Tariff Formation in Upstream Industries with Labor Interests[*]

Johannes Sandkuehler[†]

First version: October 2004
This version: May 2005

Abstract

The political economy literature on trade policy has up to now focused on the explanation of tariffs on final goods. My approach extends the seminal model of tariff formation by Grossman and Helpman (1994) to intermediate goods and labor interests. Thereby I can explain empirical findings that show higher trade barriers in final than in intermediate good sectors. The consideration of labor interests gives new insights into the interactions of trade and labor market policy. The effects of labor market distortions on tariffs on intermediate goods differ from the effects on tariffs on final goods. Thus, recent results in literature (e.g. Rama and Tabellini 1998) have to be restated, since they depend crucially on the analysis of final good sectors.

JEL Classification: F13, F16, D72
Keywords: Trade Protection, Intermediate Goods, Labor Market

1 Introduction

The explanation of tariff variances across industries has evoked a lot of research activity at least since the early nineties. The seminal approach of Grossman and Helpman (1994) explains different tariffs across industries by introducing lobbying into the analysis. Following Grossman and Helpman, a branch of political economy literature extended[1] and tested[2] their model in a variety of settings. Interestingly, all these papers focus on the tariff formation in final good sectors rather than intermediate good sectors. But trade with intermediate goods covers around half of developed countries' trade and several empirical studies (Baack and Ray 1983, Marvel and Ray 1983, Ray 1991) show systematic differences between the protection of final good sectors and of intermediate good sectors. Thus, the aim of this paper is to analyze the tariff formation in intermediate good sectors. The main questions that arise are: Where do the differences in protection between final and intermediate good sectors come from? Do the determinants in tariff formation effect tariffs on intermediate goods in the same way as tariffs on final goods? Which new effects have to be considered for tariff formation in intermediate good sectors? To answer these questions, this paper does not restrict interest to final goods, but additionally integrates intermediate goods in the framework of Grossman and Helpman (1994). It is shown that differences in protection are mainly driven by the different conflicts of interests that occur in intermediate good sectors in comparison to final good sectors. Protection of intermediate good sectors hurts final good producers and thus induces them to engage against it. Hence, there is a conflict between two groups of producers, while in final good sectors producers' interests are in conflict with consumers' interests alone. Lobbying against a large group of consumers, that is only slightly affected by a tariff, leads to other results than lobbying against a small group of producers, that is affected substantially by a tariff.

A second direction in which my model extends Grossman and Helpman deals with labor market distortions. While the role of specific capital interests in tariff formation has often been emphasized, there is only little research which integrates labor market interests (Rama and Tabellini 1998 and Matschke 2004). This is surprising since empirics show that labor issues matter in tariff formation (e.g., Andersen 1980, Marvel and Ray 1983, and Ray 1991). In the original Grossman and Helpman framework, labor is

---

[1]See, e.g., Maggi and Rodriguez-Clare 2000, Matschke 2004, Mitra 1999, and Rama and Tabellini 1998.

[2]See, e.g., Eicher and Osang 2002, Eshahani 2002, Gawande and Bandyopadhyay 2000, Goldberg and Maggi 1999, and Matschke and Sherlund 2003.

assumed to be mobile across sectors. Thereby, only sector specific capital benefits from protection and organizes itself in lobby groups to increase its sectoral tariff. However, besides capital owners, employees also benefit from trade protection. Both sectoral employment and wages increase if tariffs rise.[3] Thus, labor unions have an incentive to influence trade policies, too. While capital owners and labor unions agree upon the desired direction of trade policy, they disagree concerning labor market policies. Employees want to be protected by the government via unemployment benefits, while capital owners oppose them. An empirical paper by Matschke and Sherlund (2003) confirms the explanatory power of labor market interests within a modified Grossman and Helpman framework. The reason to integrate labor market distortions into my model are the different effects they have on tariffs on intermediate goods in comparison to final goods.

Rama and Tabellini (1998) were the first to deal with labor interests in a Grossman and Helpman setting. In their model capital owners and union members lobby the government on both tariffs and minimal wages. Their main result is that trade barriers and labor market distortions move in the same direction. They draw the conclusion that foreign organizations can decrease a country's labor market distortions by reducing its tariff barriers rather than target labor markets directly. With my approach, I show that such a policy can fail, since it may not work for intermediate good sectors.

To integrate labor market rigidities into my model, I use a simplified version of the framework developed by Matschke (2004). Her approach is more general in comparison to Rama and Tabellini and is closer to the original Grossman and Helpman setting. Matschke's results confirm the findings of Rama and Tabellini. In her model (exogenous) unemployment benefits increase tariffs. But it is critical for the results of both Rama and Tabellini (1998) and Matschke (2004), that they examine final good sectors. As already mentioned I can show that their results do not carry through to the case of intermediate goods. Unemployment benefits and tariffs are positively correlated if tariffs decrease sectoral unemployment and thereby social costs of unemployment. This is always the case in final good sectors, where tariffs increase production and employment at the cost of consumers, who have to bear higher prices. But in intermediate good sectors, it is ambiguous whether an increase in tariffs reduces sectoral unemployment or not. On the one hand higher tariffs increase employment in the intermediate good sector, but on the other hand they decrease employment in dependent final good sectors. Thus, it depends upon industry characteristics whether it is possible to influence labor market distortions

---

[3]At least with the small country assumption.

via trade policy as Rama and Tabellini are suggesting.

Across intermediate good sectors, the main source of tariff variance is the relative size of dependent final good sectors in comparison to intermediate good sectors. This relative size influences the tariff in two ways. On the one hand, the size of a sector determines the strength of its lobbying. Thus, large final good industries can prevent tariffs on their inputs. The same argument holds for the need of inputs in final good production. The higher this need, the stronger is the opposition of final good producers against tariffs on their inputs and thereby the smaller are the tariffs. On the other hand, the larger a final good sector and the higher its dependence on an intermediate good, the more devastating is the impact of an intermediate good tariff on the economy-wide unemployment. Thereby, the social costs of tariffs in those sectors are higher. Hereby, the government, which cares not only about collecting contributions but also about social welfare, sets smaller tariffs. A third determinant of tariffs in intermediate good sectors are tariff revenues. The lobbies in all sectors whose production is independent of a certain intermediate good prefer import tariffs on that good when it is an import good and export tariffs otherwise.

