the generalization of the model, developed by G.M. Grossman and E. Helpman in "Protection for Sale" (AER, 1994).

We modify the basic model to include the high-technological sector. The good, produced by this sector, can not be consumed but have to be used as a factor of production by some of the other sectors. In addition, I assume that the high-technological sector exerts a positive externality on the whole economy.

In our case free trade is no longer efficient. Lobbying in general case leads to the deviation from free trade, so, in general case, the effect of lobbying is ambiguous and depends on a number of parameters.

I analyze a two-stage game between the government and lobbies, in which the pattern of the tariff protection is determined, and describe the equilibrium of the lobbying process under different schemes. The main result is that lobbying may improve the overall social welfare.

Firstly, unlike the basic model, in which only represented by lobby sectors received protection while all the others lose, in the modified model the high-technological sector may be protected even if it is not represented. On the other hand, it may be the case that despite being represented this sector may lose (the domestic price of intermediate input could be lower than the world price). Another interesting property is that the formula for the import tariff applicable to trade in final good, production of which requires intermediate good, depends positively on the domestic price of high-technological good. These results are valid even without introducing externality effect into the model.

The welfare implications of lobbying are discussed in this paper. We describe the parameters determining the magnitude of the deviation from free trade. By considering special cases, it is argued that the lobbying process may lead to an increase (compared to the case of free trade) in the overall welfare.

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Данная работа является обобщением модели, представленной в статье "Protection for Sale" (AER,1994, G.M. Grossman and E. Helpman).

По сравнению с базисной моделью, мы рассматриваем экономику, в которой один из секторов производит высокотехнологичный товар. Этот товар не может потребляться населением, а служит фактором производства для некоторых секторов. Кроме того, мы предполагаем, что производство высокотехнологичного товара вызывает эффект положительной экстерналии.

В данном случае, когда деятельность одного сектора оказывает положительное влияние на все остальные секторы экономики, нулевые тарифы перестают быть оптимальными. В таком случае влияние лоббирования, которое в общем случае приводит к отклонению от свободной торговли, на общественное благосостояние перестает быть однозначным и зависит от целого ряда факторов.

Рассматривается двухпериодная игра между правительством и лоббистскими группами, в результате которой определяется структура тарифов. В этой работе исследуется равновесие в этой игре при различных составах участников процесса лоббирования. Если в исходной модели протекционизм применялся к тем и только тем секторам, которые представлены в процессе лоббирования, то в данной работе высокотехнологичный сектор может получить защиту от импорта, даже если он не участвует в процессе лоббирования, и может проиграть, даже если создаст лоббирующую группу. Другим важным результатом является тот факт, что тариф в тех секторах, в которых для производства используется высокотехнологичный товар, положительно зависит от равновесного тарифа, который действует в высокотехнологичном секторе. Эти результаты верны даже в случае отсутствия эффекта экстерналии.

В работе обсуждается влияние лоббирования на общественное благосостояние, выделяются те факторы, которые определяют насколько сильно благосостояние при лоббировании отличается от максимально-возможного уровня. На примере частных случаев показано, что лоббирование действительно может привести к увеличению благосостояния.

Contents

1. Introduction

There is a lively debate in the modern economic theory about the proper role of the government in regulating the economic activity. Of course, all economists agree upon the fact that we should not totally disregard the government. On the other hand, the scope of the government's intervention has to be limited somehow. So the main question is what exactly should be regulated and to what extent.

As the answer to this question from the theoretical viewpoint is yet to be found, in the real world the pressure from various interest groups tends to be the key factor in determining what policy will be ultimately implemented when the government decides to intervene in some sphere of the economy. Every lobby group is aware of what is advantageous for its members, so it tries to make the politicians to pursue a policy favorable for this particular interest group. There are mainly two ways of "persuading" the incumbent government. Firstly, given the assumption that the decision-maker is non-benevolent, a lobby could offer some money in return for the desired policy implementation. Secondly, using the fact that the government has to care about the overall welfare to stay in power, representatives of the pressure group might claim that the proposed policy is beneficial for the society as a whole. Hereinafter, it is assumed that the objective function of the incumbent government includes (with different weights) both the contributions from the lobbies and the total welfare.

In this paper I focus on one aspect of government's regulation, namely on the determination of trade tariffs. Even in the developed countries, in which most of the existing economic laws and acts are in a sense "stable", tariffs levied on various items are changed from time to time. It is no wonder that this process is more intense in the transition economies, which is usually characterized by weak state and weak institutions – lobbying plays major role in determining the final pattern of tariffs as the weak government is unable to determine the optimal level of tariff for each industry. Interests of different industries frequently clash, which means that the decision in favor of one sector is undesirable for the others. As a result, the outcome of the lobbying process, when many interest groups simultaneously exert pressure on the incumbent politicians, is difficult to predict. Obviously, the consequences this political game could be tremendous for the economy – tariffs and subsidies imply the redistribution of resources among different industries. These arguments justify the importance of research into the outcome of the lobbying game and, especially, the welfare effects of lobbying.

Few words have to be said about lobbying in general. Most people (who are not economists) think that lobbying is a negative phenomenon on the whole. Lobbying is associated with the backstage talks, in which only the agents, communicating with the decision-maker, ultimately win.

From the economic viewpoint the effect of lobbying is ambiguous. On the one hand, as any rent-seeking activity, lobbying might be treated as waste of resources; moreover, usually the result of lobbying is biased towards the represented pressure group and it might well be the case that the losses of not represented agents are much higher than the net gain of all lobbies. These effects tend to decrease the aggregate welfare.

On the other hand, it is reasonable to assume that if an industry actually needs the protection more than the other, e.g. because it is an infant industry, then subsidizing the former, and this can happen as a result of lobbying process, may have a positive effect in the long-run. There is also an opinion among the economists that lobbying may serve as a mechanism to overcome market failures and also may help to indicate the bottlenecks in the existing relations among different agents. To summarize, if the interests of lobby groups and the whole society coincide to some a certain extent, then lobbying may be beneficial for the economy.

Talking about the weak government, unaware of what the optimal industry's protection should be, one have to be cautious: economic theory doesn't tell us much about optimal tariffs for the transitional economies, which are often characterized by such problems as weak institutions, low labor mobility, imperfect capital market, etc. Let us consider an example taken from the modern Russian economy – tariff on foreign cars. Is it justified or not? The advocates of this tariff claim that our car industry at the moment cannot compete with foreign corporations and so have to be protected or it will die. In some years, when the domestic car producers will be using modern and efficient technologies enabling them to be competitive in the world market, abolishing the above-mentioned tariff will be painless. Opponents, on the other hand, say that during the ten years of transition in Russia our car industry was protected, and still the quality of "Zhiguli" and "Lada" are much lower than that of those foreign cars that cost about the same. Therefore, according to this view, only free trade and "real" competition will make our producers care about efficiency and technology.

So we are still far from understanding the circumstances, under which lobbying is beneficial for the society, when it really helps to induce the implementation of better policy than without any pressure from special interest group. Not only in Russia, but also in many other countries, when it turns out that some industry, some sector or a single firm succeeded in obtaining protection of any kind, there are always hot debates among the supporters of such measure and opponents. As I have already mentioned, interests of different lobby groups almost never coincide, therefore the decision-maker is faced by a difficult problem of making a choice.

This paper is based on the prominent model developed by Grossman and Helpman (1994) (henceforth, G&H). The authors "take a significant step beyond the existing literature", as they claim. They model the process of tariff determination as a result of the game of the "menu-auction" type – term coined by Bernheim and Whinston (1986). The G&H model attracted so much attention from the economists mainly because the authors obtained the explicit expression for the equilibrium tariff in each industry. Later on many researchers compared the predictions of the model with the patterns of protection observed in reality. Goldberg and Maggi(1999) found in their empirical investigation that G&H model is weakly consistent with the cross-industry data for the US economy, however the model fails to explain some stylized facts or, better to say, the model's assumptions about the structure of the economy do not allow to analyze the stylized patterns of protection. For example, it is widely observed that tariffs, on average, rise with the degree of processing, as illustrated by the following table.

Agricultural Products(%)

	Developing[a)]	Developed[c)]
first-stage processing	19.0	5.2
semi-processed	26.3	5.4
fully processed	29.6	5.8
first-stage>fully processed[d)]	2/36	1/7

Industrial Products(%)

	Developing[b)]	Developed[c)]
first-stage processing	9.5	0.5
semi-processed	13.1	4.0
fully processed	15.2	4.6
first-stage>fully processed[d)]	1/37	0/7

Table 1. Tariffs and the degree of processing, 1997-1999 (unweighted averages in percent).
[a)] – average for 36 countries, [b)] – average for 37 countries, [c)] – average for 7 countries, [d)] – number of observations that do not respect the inequality in the numerator.

Table 1 is taken from the recent paper by Cadot et al. (2001).

In this paper I introduce intermediate good used by some of the final-good sectors. It is often assumed that production function depends on labor, capital and the technological factor. I assume that the intermediate good stands for this factor, which implies that the firms have to buy "technology", like the other inputs of production. In this interpretation, sector, producing the intermediate good, is assumed to be a high-technological sector, producing a positive externality. Further the paper, when the equilibrium conditions are derived, I will explicitly point out what features, which differ the model from the basic one, are caused by the consideration of the intermediate good and what features have emerged as a result of introducing the externality effect. So it is possible to analyze the case, when the intermediate good is not assumed to be high-tech (consequently, there is no externality effect), within this model.

In the paper I characterize the equilibrium trade policy implemented by the incumbent government. New assumptions introduced into the basic model bring about some remarkable results. Firstly, unlike the basic model, in which only represented by lobby sectors received protection while all the others lose, in the modified model the high-technological sector may be protected even if it is not represented. On the other hand, it may be the case that despite being represented this sector may lose as a result of the lobbying game (the domestic price of intermediate input could be lower than the world price). Another interesting feature of the model is that the formula for the import tariff applicable to trade in final good, production of which requires intermediate good, can be decomposed into two terms, one with the same form as in G&H model,

the other being an increasing function of the domestic price of high-technological good. These results are valid even without introducing externality effect into the model.

From the viewpoint of the total welfare, the crucial consequence of the positive externality is that free trade is no longer optimal. This paper argues that the lobbying process may lead to an increase (compared to the case of free trade) in the overall welfare. In the G&H model lobbying always decreases the total welfare (except for the extreme case when all industries are represented by the pressure group).

This paper is organized as follows. In Section 2, we review the existing literature analyzing different aspect of tariff lobbying. Section 3 gives an overview of the G&H model. In Section 3 we develop a modified model. In this section we derive the equations for the optimal policy, characterize the equilibrium trade policy, and discuss welfare implications of the lobbying. Section 4 contains concluding remarks and suggests possible directions of research.

2. Literature Overview

The outcome of the political process, in which the structure of trade protection is determined, has an influence on the majority (if not on all) of the economic agents, so it is very important to understand what stands behind this process. Recently, different models were developed to study the role of lobbying and address such questions as: what sectors are more successful in obtaining the certain levels of protection, what contribution should they offer to the incumbent government in order to be protected, and a great number of other issues. Before the menu-action approach was proposed by Bernheim and Whinston(1986), researchers usually assumed the following structure of lobbying: each industry involved in lobbying is characterized by its pressure power, and the more resources industry uses for lobbying, the more pressure it exerts and consequently the more it receives in form of subsidies (or, alternatively, the less it pays as taxes). For example, Becker (1983) analyzed the equilibrium (Cournot-Nash) of the game between the government and interested groups and established the remarkable result – policies rising efficiency are likely to win in the competition between groups.

Bhagwati and Shrinivasan (1980) analyzed the revenue-seeking activity within the general framework of Hecksher-Ohlin-Samuelson's model. Lobbies utilize real resources to get the share in the revenues resulting from the tariff imposition. The central conclusion of this paper is that revenue seeking may be welfare improving.

Another prominent approach in the literature investigates the political motives of the lobby groups. Different political parties announce different trade policy they are going to implement after election. Special interest groups contribute to the party, which policy promises them the highest level of welfare. Parties use these recourses to inform the voters about their political position. One can find the models of this type in the paper of Magge et. al (1989) or in Hillman and Ursprung (1988).

Menu-auctions approach made it possible to analyze the equilibrium strategies in the game between the government and lobbies, when government sets a vector of import and export taxes and subsidies to maximize a weighted sum of the aggregate social welfare and the total contributions made by the pressure

groups. The political equilibrium in such game and corresponding equilibrium contributions of lobbies were derived and thoroughly analyzed by Grossman and Helpman(1994)

This model serves as a basis for my research, so in the next section the overview of this model will be given. Also, I discuss the main results and findings of G&H.

After this prominent paper, Dixit et. al. (1997) extended the menu-auctions approach to allow for the preferences with nontransferable utility , explaining in great detail the situations in which the quasi-linearity assumption does not work.

Finally, I cannot help mentioning recently published book - Grossman and Helpman(2001). It is the most comprehensive work on lobbying. In this book a great number of different lobbying schemes are described and analyzed.

One of the key assumptions made by G&H – no free-riding problem within the pressure groups. Olson (1965) in his famous book gives a detailed analysis of the possible difficulties associated with overcoming free-rider problem. Rodrik (1995) also points out that "free-rider effects should be important in lobbying". As a result, Rodrik expects more concentrated industries to have certain advantages over less concentrated ones in the lobbying process. Nevertheless, recently a number of models were developed, in which the authors claim that, contrary to the intuition, overcoming the free-rider problem is not necessarily more difficult when the number of firms in the industry rises. Pecorino (1998) considers an infinitely repeated game, where cooperation among the firms is maintained through the trigger strategy, when free-riding is punished. His main finding is that cooperation must not break down as the number of firms increases. Moreover, the author claims that this result is valid also in the case of finite punishment period.

The problem of free-riding was investigated empirically, and, in compliance with the conclusions of Pecorino(1998), it is not definitely established that highly concentrated sectors receive more protection (see Potters and Sloof (1996)). In the model developed in this paper I do not consider the problem of free-riding.

As for the empirical testing of the models, in which the government sets the policy subject to the pressure from the interest groups, it tends to be a difficult task. Firstly, in reality the process of lobbying lasts for some time, contrary to the assumptions of many models that interest groups simultaneously offer their contributions and the incumbent government chooses some vector of tariffs. The situation is in fact even worse, because we can not check the plausibility of the assumptions we make – the interest groups and the government are always reluctant to uncover the information about the process of lobbying. So, all these models are likely to give only qualitative predictions about the outcome of lobbying. In Goldberg and Maggi(1999) there is an empirical investigation of the G&H model. The authors use in their research the data for the US economy. They claim that the assumptions made by G&H are rather restrictive and unlikely to produce consistent results. That is why the authors try to incorporate as much knowledge about lobbying as possible, introducing new variables and replacing some parameters of the basic model by what they think are more relevant and more adequate variables. Goldberg and Maggi found that most estimated coefficients are reasonable in terms of both the sign and the magnitude. An interesting finding presented in this paper is the following: given the objective function of the form suggested by G&H, the weight attached to aggregate

welfare equals to 0.98 while the contributions from special interest groups receive much lower weight – only 0.02.

3. Basic Model

My research stems from the model developed by G&H. In this section of the paper brief description of that model is provided. Firstly, this leads to better understanding of the approach to the problem of the endogenous tariff determination adopted by Grossman and Helpman. Secondly, this enables us to compare the results and the features of the basic model with those of the modified version.

The modified model, which will be analyzed in the next section of the paper, is the generalization of the basic model.

G&H consider multi-sector small open economy. Each sector is characterized by a factor of production specific to this particular industry. These factors are owned by the individuals populating the economy. The authors assume that claims to the specific input are indivisible and nontradable. Also it is assumed that any individual owns at most one type of the specific input.

The government may impose tariffs and subsidies on the final goods. Equivalently, we may say that the incumbent government may set any vector of domestic prices of final goods as there is a perfect correspondence between the vector of domestic prices and the vector of tariffs (or subsidies). A natural question arises: who will pay if the net revenue from all taxes and subsidies is negative or, alternatively, who will receive the net revenue if it is positive. G&H assume that the net revenue is distributed uniformly among all those individuals who own one of the specific factors.