An additional insight the model provides is the interaction of tariffs in connected intermediate and final good sectors. Gawande and Bandyopadhyay (2000) already examined both theoretically and empirically how exogenous tariffs on intermediate goods influence tariffs on final goods. Empirics support their theoretical prediction that tariffs on final goods are positively correlated with tariffs on intermediate goods used in the final good production. My model supports this result and shows additionally that the same is true for the other direction. Tariffs on a final good increase the tariffs on the connected intermediate goods.

In summary, my model is the first that provides a theoretical explanation for the variance of tariffs on intermediate goods in a political economy framework. The model detects the sources of different tariff levels in final and intermediate good sectors. Consideration of labor interest gives new insights into the interactions between trade and labor market policies. The results concerning tariffs on intermediate goods contradict results that have been derived for final goods and give more differentiated policy advices for trade and labor market policies.

The rest of the paper is organized as follows. Section 2 describes the model framework. The equilibrium policy is described and interpreted in Section 3. Section 4 concludes. The Appendix contains some derivations that are needed for the calculation of the equilibrium policy.

2 The Model

The model describes an economy that consists of $n + 1$ sectors. Every nonnumeraire sector[4] is divided into one intermediate and one final good subsector. Within each sector, intermediate goods are needed for production of final goods. This means that a final good producer can not substitute the intermediate good from his sector by an intermediate good from another sector (but may import the intermediate good from abroad). On the other hand, intermediate good producers can only serve the final good producers in their sector or export their good. As in Grossman and Helpman (1994), there is an exogenous world market price p_i^* of final goods in sector i. Assuming a small country, national prices are determined by $p_i = p_i^* + t_i^F$, where t_i^F is the tariff on the final good in sector i chosen by the government. For the intermediate goods, there is a separated world market price q_i^* and a separated national price $q_i = q_i^* + t_i^I$. The tariff on the intermediate good in sector i t_i^I is chosen by the government separately from the tariffs on final goods. For an importing subsector $t_i^j > 0$ ($t_i^j < 0$) is equivalent to an import tariff (import subsidy). In an exporting subsector $t_i^j > 0$ ($t_i^j < 0$) describes an export subsidy (export tax). It is assumed that one unit of the final good is produced with a fixed share β_i of the intermediate good. Thus, final good producers suffer from tariffs on intermediate goods in their sector. All subsectors are provided with sector specific capital K_i^j and labor L_i^j, where the index $j = F, I$ stands for final good or intermediate good subsectors. Production $F^{ij}(K_i^j, \alpha_i^j L_i^F)$ uses sectoral capital and labor and its functions F^{ij} are weakly concave with positive cross-derivatives. α_i^j denotes the share of employment per subsector. The described setting gives both capital owners and workers an incentive to organize in lobbies to influence trade policy. As producers, both capital lobbies and trade unions lobby for protection of their own sector, while as consumers, they lobby against protection of final goods in other sectors. Final good producers lobby additionally against tariffs on intermediate goods in their sector, since these tariffs increase their input prices. Besides trade policy, the government can use unemployment benefits u as an additional policy instrument. With its labor market policy, the government is able to redistribute from capital to labor. Thereby, trade unions lobby for high unemployment benefits, while capital lobbies oppose them. The government could be induced to use this socially harmful instrument, if trade unions have a higher influence on policy than capital lobbies. All in all, the government controls

---

[4]the n+1th sector is a numeraire sector, which simplifies the modeling of consumption. If not explicitly mentioned, we will only talk about nonnumeraire sectors in what follows.

three redistributive policy instruments. With tariffs on final goods, the government can protect final good producers at the expense of consumers. Tariffs on intermediate goods support intermediate good producers and hurt final good producers. Finally, the national-wide even unemployment benefits help all workers and harm all capital owners.

The model has to formalize two interlinked decision problems. On the one hand, capital owners and trade unions have to agree upon wages and employment in all sub-sectors; on the other hand, the government needs to decide upon its policy, while all lobbies try to influence the government's decision. Following Matschke (2004), it seems to be reasonable to assume that bargaining about employment and wages takes place more often than reconsiderations of trade and labor market policy. That is, capital lobbies and unions take tariffs and unemployment benefits as given for their employment bargaining. This assumption gives the model a two-stage structure. In the first stage, tariffs and unemployment benefits are realized in a menu auction between all lobbies and the government. In the second stage, wages and employment are determined by Nash bargaining between capitalists and workers with given tariffs and unemployment benefits. This game has to be solved by backward induction. The next section will describe the outcome of the wage bargaining in stage two, while afterwards the policy game in stage one will be solved.

2.1 Wage Bargaining

In every subsector, the wage w_i^j and the share of employment α_i^j are determined by Nash bargaining between capital owners and workers. In this cooperative setting, the share of employment will be efficient for a given unemployment benefit. Both capital and labor need not necessarily be organized in lobbies in every sector. I assume that all employees in a sector are covered by wage bargaining. This is a simplification in comparison to Matschke (2004), who divides sectors in unionized and non-unionized subsectors and integrates anti-discrimination quotas that force firms in the unionized sector to employ non-unionized workers and vice versa. This more specific setting would provide no additional insights for my comparison of the different influences of labor interests on the tariffs on intermediate and final goods. In my setting, the bargaining position of workers gets stronger the higher the unemployment benefits are. The reason is that being unemployed is the outside option for workers in wage and employment bargaining. Therefore, the government by increasing unemployment benefits redistributes not only to the unemployed but also to employees. For unorganized capital owners or workers the Nash

bargaining solution can be interpreted as an average wage in a subsector. The properties of the Nash Bargaining solution which drive the results of the model make sense for non-collective wage bargaining, too. Namely that wages increase with unemployment benefits and with the bargaining power of workers and that employment decreases with unemployment benefits. The next two sections provide a formal description of the Nash bargaining solution for intermediate good and final good sectors.