Now it is clear why those who own some of the specific inputs have an incentive to form a lobby, trying to influence government's decision. By raising the domestic price of the good, these individuals increase the aggregate reward to the specific factor they own. But the burden from the import tariff is placed upon all individuals and not just those who seek protection. Correspondingly, it turns out that sector *i* gains from an increase in the price of good *i* above its world level.

Although each sector's representatives are better off after banding themselves together for protection, the authors assume that not all specific-factor owners have been able to form a lobby. They do not endogenize the process of lobby formation. It is assumed that in some exogenously given set of industries the owners of the specific factors organized themselves into pressure groups.

The objective function of the government has the following form

$$G = \sum_{i \in L} C_i(\mathbf{p}) + aW(\mathbf{p}) \tag{1}$$

L denotes the set of industries represented by pressure groups, $W(\mathbf{p})$ stands for the aggregate gross-of-contributions welfare, a is the weight the government attaches to total welfare, $C_i(\mathbf{p})$ - contribution schedule put forward by the lobby group i. This function takes account of the re-election considerations, although these considerations do not enter explicitly into the analysis. The incumbent government cares about overall welfare, as voters are more likely to support a government that provides them with a high standard of living.

Likewise, contributions could be used to finance campaign spending and, therefore, also increase the chances of being reelected.

Now I will describe the outcome of the two-stage noncooperative game in which, in the first stage, the interest groups put forward contribution schedules and, in the second stage, the incumbent government sets the policy vector maximizing its objective function given lobbies' schedules. Lemma 2 of Bernheim and Whinston (1986) implies that the equilibrium can be characterized by the following conditions:

PROPOSITION 1 (Structure of Protection): $(\{C_i\}_{i\in L}, \mathbf{p})$ *is a subgame-perfect Nash equilibrium if and only if:*

(a) for all sectors i, $i \in \mathbf{L}$, C_i *is feasible;*

(b) ($\mathbf{p}$) *maximizes* $\sum_{i\in L} C_i(\mathbf{p}) + aW(\mathbf{p})$;

(c) ($\mathbf{p}$) *maximizes* $\sum_{i\in L} C_i(\mathbf{p}) + aW(\mathbf{p}) + W_j(\mathbf{p}) - C_j(\mathbf{p})$ *for* $\mathrm{j} \in \mathbf{L}$;

for all sectors j, $j \in \mathbf{L}$ *there exists* $(\mathbf{p}^j)$ *maximizing* $\sum_{i\in L} C_i(\mathbf{p}) + aW(\mathbf{p})$ *such that* $C_j(\mathbf{p}^j) = 0$.

For complete and detailed discussion of all these conditions one should read the paper of Bernheim and Whinston, where the methodology of menu-auctions is developed and thoroughly analyzed. Here I will give intuitive arguments behind each of the conditions stated in Proposition 1.

Condition (a) is rather obvious, it restricts contribution schedules to be among the exogenously given set of plausible schedules. For example, it is reasonable to assume that the incumbent government will not pay to the interest group after the implementation of some policy, so the contribution schedule can not be negative. On the other hand, no lobby can offer more than total income available for that lobby. There may be some other restrictions imposed on the contribution schedules.

Condition (b) describes the behavior of the government - it sets the trade policy to maximize its own objective function.

Condition (c) is less obvious than previous ones, it states that, for every lobby, the equilibrium policy must maximize the sum of government's objective function and the net-of-contribution welfare of that lobby. Otherwise, as it is proved in Bernheim and Whinston (1986), the lobby could reformulate its schedule to make the government to choose the jointly optimal policy. The lobby itself would then capture almost all the surplus arising from the new policy.

Condition (d) is used for the calculation of equilibrium contributions. As it was shown by Whinston and Bernheim(1986), in general case the contributions made by interest groups can not be uniquely determined – the problem of multiple equilibria. But in the same paper the authors proposed the notion of *truthful Nash equilibria* with *truthful contribution schedules* – the lobby pays the excess of this lobby's welfare relative to some base level. Whinston and Bernheim proved that

1) The set of best responses to any strategies played by the other parties always include truthful strategy.

2) Only truthful equilibria are stable to non-binding communication among the players.

G&H considered several examples to analyze how truthful equilibrium contributions are determined. In case of a single lobby, the incumbent government derives the same level of utility as without any contribution. The lobby captures the entire surplus. In the opposite case, when all individuals are represented in the political process, the competition among lobbies is intense; the policy maker is able to capture the surplus.

In this paper our main interest is the equilibrium policy vector. Also we want to compare welfare under to schemes, namely when lobbying is banned, but the incumbent government does not implement optimal policy, versus the case when lobbing takes place. Quasi-linear environment ensures that contributions paid to the government affect only distribution of wealth among different economic agents, but not the aggregate welfare. So we leave the issue of contributions aside and focus on conditions (b) and (c), which allow us to calculate the equilibrium vector of trade taxes and subsidies.

We assume that all functions that enter into our analysis are differentiable. Given this, condition (c) implies

(2) $$\nabla W_i(\mathbf{p}) - \nabla C_i(\mathbf{p}) + \sum_{i \in L} \nabla C_i(\mathbf{p}) + a \nabla W(\mathbf{p}) = 0 \text{ for all } i \in L$$

The government's maximization of $\sum_{i \in L} C_i(\mathbf{p}) + aW(\mathbf{p})$ requires

(3) $$\sum_{i \in L} \nabla C_i(\mathbf{p}) + a \nabla W(\mathbf{p}) = 0$$

From (3) and (4) it follows that

(4) $$\nabla W_i(\mathbf{p}) = \nabla C_i(\mathbf{p})$$

It means that each lobby shapes its contribution schedule so that it reveals lobby's true preferences (at least, in the neighborhood of the equilibrium). Grossman and Helpman in their paper give an elegant graphical interpretation of this equation.

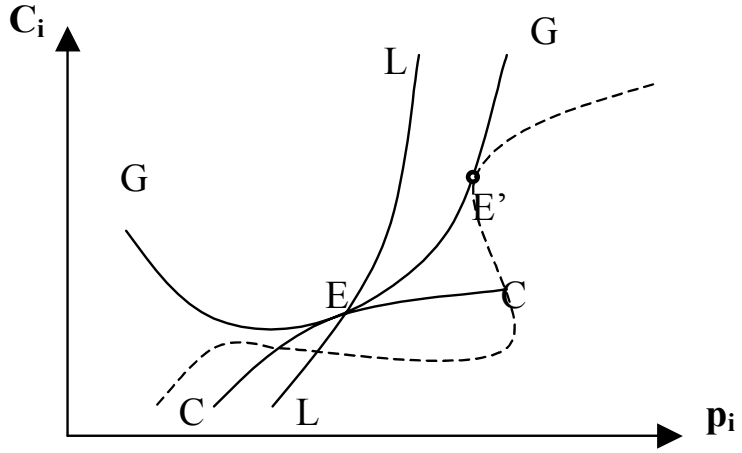

Figure 1. Local Truthfulness

In Figure 1 the curve GG stands for an indifference curve for the government, LL – an indifference curve for lobby *i*, CC- contribution schedule by lobby *i* that would compensate for altering the price of good *i*. Given CC the government maximize its objective function at point E. Suppose that condition (4) does not hold at this point. This means that at the point E curves CC and LL are not tangent to each other. Such being the case, lobby *i* could induce the incumbent agent to choose E', which yields higher welfare for this lobby, by offering a contribution schedule depicted by the dash line in Figure 1. Hence, at the equilibrium point curves CC and LL must be tangent to each other - only in this case the described above procedure of reconfiguring CC line is impossible.

Summing (4) over $i \in L$ and substituting the result into (3) we obtain the equation characterizing equilibrium domestic prices

(5) $$\sum_{i \in L} \nabla W_i(\mathbf{p}) + a \nabla W(\mathbf{p}) = 0 \,.$$

Thus, the equilibrium price vector in a two-stage game between the government and the pressure groups satisfies

(6) $$\mathbf{p} = \arg\max \left[\sum_{i \in L} W_i(\mathbf{p}) + a W(\mathbf{p}) \right]$$

So the government places different weights on different industries. Naturally, industries, represented by lobbies, receive a higher weight in the process of policy determination. It might be noticed at this point that in many papers (e.g., see N.V. Long and N. Vousden (1991)) the authors simply assume that the government attaches different weights to the agents and the agents, represented in the political game, have an advantage over the others. In G&H model the equilibrium of the political game leads to the same result.

The equilibrium trade taxes and subsidies is given by

(7) $$\frac{t_i}{1+t_i} = \frac{I_i - \alpha_L}{\alpha_L + a} \frac{z_i}{e_i}$$ for all *i*=1,2,…,*n*; *n* is the number of final-good sectors .

where t_i - ad valorem trade tax or subsidy imposed on the good produced by sector *i*, $t_i = (p_i - p_i^*)/p_i^*$; z_i is the equilibrium ratio of domestic output to imports and e_i is the elasticity of import demand (if it is negative then it should be rather referred to as export supply), defined by $e_i = -m_i'(p_i) p_i / m_i(p_i)$. I_i is equal to 1 if industry *i* is organized and 0 otherwise, α_L - the fraction of the total population of voters whose interests are represented by a pressure group.

As follows from the equation, firstly, all sectors that are represented by lobbies are protected, i.e. $t_i > 0 \Leftrightarrow p_i > p_i^*$. Moreover, these sectors manage to lower the price of sectors with no organized representation below the world level. Secondly, the higher is the weight the government places on total welfare, all else equal, the smaller are all trade tariffs and subsidies (in absolute value). This result is quite obvious. Free trade is optimal, so as the parameter *a* rises the deviation from free trade gets smaller. Thirdly, as the net government transfers are distributed uniformly among all the individuals, high value of α_L implies that lobbies have to pay much when they bid for a high domestic price and, consequently, high values of α_L

tend to decrease tariffs and subsidies in absolute value. Finally, the influence of z_i and e_i on the magnitude of deviation from free trade can be explained from the viewpoint of welfare considerations. If government's intervention in some particular sector causes significant deadweight losses then for this industry the deviation from free trade will be small. If domestic output is large while import demand is low (and so z_i is large) the economy loses relatively little from rising p_i. Similarly, if import demand elasticity is high then large (in absolute value) trade tax or subsidy results in a great deadweight loss. The last two statements follow from the equation

$$\frac{dW}{dp_j} = (p_j - p_j^*)\frac{dm_j(p_j)}{dp_j} \tag{8}$$

This equation states that marginal deadweight loss grows as the economy is moving away from free trade, and the larger is $\frac{dm_j(p_j)}{dp_j}$ the greater is marginal deadweight loss.

4. Modified Model

As I have mentioned, the economists have not reached an agreement on the circumstances when the government has to interfere in the domestic affairs. Still, there are well-know situations when market leads to an inefficient outcome, e.g. public good provision, externalities and some others. In this paper I consider the case of positive externality resulting from the production of high-technological sector.

The main question is whether the weak government can correct such market failure. There are two ways to think about the notion of *weak* government. Firstly, we may assume that the government cannot evaluate the aggregate welfare correctly; therefore, it cannot implement optimal policy because it just does not know what the optimal policy is. Here another approach to modeling the *weakness* is used. I assume that the government is aware of the overall welfare function, but the objective function of the government is different. The government is assumed to be non-benevolent, taking into account, while making decision, not only the total welfare but also contributions received from pressure groups. So I use the objective function of the form given by the equation (1).

The assumptions of the model are given in Section 4.1 and Section 4.2. Section 4.1 describes the assumptions that were "borrowed" from G&H, while Section 4.2 presents new features, which have been added to the basic model. In Sections 4.3-4.5 we analyze the equilibrium of the lobbying process and consider the welfare implications. When possible, I emphasize how the results of this paper differ from those obtained by G&H.

4.1 Basic Features

We consider small, open economy that faces exogenous world prices. Good 0 is produced from labor with constant returns to scale technology and an input-output coefficient equal to 1. This ensures that in the competitive equilibrium wage rate equals 1. Goods 1,2,…,*n* are manufactured using labor and sector-specific input with constant return to scales technology. Specific inputs are available in inelastic supply, also it is assumed that labor supply is large enough to satisfy demand for labor in all sectors of the economy. The aggregate reward to the specific factor used in the production of the final good depends only on the domestic price of that good. It is denoted by $\pi_i(p_i)$.

The economy is populated by individuals with identical preferences given by

$$u = x_0 + \sum_{i=1}^{n} u_i(x_i) \tag{9}$$

where x_i is consumption of the good *i*, i=1,2,...,*n*; x_0 denotes consumption of the numeraire good. As usual, sub-utility functions are assumed to be differentiable and concave.

An individual spending *E*, with the prices given by vector **p**, derives indirect utility

$$V(\mathbf{p},E)=E+s(\mathbf{p}) \tag{10}$$

$s(\mathbf{p})$ denotes the consumer surplus arising from the consumption of nonnumeraire goods.

Now we have completely described those assumptions of our model, which remained from the model of G&H, and turn to the next section.

4.2 Extension of the Basic Model

In the model of G&H it is assumed that all sectors in the economy are equivalent, the only aspect in which they are different is whether the interests of a sector are represented by a lobbying group or not. In the real world some sectors are considered to be more important for the country's well being. One can easily recall the everlasting debates in Russia about the low technological level and its consequences. Many economists believe that in the long run it is technology and technological progress that determine whether the developing country will be able to catch up with the group of industrialized, developed countries.

There are different approaches to the problem of modeling the technological level. A dynamic framework is used for this purpose in the majority of modern economic models; it is often assumed that today's investment in the R&D activity brings about an improvement in the level of technology in the future. But in this paper, I consider the static framework in order to be able to use "menu actions" methodology (the framework is really static in spite of the fact that the game between lobbies and the government is two-stage). Then the natural question arises: how to take into account the considerations of technological level?

In this model we consider, along with the other sectors, the high-technological sector. It produces the good, which cannot be consumed by individuals, but is used by some of the final-good sectors as an input of production. One way to think about it might be the following: high-technological sector carries out a research resulting in new technologies, later on used by some industries for manufacturing. In other words, we assume that high-technological sector produces *intermediate* good. Technology and research ideas cannot be consumed directly; they affect individuals only through those final goods, production of which involves the use of high-technological good.

Until now it is not quite clear why we use the term *high-technological* for intermediate-good sector. The assumption justifying this is that the operation of these sectors exerts a positive externality on the economy as a whole.

Let us formally describe the new features of the model, which we just have discussed. The economy consists of *n* sectors producing final goods and one sector producing intermediate good. Intermediate good is manufactured by labor and a sector-specific input. I assume that it is the amount of the intermediate good produced that determines the magnitude of the externality effect via the function $E(y^I(q))$. It is assumed that no industry takes into account the externality effect. This is justified if we think about $E(y^I(q))$ as the discounted long-term benefit, which only the government is able to evaluate and consider while making the decision.

At first we start with the assumption that this good is used in the production of all the final goods, along with labor and sector-specific input. All technologies of production exhibit constant returns to scale. The aggregate reward to the specific factor used in the production of the intermediate good depends only on the domestic price of that good .The reward to the specific factors used in the production of the final good depends on the domestic price of that good and also on the domestic price of the intermediate good. I denote these parameters by $\pi^I(q)$, $\pi_i(p_i, q)$ correspondingly. Here superscript *I* stands for *intermediate*, subscript *i* corresponds to sector *i*, *i*=1,2,…,*n*; *q* is the price of intermediate good and p_i is the price of the final good *i*. Superscript * is used to denote the world price of the corresponding good.

In general, the industrial policy includes various instruments. Here we restrict the set of instruments, allowing the government to impose only trade taxes and subsidies. Resulting net revenue of the government is given by

$$(11) \qquad r(\mathbf{p}, q) = \sum_i (p_i - p_i^*)\left[N d_i(p_i) - y_i(p_i, q)\right] + (q - q^*)\left[\sum_i d_i^I(p_i, q) - y^I(q)\right]$$

$d_i(p_i)$ – demand for the good *i*, $y_i(p_i, q)$ – supply of the good *i*, $d_i^I(p_i, q)$ – demand for the intermediate input from *i*-th sector, $y^I(q)$ – supply of the intermediate good, N- the total population in the economy. As it has been mentioned before, this revenue is distributed uniformly over all individuals (if it is negative, "distributed" in fact means taken away). We will need the expression for the overall social welfare, so here it is

(12) $$W(\mathbf{p},q) = l + \sum_i \pi_i(p_i,q) + \pi^I(q) + r(\mathbf{p},q) + Ns(\mathbf{p}) + E(y^I(q))$$

l represents total labor supply and, at the same time, total labor income (because wage rate is equal to 1).