2.1.1 Generalized Nash Bargaining Solution for Intermediate Good Sectors

The payments a subsector's labor force receives are the wages paid to the employed and the unemployment benefits

$$\alpha_i^I L_i^I w_i^I + (1 - \alpha_i^I) L_i^I u. \tag{1}$$

Since only labor imposes costs on firms, the profits of capital owners in sector i are equal to

$$q_i F^{iI}(K_i^I, \alpha_i^I L_i^I) - \alpha_i^I L_i^I w_i^I. \tag{2}$$

With fixed tariffs and unemployment benefits the generalized Nash bargaining solution[5] between capital owners and workers solves

$$\max_{\alpha_i^I, w_i^I} (q_i F^{iI}(K_i^I, \alpha_i^I L_i^I) - \alpha_i^I L_i^I w_i^I)^{1-s_i^I} (\alpha_i^I L_i^I (w_i^I - u))^{s_i^I} \tag{3}$$

where s_i^I is the exogenously given relative bargaining power of workers in intermediate good production in sector i.

Using the FOCs of the maximization problem, the share of employment α_i^I is implicitly given by

$$q_i F_L^{iI}(K_i^I, \alpha_i^I L_i^I) = u \tag{4}$$

and wages can be expressed as

$$w_i^I = (1 - s_i^I)u + s_i^I \frac{q_i F^{iI}}{\alpha_i^I L_i^I}. \tag{5}$$

---

[5]For a discussion of wage bargaining concepts see McDonald and Solow (1981).

As one can see, the wages are a weighted sum of the unemployment benefits and the average value product of labor. The higher the bargaining power of workers, the higher is their income, since they can extract a larger part of the firms' profits in wage bargaining.

For the determination of the equilibrium tariffs and unemployment benefits in the policy game in stage one of the model, the effects of changes of all policy instruments on the welfare of capital owners and workers have to be calculated. For this purpose the following derivatives are needed

$$\frac{\partial \alpha_i^I}{\partial q_i} = -\frac{u}{q_i^2 F_{LL}^{iI} L_i^I} > 0 \tag{6}$$

$$\frac{\partial (\alpha_i^I w_i^I)}{\partial q_i} = \frac{s_i^I F^{iI}}{L_i^I} + \frac{\partial \alpha_i^I}{\partial q_i} u > 0 \tag{7}$$

$$\frac{\partial \alpha_i^I}{\partial u} = \frac{1}{q_i F_{LL}^{iI} L_i^I} < 0 \tag{8}$$

Obviously, the only policy instruments which affect the specific factor returns in any intermediate good subsector are the tariffs in this subsector and the unemployment benefits. In the next section we will see that the situation is different in final good subsectors.

2.1.2 Generalized Nash Bargaining Solution for Final Good Sectors

The earnings of the labor force in a final good subsector can be expressed in the same way as in intermediate good subsectors:

$$\alpha_i^F L_i^F w_i^F + (1 - \alpha_i^F) L_i^F u \tag{9}$$

But, the expression for the firms' profits in a final good subsectors shows the main difference between final and intermediate good sectors:

$$(p_i - \beta_i q_i) F^{iF}(K_i^F, \alpha_i^F L_i^F) - \alpha_i^F L_i^F w_i^F \tag{10}$$

Since the share β_i of intermediate good i is needed for the production of one unit of final good i, the price of that intermediate good influences profits in the final good subsector.

Hence, the Nash bargaining solution for wage and employment bargaining solves the following maximization problem:

$$\max_{\alpha_i^F, w_i^F} ((p_i - \beta_i q_i) F^{iF}(K_i^F, \alpha_i^F L_i^F) - \alpha_i^F L_i^F w_i^F)^{1-s_i^F} (\alpha_i^F L_i^F (w_i^F - u))^{s_i^F} \tag{11}$$

where s_i^F is the exogenously given relative bargaining power of workers in final good production in sector i.

Using the FOC, employment can still be determined by

$$(p_i - \beta_i q_i) F_L^{iF}(K_i^F, \alpha_i^F L_i^F) = u \tag{12}$$

and wages can be expressed as

$$w_i^F = (1 - s_i^F) u + s_i^F \frac{(p_i - \beta_i q_i) F^{iF}}{\alpha_i^F L_i^F}. \tag{13}$$

But specific factor returns are now not only dependent on tariffs in the final good subsector, but also on tariffs in the connected intermediate good subsector. Thereby, specific factor owners in the final good subsector get interested in tariffs on intermediate goods. They will try to influence the tariffs on the intermediate good in their sector in the policy game. Thus, for calculations of the equilibrium tariffs, two additional derivatives are needed in comparison to intermediate good subsectors. Those derivatives determine how returns to specific factors in the final good sectors change, if tariffs on intermediate goods change.

$$\frac{\partial \alpha_i^F}{\partial p_i} = - \frac{u}{(p_i - \beta_i q_i)^2 F_{LL}^{iF} L_i^F} > 0 \tag{14}$$

$$\frac{\partial (\alpha_i^F w_i^F)}{\partial p_i} = \frac{s_i^F F^{iF}}{L_i^F} + \frac{\partial \alpha_i^F}{\partial p_i} u > 0 \tag{15}$$

$$\frac{\partial \alpha_i^F}{\partial u} = \frac{1}{(p_i - \beta_i q_i) F_{LL}^{iF} L_i^F} < 0 \tag{16}$$

$$\frac{\partial \alpha_i^F}{\partial q_i} = \frac{\beta_i u}{(p_i - \beta_i q_i)^2 F_{LL}^{iF} L_i^F} < 0 \tag{17}$$

$$\frac{\partial(\alpha_i^F w_i^F)}{\partial q_i} = -\frac{s_i^F \beta_i F^{iF}}{L_i^F} + \frac{\partial \alpha_i^F}{\partial q_i} u < 0 \tag{18}$$

Since $-\frac{s_i^F \beta_i F^{iF}}{L_i^F}$ is strictly negative and with consideration of (9), workers in final good industries suffer from tariffs on intermediate goods used in the final good production. The other derivatives have the same and expected signs as in the case of final good sectors.