As follows from the title of this paper, the aim of this research is to evaluate the welfare effect of government intervention into the process of setting trade tariffs, i.e. whether it is advantageous, relative to free trade, for the economy as a whole to let the government to determine the structure of protection. But at the same time it is equivalent to picking out the factors and parameters of the model determining the magnitude of deviation from the first-best policy. Because of this, before we proceed and describe and equilibrium in the political game let us find the optimal tariff policy, i.e. the domestic price vector maximizing aggregate welfare.

PROPOSITION 2 (First-Best Policy): *With the total welf*are *function described by (12), the first-best policy requires positive import tariffs for all the final goods and also for the intermediate good.*

PROOF: Differentiating (12) with respect to p_j yields

$$\frac{\partial W}{\partial p_j} = y_j(p_j,q) + (p_j - p_j^*)\frac{\partial m_j(p_j,q)}{\partial p_j} + Nd_j(p_j) - y_j(p_j,q) +$$

$$+ (q - q^*)\frac{\partial d_j^I(p_j,q)}{\partial p_j} - Nd_j(p_j) = (p_j - p_j^*)\frac{\partial m_j(p_j,q)}{\partial p_j} + (q - q^*)\frac{\partial d_j^I(p_j,q)}{\partial p_j} = 0$$

$m_j(p_j,q)$ denotes the net import of final good j, $m_j(p_j,q) = Nd_j(p_j) - y_j(p_j,q)$.

In deriving this expression we used the fact (Hotelling's lemma) that $\frac{\partial \pi(p_j,q)}{\partial p_j} = y_j(p_j,q)$.

The derivative with respect to the price of intermediate good q is given by

$$\frac{\partial W}{\partial q} = -\sum_{j=1}^{n} d_j^I(p_j,q) + y^I(q) + (q - q^*)\frac{\partial m^I(\mathbf{p},q)}{\partial q} + \sum_{j=1}^{n} d_j^I(p_j,q)) -$$

$$- y^I(q) - \sum_{j=1}^{n}(p_j - p_j^*)\frac{\partial y_j(p_j,q)}{\partial q} + E'\frac{\partial y^I(q)}{\partial q} =$$

$$= (q - q^*)\frac{\partial m^I(\mathbf{p},q)}{\partial q} - \sum_{j=1}^{n}(p_j - p_j^*)\frac{\partial y_j(p_j,q)}{\partial q} + E'\frac{\partial y^I(q)}{\partial q} = 0$$

$m^I(\mathbf{p},q)$ - net import of the intermediate good, $m^I(\mathbf{p},q) = \sum_{j=1}^{n} d_j^I(p_j,q) - y^I(q)$. Again, Hotelling's lemma was used to substitute $\frac{\partial \pi(p_j,q)}{\partial q}$ for $-d_j^I(p_j,q)$.

To summarize, the optimal policy is given by the following equations

(13) $$(p_j - p_j^*)\frac{\partial m_j(p_j,q)}{\partial p_j} + (q - q^*)\frac{\partial d_j^I(p_j,q)}{\partial p_j} = 0$$

(14) $$(q - q^*)\frac{\partial m^I(\mathbf{p},q)}{\partial q} - \sum_{j=1}^{n}(p_j - p_j^*)\frac{\partial y_j(p_j,q)}{\partial q} + E'\frac{\partial y^I(q)}{\partial q} = 0$$

Now it is easy to see that the first-best solution calls for the protection of all final-good sectors and the sector producing the intermediate good as well. As long as $E' \frac{\partial y^I(q)}{\partial q} > 0$, which is assumed to be the case, one vector of the possible solutions of the equation (13), namely $p_j = p_j^*; q = q^*$ for all *j*=1,2,…, *n*, does not constitute the solution to (14). As follows from (14), when $p_j = p_j^*; q = q^*$ the derivative of the total welfare with respect to q is positive, therefore, if $W(\mathbf{p}, q)$ is a concave, single-peaked function, $q > q^*$. But if we look at (13), then, because $\frac{\partial m_j(p_j, q)}{\partial p_j} < 0, \frac{\partial d_j^I(p_j, q)}{\partial p_j} > 0$, it must also be the case that $p_j > p_j^*$ for all *j*. Q.E.D.

At first glance, it may seem puzzling – why import taxes should be levied on the final goods, production of which has no externality effect. This happens, because protection of high-the technological sector tends to decrease the profits of the firms using intermediate good. This, in turn, adversely affects the total welfare. Therefore, optimally the protection should be "spreaded" over the sectors using high technology for manufacturing.

In the real world it is unlikely that optimally all industries have to be protected. Because of this reason and also in order to make the model more general, henceforth I consider the situation when intermediate good is used by some (not all) of the final-good producers. In this case, the first-order condition with respect to the price of the sector not using intermediate input has the same form as (13), but without the term $(q - q^*)\frac{\partial D_j(\mathbf{p}, q)}{\partial p_j}$. Consequently, the domestic price for such sectors equals to the world price in the optimum.

To summarize, optimally the government should stimulate the production in the high-technological sector by pushing up the price above the world level. But because of the negative influence on the profits of the sectors using intermediate input, in the optimum these sectors have to be compensated also. In those sectors, in which the intermediate input is not used, free trade is optimal.

A word of caution is in place at this stage of the paper. Firstly, we do not consider the case of the negative externalities. Tobacco and alcohol-producing industries are notorious examples of the sectors imposing negative effect on the society as a whole. Obviously, not considering such sectors makes the model incomplete and requires elaboration of this aspect. There is an interesting point of view among some economists. Huge oil&gas sector (like the one in Russia) generates enormous profits, some share of which is paid to the government in form of taxes. This makes the government reluctant to undertake some serious measures (developing new institutions, improving legal system, etc) in the other sectors. Given this, it is argued that oil&gas sector might be treated as the sector producing negative externality.

Secondly, in the light of our model such sectors in the optimum should suffer from low domestic prices implied by import subsidies or export taxes. What is the result of such trade policy? Cigarettes and

alcohol are cheap, amount of these goods consumed is large, consequently, the negative effect is strong – trade policy failed to achieve its goals. The thing is that in this case it is the consumption of the good that exerts negative externality. This example is given to illustrate the idea that one has to be very careful describing formally where externality stems from and how it affects the aggregate welfare. Otherwise, it is easy to get the wrong conclusions. Introducing new features into the basic model, I assume that it is the *production* of the intermediate good that brings about positive externality.

4.3 Structure of Protection

From now on, all sectors, producing the final good and not using a high-technological input, will be referred to as *type 1* sectors. Those sectors, producing final good and using intermediate good, as *type 2* sectors. The remaining sector, which produces high-technological good, will be referred to as *type 3* sector. All variables will have an upperscript – *1*,*2* or *3* – denoting that this variable is related to the corresponding type. The modified expression for the net government revenue is

$$r(\mathbf{p},q)=\sum_{i=1}^{n}(p_i^1-p_i^{1^*})\left[Nd_i(p_i^1)-y_i^1(p_i^1)\right]+$$

(15)

$$\sum_{i=1}^{m}(p_i^2-p_i^{2^*})\left[Nd_i(p_i^2)-y_i^2(p_i^2,q)\right]+(q-q^*)\left[\sum_{i=1}^{m}d_i^3(p_i^2,q)-y^3(q)\right]$$

Suppose that *n* industries of *type 1* are represented by lobby, while the number of *type 2* industries is *m*. From the equation for the equilibrium structure of protection it can be seen, that in general case we need to know how each sector responds to the price vector's alteration. For this purpose, now we explicitly write the expressions for the each sector's welfare and for the derivatives with respect to all individual prices. In the following equations α_i^k denotes the fraction of the total population representing industry *i* of *type k*;

$$\delta_{ij}=\begin{cases}1, & if\ i=j\\ 0, & otherwise\end{cases}$$

Type 1:

$$W_i^1(\mathbf{p},q)=l_i^1+\pi_i^1(p_i^1)+\alpha_i^1\left[r(\mathbf{p},q)+Ns(\mathbf{p})\right]$$

$$\frac{\partial W_i^1(\mathbf{p},q)}{\partial p_j^1}=(\delta_{ij}-\alpha_i^1)y_j^1(p_j^1)+\alpha_i^1(p_j^1-p_j^{1^*})\frac{\partial m_j^1(p_j^1)}{\partial p_j^1}$$

$$\frac{\partial W_i^1(\mathbf{p},q)}{\partial p_j^2}=-\alpha_i^1y_j^2(p_j^2)+\alpha_i^1(p_j^2-p_j^{2^*})\frac{\partial m_j^2(p_j^2)}{\partial p_j^2}+\alpha_i^1(q-q^*)\frac{\partial d_j^2(p_j^2,q)}{\partial p_j^2}$$

$$\frac{\partial W_i^1(\mathbf{p},q)}{\partial q}=-\alpha_i^1\sum_{j=1}^{m}(p_j^2-p_j^{2^*})\frac{\partial y_j^2(p_j^2,q)}{\partial q}+\alpha_i^1(q-q^*)\frac{\partial m^3(\mathbf{p},q)}{\partial q}+\alpha_i^1m^3(\mathbf{p},q)$$

Type 2:

$$W_i^2(\mathbf{p},q) = l_i^2 + \pi_i^2(p_i^2, q\ ) + \alpha_i^2\left[r(\mathbf{p},q) + Ns(\mathbf{p})\right]$$

$$\frac{\partial W_i^2(\mathbf{p},q)}{\partial p_j^1} = -\alpha_i^2 y_j^1(p_j^1) + \alpha_i^2(p_j^1 - p_j^{1^*})\frac{\partial m_j^1(p_j^1\ )}{\partial p_j^1}$$

$$\frac{\partial W_i^2(\mathbf{p},q)}{\partial p_j^2} = (\delta_{ij} - \alpha_i^2) y_j^2(p_j^2\ , q) + \alpha_i^2(p_j^2 - p_j^{2^*})\frac{\partial m_j^2(p_j^2\ , q)}{\partial p_j^2} + \alpha_i^2(q - q^*)\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2}$$

$$\frac{\partial W_i^2(\mathbf{p},q)}{\partial q} = -d_i^2(p_i, q) - \alpha_i^2 \sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + \alpha_i^2(q - q^*)\frac{\partial m^3(\mathbf{p},q)}{\partial q} + \alpha_i^2 m^3(\mathbf{p},q)$$

Type 3:

$$W^3(\mathbf{p},q) = l^3 + \pi^3(q\ ) + \alpha^3\left[r(\mathbf{p},q) + Ns(\mathbf{p})\right]$$

$$\frac{\partial W^3(\mathbf{p},q)}{\partial p_j^1} = -\alpha^3 y_j^1(p_j^1) + \alpha^3(p_j^1 - p_j^{1^*})\frac{\partial m_j^1(p_j^1\ )}{\partial p_j^1}$$

$$\frac{\partial W^3(\mathbf{p},q)}{\partial p_j^2} = -\alpha^3 y_j^2(p_j^2\ , q) + \alpha^3(p_j^2 - p_j^{2^*})\frac{\partial m_j^2(p_j^2\ , q)}{\partial p_j^2} + \alpha^3(q - q^*)\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2}$$

$$\frac{\partial W^3(\mathbf{p},q)}{\partial q} = y^3(q) - \alpha^3 \sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + \alpha^3(q - q^*)\frac{\partial m^3(\mathbf{p},q)}{\partial q} + \alpha^3 m^3(\mathbf{p},q)$$

The overall welfare:

$$W(\mathbf{p},q) = l + \sum_{i=1}^{n}\pi_i^1(p_i^1\ ) + \sum_{i=1}^{m}\pi_i^2(p_i^2, q\ ) + \pi^3(q) + N\left[r(\mathbf{p},q) + s(\mathbf{p})\right] + E(y^3(q))$$

$$\frac{\partial W(\mathbf{p},q)}{\partial p_j^1} = (p_j^1 - p_j^{1^*})\frac{\partial m_j^1(p_j^1\ )}{\partial p_j^1}$$

$$\frac{\partial W(\mathbf{p},q)}{\partial p_j^2} = (p_j^2 - p_j^{2^*})\frac{\partial m_j^2(p_j^2, q\ )}{\partial p_j^2} + (q - q^*)\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2}$$

$$\frac{\partial W(\mathbf{p},q)}{\partial q} = -\sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*)\frac{\partial m^3(\mathbf{p},q)}{\partial q} + \frac{\partial y^3(q)}{\partial q}E'$$

Firstly, consider the case when the industry, producing the intermediate input, is not represented by lobby in the political game. Substituting the obtained expressions (they, in fact, characterize gradient of the

welfare function for every sector) into the equation (5) we have the following expressions for equilibrium policy:

Type 1 Sectors:

$$(I_j^1 - \boldsymbol{\alpha}) y_j^1(p_j^1) + \boldsymbol{\alpha}(p_j^1 - p_j^{1*}) \frac{\partial m_j^1(p_j^1)}{\partial p_j^1} + a(p_j^1 - p_j^{1*}) \frac{\partial m_j^1(p_j^1)}{\partial p_j^1} = 0$$

Now it is easy to get the expression for $p_j^1 - p_j^{1*}$

$$p_j^1 - p_j^{1*} = -\frac{(I_j^1 - \boldsymbol{\alpha}) y_j^1(p_j^1)}{\boldsymbol{\alpha} + a} \left[\frac{\partial m_j^1(p_j^1)}{\partial p_j^1} \right]^{-1}$$

This equation is the same as the one obtained by G&H. Our modification of the model enters into this equation only through parameter $\boldsymbol{\alpha}$, which in the modified model includes also the individuals from the sectors that we add into the model. Equilibrium protection in *type 1* sectors does not depend on the equilibrium protection in *type 2* and *type 3* sectors.

Type 2 Sectors:

$$(I_j^2 - \boldsymbol{\alpha}) y_j^2(p_j^2, q) + (\boldsymbol{\alpha} + a) \left[(p_j^2 - p_j^{2*}) \frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2} + N(q - q^*) \frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2} \right] = 0$$

$$p_j^2 - p_j^{2*} = -\frac{(I_j^2 - \boldsymbol{\alpha}) y_j^2(p_j^2, q)}{\boldsymbol{\alpha} + a} \left[\frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2} \right]^{-1} - N(q - q^*) \frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2} \left[\frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2} \right]^{-1}$$

The expression for $p_j^2 - p_j^{2*}$ is made up of two terms. One has the same form as for *type 1* sectors, the other being an increasing function of *q*. This follows from the fact that $\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2}$ is positive, while the term $\frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2}$ is negative.

Type 3 Sector:

$$-\sum_{i \in L} d_i^2(p_i, q) + (\boldsymbol{\alpha} + \mathbf{a}) \left[-\sum_{j=1}^{m} (p_j^2 - p_j^{2*}) \frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*) \frac{\partial m^3(\mathbf{p}, q)}{\partial q} \right] + \boldsymbol{\alpha} m^3(\mathbf{p}, q)$$

$$+ a \frac{\partial y^3(q)}{\partial q} E' = 0$$

We will not solve this equation explicitly. It is clear that equations describing equilibrium domestic prices for *type 3* sector and *type 2* sectors comprise a system of equations and so have to be solved simultaneously. Our main interest is not the final expression for protection in different sectors, because in any case without specifying the exact form of profit functions, consumer preferences, etc, we are unable to calculate the outcome of lobbying. Mostly what we are interested in is how different factors influence tariffs and/or subsidies levied on different goods.

Firstly, we notice that even though sector, producing high-technological good, is not represented by lobby it is not necessarily the case that $q < q^*$.