2.2 Lobby Groups and Social Welfare

The economy consists of N individuals. Each individual is either endowed with one unit of sector specific capital or with one unit of sector specific labor. Individuals' welfare is determined by the returns to their specific factor, their consumption rent $s(p)$ and the per capita net revenues from taxes and subsidies $r(p, q, u)$. The first part of individuals' welfare is their consumption rent $s(p)$. As in Grossman and Helpman (1994), individuals have quasilinear consumption preferences. It is assumed that all goods are consumed by the representative consumer. Then, the existence of a numeraire good ensures that the consumption of every final good only depends on its own price or rather tariff. Thus, the tariffs on final goods determine the consumption rent $s(p)$ and consumption levels $d(p)$ and the impact of a tariff change on the consumption rent can easily be calculated.

The government finances unemployment benefits and trade subsidies by lump sum taxes on a per capita basis, while the revenues from import taxation are redistributed to the individuals. Thereby, the per capita net revenue from taxes and subsidies can be expressed as

$$\begin{aligned} r(p, q, u) &= \frac{1}{N} \sum_{i=1}^{n} [(p_i - p_i^*)[Nd_i - F^{iF}] + (q_i - q_i^*)[\beta_i F^{iF} - F^{iI}]. \\ &\quad - L_i^F (1 - \alpha_i^F) u - L_i^I (1 - \alpha_i^I) u], \end{aligned} \tag{19}$$

where d_i is the per capita demand for the final good i.

The consumption rent and the per capita net revenues from taxes and subsidies are the same for all individuals. What makes individuals different is the return to their specific factor. This return is influenced by tariffs and unemployment benefits as we saw in the last sections. As already mentioned (this will be formalized below) the government policy decision responds to lobby contributions. Since the interests of owners of different factors concerning policy are divergent, individuals which own the same factor have an incentive to organize in lobbies. In the whole economy, there are two subsectors per

sector and in each subsector there are two specific factors. This means that $4n$ groups of individuals with different interests exist in the economy. We assume that L of them are organized in a lobby. A lobby represents the interest of all owners of a specific factor. Hence, a lobby's welfare is the aggregated welfare of all specific factor owners. The returns to the specific factor labor are wages and unemployment benefits. Thus, we can express a union's welfare in a subsector with L_i^j workers as

$$W_i^{Lj}(p,q,u) = L_i^j \alpha_i^j w_i^j + L_i^j(1 - \alpha_i^j)u + L_i^j[r(p,q,u) + s(p)], \quad j = F, I, \qquad (20)$$

where wages w_i^j and employment shares α_i^j are dependent on tariffs and unemployment benefits.

The returns to capital are firms' sales minus wages. The following equations already reflect the outcome of the wage bargaining in stage two. Looking first at final good sectors, capital lobbies' welfare is determined by

$$W_i^{KF}(p,q,u) = (1 - s_i^F)[(p_i - \beta_i q_i)F^{iF} - \alpha_i^F u L_i^F] + K_i^F[r(p,q,u) + s(p)], \qquad (21)$$

while capital lobbies' welfare in intermediate good sectors is

$$W_i^{KI}(p,q,u) = (1 - s_i^I)[q_i F^{iI} - \alpha_i^I u L_i^I] + K_i^I[r(p,q,u) + s(p)]. \qquad (22)$$

Social welfare is the sum over all N individuals welfare. It can be expressed as

$$\begin{aligned} W(p,q,u) &= \sum_{i=1}^{n}[(p_i - \beta_i q_i)F^{iF} + q_i F^{iI} + (1 - \alpha_i^F)u L_i^F + (1 - \alpha_i^I)u L_i^I] \\ &\quad + N[r(p,q,u) + s(p)]. \end{aligned} \qquad (23)$$

One might wonder why the unemployment benefits seem to influence the welfare in a positive way. But they have to be financed by taxes and thus their positive effect on labor income is fully outweighed by their negative effect on $Nr(p,q,u)$. Unemployment benefits' net effect on welfare is the reduction of production both in final and intermediate good sectors.

Finally, it is necessary to characterize the objective function of the government. As it is standard in this branch of literature, the government cares both about collected

political contributions C_i and social welfare $W(p, q, u)$. It puts higher weight on contributions than on (net-of-contributions) social welfare. Otherwise, it would be impossible for lobbies to influence the government. An additional feature of my model is, that the government weighs political contributions stronger, the more voters S_i are organized in a lobby. To model this government bias towards voters, I introduce a function $v(S_i)$ with $v'(S_i) > 0$. The intuition behind this function is quite simple. In a situation where two lobbies offer the same amount of contributions pro and contra a tariff,[6] a government will be biased to serve the lobby that represents more voters. This also reflects the informative effect of lobbying. Governments can learn by lobbying what the needs of their voters are and the more voters S_i signal to want some policy c, the higher is the probability that this policy is adopted. However, this bias to serve voters does not drive the main results of my model. But without it, the existence of positive unemployment benefits could hardly be explained. The lobbies offer contribution schedules $C(p, q, u)$, which announce nonnegative payments to the government for all possible policy choices. The government's objective function is then

$$G(p, q, u) = \sum_{i \in L} v(S_i) C_i(p, q, u) + aW(p, q, u) \qquad a \geq 0, \tag{24}$$

where a is the government's weight on (gross-of-contributions) social welfare. With the government's objective function the objective functions of all groups which participate in the policy game have been characterized in a sufficient way. The next section describes how these objective functions determine the outcome of the policy game. The game is formalized as a menu auction, which is the standard way to solve such a policy game in the Grossman and Helpman framework.