If *type 3* sector participates in influencing incumbent government's decision, the last equation changes in a simple way

$$y^3(q) - \sum_{i \in L} d_i^2(p_i, q) + (\boldsymbol{\alpha} + \mathbf{a}) \left[-\sum_{j=1}^{m} (p_j^2 - p_j^{2^*}) \frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*) \frac{\partial m^3(\mathbf{p}, q)}{\partial q} \right] + \boldsymbol{\alpha} m^3(\mathbf{p}, q)$$

$$+ a \frac{\partial y^3(q)}{\partial q} E' = 0$$

Again, contrary to the result for *type 1* sector, it might be the case that $q < q^*$ - despite the fact that high-technological industry devotes the resources to lobbying, it receives no protection.

The conditions derived are just the first-order conditions necessary for the maximization in (6). If we assume that maximization takes place within a compact set of possible prices, then, firstly, the maximum exists and, secondly, it satisfies first-order conditions we have derived. I disregard the possibility of corner solutions. Also I do not analyze the possible cases of multiple local extreme points. Interesting from the mathematical viewpoint, these cases do not deserve much attention from the economic perspective.

4.4 Welfare Implications

Having derived the equilibrium trade policy we now turn to the issue of aggregate welfare with and without lobbying. In general case we can not establish the conditions for the lobbying to be welfare-improving, because without specifying the utility functions for all individuals and the production functions for all industries we can not solve analytically the equations describing the equilibrium of the political game. Furthermore, specifying exact form of these functions and getting some results make sense only if we consider some particular problem with known consumers' preferences and production functions. The results thus obtained could hardly be generalized to be valid under different settings. In this paper it is more important to adhere to a general form and to discuss the factors that determine the deviation of tariffs and/or subsidies from the optimal level. This is equivalent to answering the question of whether lobbying is better than free trade: if the deviation is relatively low then it is likely that welfare with lobbying is greater than the one with free trade.

There are several possible ways of how to assess the effect of political pressure. Firstly, if one is able to prove that the outcome of lobbying is free trade in *type 1* sectors and positive import tariffs in *type 2* and

type 3 sectors, not exceeding the corresponding optimal level, it can be stated that "lobbying" outcome is better than "no-government-intervention" outcome. This statement is based on the assumption that function $W(\mathbf{p},q)$ is single-peaked and concave, which are quite reasonable assumptions to make. We may also assume another property of $W(\mathbf{p},q)$, which is more restrictive, namely the "symmetry" of $W(\mathbf{p},q)$ with respect to the deviation from the optimum. This means, that if we alter the price of one good, all other prices being fixed, then welfare in case of a positive deviation from the optimal level equals to welfare in case of a negative deviation of the same magnitude. If this property holds, then we can claim that lobbying increases welfare even if import tariffs in *type 2* and *type 3* sectors exceed the optimal level, given that this deviation is less in absolute value than optimal value itself.

Second approach is also serves to give some ideas about the factors and parameters of the model, which might be helpful in comparing the overall welfare under two settings: with and without lobbying activity. It rests upon the assumption of the stability of the obtained system of simultaneous equations characterizing equilibrium trade policy. By stability I mean that if we alter a little the parameters of the equation, then the solution will change only slightly. This assumption enables us to claim that if we make an infinitesimal modification of the equations describing first-best policy, the solution will also be altered infinitesimally. Consequently, we will be able to determine the parameters, small values of which guarantee that lobbying improves the social welfare. In general, this approach could hardly be implemented, but in some extreme cases we may be able to find in what circumstances lobbying is advantageous.

4.5 Special Cases

Firstly, it should be mentioned that if one parameter, namely a – weight, placed by the government on the total welfare in its objective function, is large enough then lobbying improves welfare regardless of the other parameters. This follows from the fact, that when a increases more and more, the incumbent government cares about contributions less and less, so the equilibrium policy tends to the optimal solution. Further in our discussion I consider only the other parameters.

Example 1: Represented Special Interests Are Concentrated. - It is important to understand that by high concentration of special interests we do not mean that the number of lobbies is small. This case corresponds to the situation when pressure-group members account for a very small fraction of the total number of individuals populating the economy. As a result, if we consider the welfare function of the industry represented by lobby, the term $\alpha_i N\left[r(\mathbf{p},q)+s(\mathbf{p})\right]$ is negligible and, hence, the members of lobby derive almost no surplus from consuming final goods (compared to how much they derive as the owners of specific factor). Consequently, each lobby is willing to influence the government's decision concerning only its own sector. Formally, if α=0 then three equilibrium conditions in the case, when high-technological sector is not represented by lobby, have the following form

$$p_j^1 - p_j^{1^*} = -\frac{I_j^1 * y_j^1(p_j^1)}{a}\left[\frac{\partial m_j^1(p_j^1)}{\partial p_j^1}\right]^{-1}$$

$$I_j^2 * y_j^2(p_j^2, q) + a\left[(p_j^2 - p_j^{2^*})\frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2} + N(q - q^*)\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2}\right] = 0$$

$$-\frac{1}{a}\sum_{i\in L} d_i^2(p_i, q) - \sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*)\frac{\partial m^3(\mathbf{p}, q)}{\partial q} + \frac{\partial y^3(q)}{\partial q}E' = 0$$

It can be seen, that if only sectors of *type 2* participate in influencing the decision-maker, then lobbying is likely to be advantageous given 1) the output of represented industry is small and so $I_j^2 * y_j^2(p_j^2, q)$ is negligible, 2) the total demand for intermediate input from only those industries, which are represented by lobbies, is relatively small, which means that the term $-\frac{1}{a}\sum_{i\in L} d_i^2(p_i, q)$ is small.

If *type 3* sector is lobbying, the last equation changes to

$$\frac{1}{a}(y^3(q) - \sum_{i\in L} d_i^2(p_i, q)) - \sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*)\frac{\partial m^3(\mathbf{p}, q)}{\partial q} + \frac{\partial y^3(q)}{\partial q}E' = 0$$

In this case, condition 1) holds, but condition 2) alters – what matters is not lobbies' demand for intermediate good, but the difference between production of high-technological good and demand from lobbies. In general, this proposition obviously does not hold (or, if it holds, it has to be proved by the detailed analysis of this system of equations; from the given above reasoning it would be incorrect to claim that the effect of high-technological lobby is always positive).

Example 2 All Industries are Represented by Pressure Group. - This case is interesting to analyze, because in many economic models deadweight losses are minimized when all agents participate in lobbying (or in rent-seeking activity). In the model of G&H the outcome of lobbying under this assumption is free trade, i.e. socially optimal outcome. In our model, as it can be easily seen, in this case we have free trade in *type 1* sectors, the equations describing equilibrium in the other types of sectors are

$$(p_j^2 - p_j^{2^*})\frac{\partial m_j^2(p_j^2, q)}{\partial p_j^2} + N(q - q^*)\frac{\partial d_j^2(p_j^2, q)}{\partial p_j^2} = 0$$

$$(1 + \frac{1}{a})\left[-\sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*)\frac{\partial m^3(\mathbf{p}, q)}{\partial q}\right] + \frac{\partial y^3(q)}{\partial q}E' = 0$$

So, this case is rather simple. The second equation differs from the corresponding equation for the optimum only in that it contains the term $\frac{1}{a}\left[-\sum_{j=1}^{m}(p_j^2 - p_j^{2^*})\frac{\partial y_j^2(p_j^2, q)}{\partial q} + (q - q^*)\frac{\partial m^3(\mathbf{p}, q)}{\partial q}\right]$. So, if either *a* is large enough or the expression in brackets is small the effect of lobbying would be positive. An interesting

property of this framework is that as *a* tend to zero the equilibrium tariff vector tends to zero also – free trade! This result is rather obvious, if the government does not care about the aggregate welfare, but only about the welfare of pressure groups, then, if every industry is represented, all industries' welfare constitutes the aggregate welfare, but without externality effect. As a result, the government implements free trade.

Example 3: General Case. - As it has been already mentioned, in general case it is difficult (if not impossible) to compare welfare with and without lobbying. Previously, we have discussed the process of lobbying and its effect, but our reasoning was not rigorous from the mathematical viewpoint. We were not even able to prove that simultaneous equations for the equilibrium trade policy have a solution. Of course, from the economic viewpoint, it is unlikely that there is no policy vector maximizing government's objective function. So any possible example, when this system does not have a solution, is probably describes some imaginary framework and not the reality. Nevertheless, a better way to show that our approach can produce reasonable results is to give some concrete example by specifying the structure of our economy and solving the equilibrium equations.

For simplicity, I assume that all *type 1* sectors are identical as well as all sectors of *type 2*. *Identical* in our case means, firstly, that the amount of the specific factor is the same among the industries of the same type, and, secondly, the production function is common for all sectors of the same type. Moreover, another simplifying assumption is that the number of *type 1* sectors equals the number of *type 2* sectors and is equal to *n*. The world prices of all goods are assumed to be unity. I assume that population is distributed uniformly among all sectors, also I take the total population to be *N*=1.

Each sector's technology is given by the Cobb-Douglas production function. *Type 1* sectors and *type 3* sector use labor and a sector-specific input. As we have assumed that any sector-specific input is owned by the firms and available in inelastic supply, such firms are actually choose only how much labor to hire. Therefore, it is valid to write the production function for these industries in the following form:

$y^1 = f^1(L) = \sqrt{L}, \quad y^3 = f^3(L) = \sqrt{L}$, L – the amount of labor used in production

Similar reasoning for the *type 2* sectors allows writing the production function as

$y^2 = f^2(x^I, L) = (x^I L)^{1/3}$, L – is, again, the amount of labor, x^I - the amount of high-technological good used in production.

Corresponding profit functions for these cases is easy to obtain, they are given by $\pi^1(p^1) = (p^1/2)^{\mathbf{2}}$, $\pi^3(q) = (q/2)^{\mathbf{2}}$, $\pi^2(p^2, q) = \dfrac{(p^2)^{\mathbf{3}}}{27q}$. Bold digits are used to denote raising to the power.

Taking the first derivative of the profit function with respect to price gives the supply behavior of the firm: $y^1(p^1) = p^1/2$, $y^3(q) = q/2$, $y^2(p^2, q) = \dfrac{(p^2)^{\mathbf{2}}}{9q}$. Demand for the intermediate input by *type 2* sectors is given by $d^3(p^2, q) = -\dfrac{\partial \pi^2(p^2, q)}{\partial q} = \dfrac{(p^2)^{\mathbf{3}}}{27q^{\mathbf{2}}}$

Consumers' demand is taken to be linear in price. Also I assume that the value of different final goods to the consumers is the same, so we may write $d_i(p_i) = A - p_i$, A is the constant large enough to ensure that for all possible values of price the demand is positive. With such specification of the demand functions, the consumer surplus is given by $s(\mathbf{p}) = (1/2)\left[\sum_{i=1}^{n}(A - p_i^1)^2 + \sum_{i=1}^{n}(A - p_i^2)^2\right]$.

Substitution of the obtained expressions into the identity for the net government transfer yields

$$r(\mathbf{p},q) = \sum_{i=1}^{n}(p_i^1 - p_i^{1*})\left[N(A - p_i^1) - (p_i^1/2)\right] +$$
$$\sum_{i=1}^{n}(p_i^2 - p_i^{2*})\left[N(A - p_i^2) - \frac{(p_i^2)^2}{9q}\right] + (q - q^*)\left[\sum_{i=1}^{n}\frac{(p_i^2)^3}{27q^2} - (q/2)\right]$$

Now we are ready to apply the conditions characterizing the first-best trade policy. Irrespective of the specification, free trade is optimal in *type 1* sectors. For the other sectors, substituting the obtained expression, we have

$$(17)\quad (p_j - p_j^*)\frac{\partial\left[N(A - p_j^2) - \frac{(p_j^2)^2}{9q}\right]}{\partial p_j} + (q - q^*)\frac{\partial\left(\frac{(p_j^2)^3}{27q^2}\right)}{\partial p_j} = 0$$

$$(18)\quad (q - q^*)\frac{\partial\left[\sum_{i=1}^{n}\frac{(p_j^2)^3}{27q^2} - (q/2)\right]}{\partial q} - \sum_{j=1}^{n}(p_j^2 - p_j^{2*})\frac{\partial\left[\frac{(p_i^2)^2}{9q}\right]}{\partial q} + (1/2)E' = 0$$

Of course, we can simplify this equation by taking the derivatives, but even at this point it can be seen that it is impossible to solve these equations analytically. That is why I used the computer package "Mathematica 4" for numerical calculations. I have done a lot of simulations, altering the lobbies' participants in many ways, also using different specification for the externality function. The most robust result, which is not always true but in most cases it is valid, is the following: the outcome of lobbying is likely to improve the overall welfare when the lobbying process is "balanced", i.e. the number of participants from each sector's type is "almost" the same. Second important condition is that the overall number of pressure groups should be either very small or very large. The intuition is clear: from the condition for the equilibrium $\sum_{i\in L}\nabla W_i(\mathbf{p}) + a\nabla W(\mathbf{p}) = 0$ it follows that if we omit the term $\sum_{i\in L}\nabla W_i(\mathbf{p})$ then the first-order condition leads to first-best trade policy. So it is this term that brings about the deviation from the optimum. If the number of pressure groups is small, they are unable to bring about significant distortion. On the other hand, as the number of lobbies increases, the total welfare of these lobbies gets closer to the overall social welfare and so the policy vector tends to the optimal one.

5. Summary and Possible Extensions

We have considered the model with high-technological good used as a factor of production by the final good producers. This small modification of the basic model brings about a large number of interesting properties, in which the model differs from the basic version. Firstly, under the assumptions that were made free trade is no longer optimal – high-technological industry as well as all sectors using the output of this industry have to be protected in the optimum. Only in the remaining sectors free trade is desirable.

In the basic model the overall effect of lobbying is almost always negative. Free trade, which is optimal under the assumptions of that model, is reached only when the interest groups represent all sectors. Clearly, in the real world it is unlikely that every industry could have a lobby protecting this industry's interests.

According to the modified model, even when some sectors are not represented, lobbying may improve the overall welfare. Nevertheless, there does not exist a condition applicable in any case, which says when lobbying is better than free trade. For some special cases, we were able to find the sufficient conditions for the lobbying to improve the social welfare.

The other results of the model are also of interest. We have obtained the equilibrium structure of protection after the modification of the G&H's model. The main differences from the basic model is: for the sector producing intermediate good as well as for the sector using this good, it is not crucial for getting the protection whether the sector participates or not in the process of lobbying. In the basic model each represented sector enjoys the domestic price exceeding the world level, while on the goods of all the other sectors import subsidy is levied. Another interesting feature is that the price in the industry using intermediate good depends positively on the equilibrium tariff imposed on the intermediate good. Roughly, this can be used to explain the phenomenon of "tariff escalation" – escalation of nominal protection with the degree of processing. It should be noted that these results concerning the protection in the high-technological sector are also valid if we disregard the externality effect.

As for the possible extensions of the model, then there are two different ways. The first one is, staying within the same framework, to analyze how the results of the model change when we add new features. For example, we may consider the situation when different sectors use different intermediate inputs, or we may investigate the case with a multi-stage processing. Clearly, this would make the model more adequate in describing the production side of the economy. However, as the model presented in this paper illustrates, even small modification of the G&H' model causes the great difficulties in solving the model. Besides, such modifications tend to stress the importance of the intermediate-good considerations, while I believe that it is more important to focus on the issue of technological progress. This paper analyzes the static model, in which the effect of technological progress is modeled by assuming that manufacturing in high-technological sector brings about positive externality. Clearly, it would be better to model the technological progress the way it goes in the real world, namely in the dynamic framework. For example, we may consider the infinite-horizon game in which lobbying happens in each period. The government,

choosing the trade policy vector in each period, takes into account the fact that by protecting the high-technological sector it promotes economic growth. At the same time, a high degree of protection, which implies that the price of the advanced technologies is high, draws the profits of the domestic producers down. Given these assumptions, it would be interesting to calculate the integral of the utility of representative individual over the lifetime when the government does not take any measures and when it does, subject to the pressure from the interest groups.

Another interesting problem, which could be analyzed in the dynamic framework, is how a country can attract the high-technological industries into the economy if they are missing. It might well be the case that if these industries could influence the decision-maker and get some protection, then they would decide to enter into the economy and would raise the overall welfare, while without lobbying it would not happen.

6. References

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