2.3 Equilibrium of the Lobby Game

As in Grossman and Helpman (1994), the lobby game between the various lobbies and the government has the structure of a menu-auction problem. In contrast to Grossman and Helpman, the contribution functions do not only depend on the domestic price vector of final goods p, but additionally on the domestic price vector of intermediate goods q and the domestic unemployment benefits u. Let $\mathcal{C}$ be the set of possible policy choices c which is defined as $\mathcal{C} := (\mathcal{P} \times \mathcal{Q} \times \mathcal{U})$, where $\mathcal{P}, \mathcal{Q}$ and $\mathcal{U}$ are the sets from which the government can choose p, q and u. Then the equilibrium of the lobby game

---

[6]The effects on social welfare are are not considered here.

can be characterized with regard to Lemma 2 of Bernheim and Whinston (1986):

Proposition 1: $(\{C_i^o\}_{i \in L}, c^o)$ *is a subgame-perfect equilibrium of the lobby game if and only if*:

1. C_i^o *is feasible for all* $i \in L$;

2. c^o *maximizes* $\sum_{i \in L} v(S_i) C_i^o(c) + aW(c)$ *on* $\mathcal{C}$

3. c^o *maximizes* $W_j(c) - C_j^o(c) + \sum_{i \in L} v(S_i) C_i^o(c) + aW(c)$ *on* $\mathcal{C}$ *for every* $j \in L$

4. *for every* $j \in L$ *there exists a* $c^j \in \mathcal{C}$ *that maximizes* $\sum_{i \in L} v(S_i) C_i^o(c) + aW(c)$ *on* $\mathcal{C}$ *such that* $C_j^o(c^j) = 0$.

For a detailed discussion of this proposition the reader is referred to Grossman and Helpman (1994). For my purposes it is enough to state that their results can be carried over to the context of my model. To facilitate the analysis, differentiable contribution functions are assumed. Then, similar to equation (12) in Grossman and Helpman, the equilibrium domestic policy choice can be characterized by:

$$\sum_{i \in L} v(S_i) \nabla W_i(c^o) + a \nabla W(c^o) = 0 \tag{25}$$

To calculate the equilibrium policy choice, it must be examined how marginal policy changes affect social and lobby groups' welfare. In the setting of my model, we have to analyze the effects of the three different policy instruments (tariffs on final goods, tariffs on intermediate goods and unemployment benefits) on the welfare of four different kinds of lobbies (capital lobbies and unions in final and intermediate good sectors) and on social welfare. Thereby, five derivatives are needed to calculate the equilibrium level of each policy instrument. The interested reader can find the derivatives in the Appendix.

After inserting the derivatives into the above equation, one can solve for the equilibrium tariffs on final goods, on intermediate goods and the equilibrium unemployment benefits. The next section presents the equilibrium of the policy game, explains the differences to previous results in the literature and discusses possible political implications.

3 Equilibrium Policy Structure

To analyze the equilibrium policy structure we start with tariffs on final goods. These tariffs have already been analyzed by various authors. We will compare my results to

the results of the basic model of Grossman and Helpman (1994) and to the results of approaches, which already integrated labor interests, namely Matschke (2004) and Rama and Tabellini (1998). Further, we check whether the effects of (exogenous) intermediate goods on tariffs on final goods, detected by Gawande and Bandyopadhyay (2000), are preserved in my framework. Then, we will proceed with the main contribution of my approach, the equilibrium tariffs on intermediate goods, and compare their structure to the final good case. Finally, we will analyse the equilibrium unemployment benefits.

Proposition 2: *The equilibrium tariff in a final good sector is*

$$
\begin{aligned}
t_i^F \;\; = \;\; & \frac{I_i^{LF}v(L_i^F)s_i^F F^{iF} + I_i^{KF}v(K_i^F)(1-s_i^F)F^{iF} - bF^{iF}}{-(a+b)M_{p_i}^{iF}} \\
& + \frac{(q_i - q_i^*)\beta_i(F_L^{iF})^2}{(p_i - \beta_i q_i)F_{LL}^{iF}M_{p_i}^{iF}} + \frac{u^2}{(p_i - \beta_i q_i)^2 F_{LL}^{iF}M_{p_i}^{iF}},
\end{aligned}
\tag{26}
$$

where I_i^{LF} (I_i^{KF}) is equal to one if labor (capital) is organized in that subsector and equal to zero else, $M_{p_i}^{iF}$ are the net imports changes of final good i, if p_i changes, and b is the aggregated national influence of lobbies[7].

If we neglect the voting function v for a while, we find the equilibrium tariff of the basic Grossman and Helpman model in the first fraction of the equation. When capital owners earn all firm profits ($s_i^F = 0$), one gets exactly their expression for the equilibrium tariff. If trade unions can extract a part of firms' profit ($s_i^F > 0$), the first fraction represents the (simplified) effect of lobbying with the inclusion of trade unions as detected by Matschke (2004). Both lobby groups prefer a high tariff in their sector and thus lobbying increases a sector's tariff as long as capital and/or labor is organized. The lobbying effects are additive and thus a tariff is largest if both capital and labor lobby. Lobbies from all other sectors oppose tariffs since they reduce their consumption rents. Taking the voting functions into account, we observe that the tariff on a final good increases with the number of voters organized in a lobby group within that subsector, while it decreases with the number of voters organized in a lobby group outside that subsector.

The effect represented by the second fraction of the equation is caused by the demand

---

[7]The parameter b is in my setup not the share of individuals organized as in all other approaches. Since voting functions v are introduced, it describes the aggregated national influence of lobbies. It is determined by $b = \frac{1}{N}\sum_{i=1}^{n}\sum_{j=F,I}(I_i^{Lj}v(L_i^j)L_i^j + I_i^{Kj}v(K_i^j)K_i^j)$.

$\beta_i F^{iF}$ for the sector-specific intermediate good in final good production. A higher tariff in the final good sector increases its production F^{iF}. Thereby the demand for and the import of intermediate goods grow. Thus, it is possible to enlarge tariff revenues of intermediate good imports by increasing tariffs on final goods. The higher the tariffs on intermediate goods t_i^I are, the more attractive is this option. A similar effect can be found in Gawande and Bandyopadhyay (2000), where higher tariffs on intermediate goods increase tariffs on final goods. Finally, high unemployment benefits make a tariff on a final good more attractive, the more the tariff can ameliorate the sectoral negative effects of unemployment benefits on social welfare. Those effects of unemployment given by the last fraction of the equation are the same as in Matschke (2004).

Up to now we have seen that my model includes all well known effects of labor market distortions and intermediate goods on tariffs on final goods. Keeping these effects in mind, we can now have a look at tariffs on intermediate goods and analyze their different structure in comparison to final good sectors.

Proposition 3: *The equilibrium tariff in an intermediate good sector is*

$$
\begin{aligned}
t_i^I \;=\; & \frac{I_i^{LI} v(L_i^I) s_i^I F^{iI} + I_i^{KI} v(K_i^I)(1 - s_i^I) F^{iI}}{-(a+b) M_{q_i}^{iI}} \\
& -\frac{I_i^{LF} v(L_i^F) s_i^F \beta_i F^{iF} + I_i^{KF} v(K_i^F)(1 - s_i^F)\beta_i F^{iF}}{-(a+b) M_{q_i}^{iI}} + \frac{b \cdot M^{iI}}{-(a+b) M_{q_i}^{iI}} \\
& +\frac{(p_i - p_i^*)\beta_i (F_L^{iF})^2}{(p_i - \beta_i q_i) F_{LL}^{iF} M_{q_i}^{iI}} - \frac{\beta_i u^2}{(p_i - \beta_i q_i)^2 F_{LL}^{iF} M_{q_i}^{iI}} + \frac{u^2}{q_i^2 F_{LL}^{iI} M_{q_i}^{iI}},
\end{aligned}
\tag{27}
$$

where I_i^{LI} (I_i^{KI}) is equal to one, if labor (capital) is organized in that subsector, and equal to zero else, M^{iI} are the net imports of intermediate good i and $M_{q_i}^{iI}$ are the net imports' changes of intermediate good i, if q_i changes.

As in final good sectors both capital and labor lobbies lobby for high tariffs in their own sector (first fraction of the equation). But, final good producers are harmed by tariffs on their inputs and thereby have an incentive to counterlobby against the intermediate good producers. This new effect on the equilibrium tariff in comparison to tariffs on final goods is represented by the second fraction in the equation. If all interest groups in a sector are organized, the effect of lobbying depends upon the size of the subsectors, the number of voters that are organized and the demand for the intermediate good in final good production. It can well be that lobbying of intermediate good

producers is not sufficient to guarantee a positive tariff, as it is the case for final good producers in their subsectors. If final good production F^{iF} is large, needs many intermediate goods (large β_i) and represents many voters, final good lobbies can dominate the intermediate good lobbies.

Consumption rents are not affected by intermediate good prices and thereby play no role in the tariff formation in intermediate good sectors. But since consumers are not harmed by tariffs on intermediate goods, they get interested in positive tariffs on imported intermediate goods to collect revenues. For the same reason they oppose tariffs in sectors where intermediate goods get exported. Thus, as long as tariffs are below (above) the revenue maximizing level, all lobbies try to increase (decrease) the tariff level in importing (exporting) intermediate good sectors. This effect enters the equilibrium equation through the third fraction. As tariffs in final good subsectors have tariff revenue effects in intermediate good subsectors, tariffs in intermediate good subsectors influence tariff revenues in final good subsectors. Higher tariffs in the intermediate good subsector lead to less production in the dependent final good subsector. Thereby, the import of the final good and tariff revenues increase (until the revenue maximizing level is reached). This effect (the fourth fraction in the equation) makes a higher tariff in the intermediate good sector more attractive.

An interesting result describes the influence of unemployment benefits u on tariffs in intermediate sectors. In contrast to final good sectors, it is ambiguous whether unemployment benefits have a positive or negative effect on tariffs on intermediate goods. On the one hand, the higher the costs of unemployment in an intermediate good subsector, the higher are the tariffs in that subsector. The reason is that a tariff can alleviate the cost of unemployment via higher production and employment. On the other hand, high tariffs on intermediate goods reduce the production in the dependent final good subsector. Thus, high unemployment costs in the final good sector make tariffs in the intermediate good sector less attractive. The two effects induced by unemployment benefits can be found in the last two fractions in the tariff equation. Thus, the effect of unemployment benefits on intermediate good sectors' tariffs is not uniquely predictable. On the one hand it increases employment in the intermediate good sector, on the other hand it reduces employment in the final good sector. Which effect dominates depends upon the sensibility of employment to price and cost changes in both subsectors and the demand for the intermediate good in the final good production (β_i).

To conclude the analysis of the equilibrium policy, we look at the economy's equilibrium unemployment benefits.

Proposition 4: *The unemployment benefits in equilibrium are*

$$u = \frac{\sum_{i=1}^{n} \sum_{j=F,I} L_i^j (I_i^{Lj} v(L_i^j)(1 - \alpha_i^j s_i^j) - I_i^{Kj} v(K_i^j) \alpha_i^j (1 - s_i^j) - b(1 - \alpha_i^j))}{-(a+b) \sum_{i=1}^{n} \left(\frac{(p_i^* - \beta_i q_i^*)}{(p_i - \beta_i q_i)^2 F_{LL}^{iF}} + \frac{q_i^*}{q_i^2 F_{LL}^{iI}} \right)}$$

Lobbying of labor unions has a positive influence on unemployment benefits as the first summand in the numerator shows. Both labor unions in the final good sectors and in intermediate good sectors benefit from unemployment benefits. The larger the labor force in the organized sectors, the larger are those benefits. But, the higher the quota of employment α_i^j and the larger the bargaining power in wage bargaining of workers s_i^j, the smaller is the employees' interest in unemployment benefits. The rationale for the latter result is that workers with a strong position in wage bargaining do not need the outside option of unemployment benefits as much as workers with a weak position. The capital owners lobby against unemployment benefits (the second summand in the numerator). The larger the capital owners power in wage bargaining, $1 - s_i^j$, the stronger are their incentives to prevent unemployment benefits and therefore their lobbying. All lobby groups have a common interest to reduce unemployment benefits, because they have to finance the benefits via per-capita taxes. This lobbying of all organized interest groups results in the third summand in the numerator. The larger the social costs of unemployment are, the smaller are unemployment benefits in equilibrium. The social cost of unemployment are represented by the denominator in the equilibrium equation. Higher tariffs on consumption goods (included in p_i) reduce the social costs of unemployment benefits and thus increase equilibrium unemployment benefits. For tariffs on intermediate goods (included in q_i) the result is ambiguous, since they are mainly a redistribution between final good and intermediate good producers. This makes clear that statements on interactions between tariffs and labor market distortions have to be treated carefully. Rama and Tabellini (1998) suggest that it is possible to induce countries to reduce their labor market distortions by reducing their tariff barriers. This conclusion hinges on the absence of intermediate goods. With intermediate good sectors it is not possible anymore to make such general predictions. A (selective) reduction of tariffs could have no influence on labor market distortions or even increase distortions.

4   Conclusion

This paper is the first that explains the tariff structure in intermediate good sectors using the seminal political economy framework for tariff formation by Grossman and Helpman (1994). My approach turned out to be fruitful, since important differences in comparison to tariff formation in final good sectors could be identified. As empirics suggest, tariffs on final goods tend to be higher than tariffs on intermediate goods. Additional insights in tariff formation are gained by the consideration of labor interests. They have a different effect on tariffs in intermediate good sectors in comparison to final good sectors. As already shown by Matschke (2004) and Rama and Tabellini (1998), labor market distortions increase tariffs in final good sectors. In contrast to final good sectors this paper shows that for intermediate good sectors no unique effects of labor market distortions are observable. It depends on the industry structure, especially on the degree of dependency of the national production on the intermediate good, in which direction labor market distortions push tariffs in intermediate good sectors. Otherwise, tariffs influence the optimal level of labor market distortions. While tariffs on final goods make labor market distortions more attractive by reducing their social costs, this does not hold for tariffs on intermediate goods. They reduce final good production and can thereby increase overall unemployment. Thus, it is not necessarily possible to put pressure on labor market distortions by reducing tariffs as Rama and Tabellini suggest.

It remains for future research to examine whether the identified pattern of tariff formation can be confirmed by empirics. Testable results of my model are the following: The more interest groups are organized in the whole economy, the higher contributions should be observable in final good sectors. In intermediate good sectors, the level of contributions should be larger, the better organized the dependent final good producers are. In sectors where all interest groups are organized, higher tariffs should prevail on final goods in comparison to intermediate goods. In a country with large labor market distortions, tariffs on final goods should be higher than in countries with more liberalized labor markets. This effect should be weaker or even absent in intermediate good sectors.

Further, it would be interesting to know how robust these results are to the internationalization of lobbying. It could well be that international lobbying has different effects on tariffs on final in comparison to intermediate goods. This would e.g. be the case, if it is easier for firms to lobby internationally than it is for consumers. Changes in the equilibrium tariff structure could also occur if different organizational forms are reflected in the tariff formation. In sectors where a large share of intermediate good

producers is integrated, the policy game between final and intermediate good producers should be less intensive and thus contributions smaller. In those sectors, the focus of the policy game should shift from national redistribution conflicts between final and intermediate good producers to international redistribution conflicts between suppliers of the same intermediate good. A final good producer who owns its input supplier could even be interested in a positive tariff on his input to protect his supplier against import penetration.

5   Appendix

Derivatives of welfare with respect to unemployment benefits

$$\frac{\partial W}{\partial u} = u \sum_{i=1}^{n} \left(\frac{(p_i^* - \beta_i q_i^*)u}{(p_i - \beta_i q_i)^2 F_{LL}^{iF}} + \frac{q_i^* u}{q_i^2 F_{LL}^{iI}} \right)$$

$$\frac{\partial W_i^{LF}}{\partial u} = L_i^F(1 - \alpha_i^F s_i^F) + \frac{L_i^F}{N} \cdot \frac{\partial r(p, q, u)}{\partial u}$$

where

$$\frac{\partial r(p, q, u)}{\partial u} = \sum_{j=1}^{n} \left(\frac{(p_j^* - \beta_j q_j^*)u}{(p_j - \beta_j q_j)^2 F_{LL}^{jF}} + \frac{q_j^* u}{q_j^2 F_{LL}^{jI}} - L_j^F(1 - \alpha_j^F) - L_j^I(1 - \alpha_j^I) \right)$$

$$\frac{\partial W_i^{KF}}{\partial u} = -L_i^F \alpha_i^F(1 - s_i^F) + \frac{K_i^F}{N} \cdot \frac{\partial r(p, q, u)}{\partial u}$$

$$\frac{\partial W_i^{LI}}{\partial u} = L_i^I(1 - \alpha_i^I s_i^I) + \frac{L_i^I}{N} \cdot \frac{\partial r(p, q, u)}{\partial u}$$

$$\frac{\partial W_i^{KI}}{\partial u} = -L_i^I \alpha_i^I(1 - s_i^I) + \frac{K_i^I}{N} \cdot \frac{\partial r(p, q, u)}{\partial u}$$

Derivatives of welfare with respect to tariffs on intermediate goods

$$\frac{\partial W}{\partial q_j} = (q_j - q_j^*)M_j^{I'}(q_j) - \frac{(p_j - p_j^*)\beta_j(F_L^{jF})^2}{(p_j - \beta_j q_j)F_{LL}^{jF}} - \frac{\beta_j u^2}{(p_j - \beta_j q_j)^2 F_{LL}^{jF}} - \frac{u^2}{q_j^2 F_{LL}^{jI}}$$

$$\frac{\partial W_i^{LF}}{\partial q_j} = -I_{ij}s_i^F \beta_i F^{iF} + \frac{L_i^F}{N} \cdot \frac{\partial r(p,q,u)}{\partial q_j}$$

where

$$\frac{\partial r(p,q,u)}{\partial q_j} = -\frac{(p_j - p_j^*)\beta_j(F_L^{jF})^2}{(p_j - \beta_j q_j)F_{LL}^{jF}} - \frac{\beta_j u^2}{(p_j - \beta_j q_j)^2 F_{LL}^{jF}} - \frac{u^2}{q_j^2 F_{LL}^{jI}} + (q_j - q_j^*)M_j^{I'}(q_j) + M_j(q_j)$$

$$\frac{\partial W_i^{KF}}{\partial q_j} = -I_{ij}(1 - s_i^F)\beta_i F^{iF} + \frac{K_i^F}{N} \cdot \frac{\partial r(p,q,u)}{\partial q_j}$$

$$\frac{\partial W_i^{LI}}{\partial q_j} = I_{ij}s_i^I F^{iI} + \frac{L_i^I}{N} \cdot \frac{\partial r(p,q,u)}{\partial q_j}$$

$$\frac{\partial W_i^{KI}}{\partial q_j} = I_{ij}(1 - s_i^I)F^{iI} + \frac{K_i^I}{N} \cdot \frac{\partial r(p,q,u)}{\partial q_j}$$

Derivatives of welfare with respect to tariffs on final goods

$$\frac{\partial W}{\partial p_j} = (p_j - p_j^*)M_j^{F'}(p_j) - \frac{(q_j - q_j^*)\beta_j(F_L^{jF})^2}{(p_j - \beta_j q_j)F_{LL}^{jF}} - \frac{u^2}{(p_j - \beta_j q_j)^2 F_{LL}^{jF}}$$

$$\frac{\partial W_i^{LF}}{\partial p_j} = I_{ij}s_i^F F^{iF} + \frac{L_i^F}{N} \cdot \frac{\partial(r(p,q,u) + s(p))}{\partial p_j}$$

where

$$\frac{\partial(r(p,q,u) + s(p))}{\partial p_j} = (p_j - p_j^*)M_j^{F'}(p_j) - \frac{(q_j - q_j^*)\beta_j(F_L^{jF})^2}{(p_j - \beta_j q_j)F_{LL}^{jF}} - \frac{u^2}{(p_j - \beta_j q_j)^2 F_{LL}^{jF}} - F^{jF}$$

$$\frac{\partial W_i^{KF}}{\partial p_j} \quad = \quad I_{ij}(1 - s_i^F)F^{iF} + \frac{K_i^F}{N} \cdot \frac{\partial(r(p,q,u) + s(p))}{\partial p_j}$$

$$\frac{\partial W_i^{LI}}{\partial p_j} \quad = \quad \frac{L_i^I}{N} \cdot \frac{\partial(r(p,q,u) + s(p))}{\partial p_j}$$

$$\frac{\partial W_i^{KI}}{\partial p_j} \quad = \quad \frac{K_i^I}{N} \cdot \frac{\partial(r(p,q,u) + s(p))}{\partial p_j}$$

References

[1] K. Anderson. The political market for government assistance to australian manufacturing industries. *The Economic Record*, 56 (153):132–44, 1980.

[2] B.D. Baack and E.J. Ray. The political economy of tariff policy: A case study of the united states. *Explorations in Economic History*, 20:73–93, 1983.

[3] B.D. Bernheim and M.D. Whinston. Menue auctions, resource allocation, and economic influence. *Quarterly Journal of Economics*, 101:1–31, 1986.

[4] T. Eicher and T. Osang. Protection for sale: An empirical investigation: A comment. *American Economic Review*, 92(5):1702–11, 2002.

[5] H. S. Eshahani. Searching for the (dark) forces behind protection. *Working Paper*, March 2002.

[6] K. Gawande and U. Bandyopadhyay. Is protection for sale? evidence on the grossman-helpman theory of endogenous protection. *Review of Economics and Statistics*, 82:139–52, 2000.

[7] P. K. Goldberg and G. Maggi. Protection for sale: An empirical investigation. *American Economic Review*, 89(5):1135–55, 1999.

[8] G. Grossman and E. Helpman. Protection for sale. *American Economic Review*, 84:833–50, 1994.

[9] G. Maggi and A. Rodriguez-Clare. Import penetration and the politics of trade protection. *Journal of International Economics*, 51:287–304, 2000.

[10] H.P. Marvel and E.J. Ray. The kennedy round: Evidence on the regulation of trade in the us. *American Economic Review*, 73(3):190–97, 1983.

[11] X. Matschke. Labor market rigidities and the political economy of trade protection. *Working Paper*, 2004.

[12] X. Matschke and S. Sherlund. Do labor issues matter in the determination of u.s. trade policy? an empirical reevaluation. *Working Paper*, 2003.

[13] I.M. McDonald and R.M. Solow. Wage bargaining and employment. *American Economic Review*, 71(5):896–908, 1981.

[14] D. Mitra. Endogenous lobby formation and endogenous protection: A long-run model of trade policy determination. *American Economic Review*, 89(5):1116–34, 1999.

[15] M. Rama and G. Tabellini. Lobbying by capital and labor over trade and labor market policies. *European Economic Revue*, 42:1295–316, 1998.

[16] E.J. Ray. Protection of manufactures in the united states. In D. Greenaway, editor, *Global Protectionism: Is the U.S. Playing on a Level Field?* Macmillan, London, 1991.