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POLITICAL ECONOMY OF TRADE POLICY:
WHY GOVERNMENTS FAVOUR
ONE INDUSTRY OVER ANOTHER

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Abstract

This paper presents a political economy model of international trade in which import-competing and export industries seek favorable trade policies from the government. The trade setting is a small open economy model where the import-competing and the export industries use two factors: mobile labour, immobile sunk capital and non-sunk capital which is mobile across the two industries in the long run. Equilibrium domestic prices are determined by political interactions of an incumbent government and interest groups representing the two industries. The paper shows how the direction of relocation of non-sunk capital and the resulting equilibrium industry sizes (composition) are determined. Government preferences over different industry compositions are also derived. Combining the direction of relocation, the equilibrium industry composition and the government preferences, the paper presents cases where a government faces incentives to favour either an import-competing industry or an export industry.

1. Introduction

Even though tariff barriers and quotas have been progressively reduced since the first General Agreement on Tariffs and Trade was ratified by 23 nations in the late 1940's, we still observe trade barriers, not only in the form of tariffs and quotas but also through non-tariff barriers such as VER's, countervailing duties, competition policy, product standards, preferential tax treatments, etc. Such protectionist measures stand in contradiction to general principle of international trade theory that free trade is the welfare maximizing policy. Economists have sought to explain this contradiction by developing political economy models of trade policy. In the political economy setting, governments are motivated by their own political objectives rather than social welfare in determining trade policies. A literature has developed to examine the formation of trade policy in such a setting (see, for example, Hillman (1982) and Long-Vousden (1991)¹, Findlay-Wellisz (1982)², Magee-Young (1986)³). In these models, the mechanism through which the political economy of trade policy is determined is unspecified. A prominent example of a political economy model of trade policy that explicitly specifies the mechanism by which voters, interest groups and government interact with each other is the one developed by Grossman and Helpman (1994). Using the "menu auctions" approach of Bernheim and Whinston (1986), they show how an equilibrium set of trade policies (i.e., equilibrium prices) are determined and what those policies are.

The Grossman and Helpman (1994) model is essentially static providing a snapshot of the level of protection for a given industry configuration and a set of interest groups. In any

¹They use a reduced form approach in which a government maximizes a political support function assigning different weights to the welfare of different individuals or interest groups.

²In a specific factor setting, they use a tariff formation function which depends on allocations of mobile labor chosen as a Nash-equilibrium lobbying efforts by interest groups.

³They use political competition approach where rival parties announce their policies whose benefits lobby groups weigh in deciding contributions. An unique interior equilibrium is shown to exist which is characterized by the extent political parties are willing to adopt specific interest policies and lobby efforts specified by interest groups to influence election outcome.

economy, however, industry structure changes over time as do levels of protection. Most importantly, levels of protection can affect industry structure and thereby affect government incentives to engage in future protections. By failing to account for the dynamic features, static analyses leave it unclear whether their equilibria would persist over time as capital moves in and out of various industries.

This paper seeks to address this issue by looking at a setting in which trade policies are determined by the same process as in Grossman-Helpman model, but with dynamics included in the model. In particular, sizes of the import-competing industry and the export industry, as measured in terms of capital used in each industry, are allowed to adjust in response to trade policies.⁴ Further trade policies adjust as industry structure changes. In this way, the paper addresses the dual question of how trade policies affect industry structure and how the consequent change in industry structure affects future trade policies. It also speaks to the issue of why and how government preferences for intervention may change over time from favoring import-competing industry to favoring export industry or vice versa.

To study these issues, this paper considers a small open economy which has three industries: an import-competing industry, an export industry and a numeraire industry. There are two input factors: labor and capital. Capital is of two types: sunk capital which is immobile and non-sunk capital which is mobile in the long run. Only sunk capital is organized to form lobby groups while non-sunk capital is not organized and moves freely across the two nonnumeraire industries.⁵ Lobby groups make political contributions to the government based on the policies the government adopts. The government chooses policies to maximize weighted sum of social welfare and contributions.

The model shows that: (1) The level of protection for a given industry increases as the industry gets smaller, i.e., a declining industry gets higher protection. The industry obtains

⁴One example where an input factor moves is a paper by Maggi and Rodriguez-Clare (1998).

⁵Marceau-Smart endogenously derive this assumption. They show that sunk capital is more interested in lobbying than non-sunk capital.

the highest protection when it is composed of only lobby members. In general, a smaller industry obtains more protection than a big industry, as measured by relative magnitude of protection. (2) The level of protection and capital intensity are negatively related. As an industry becomes more capital intensive, it gets less protection. (3) Government utility is maximized by having all mobile capital in a single industry. This feature of the model has an interesting implication that the government's interest and that of the mobile capital owners may be misaligned. In particular, the steady-state industry composition may not be the one preferred by the government. Therefore, the government has an incentive to favor one industry over another.

The paper is organized as follows. Section 2 describes the basic model. Production structures of industries, consumer preferences and composition of industries, lobby groups, government and their objectives are specified. In section 3, equilibrium domestic prices are derived when a series of one-shot games is played for different industry compositions. Section 4 describes when and how industry sizes may change in response to the equilibrium domestic prices and how the equilibrium industry sizes are achieved in two period repeated game. Characteristics of government welfare and its relationship with the change in industry sizes for the two-period game are also discussed. Section 5 constitutes extensions of the basic two-period game. Conclusion follows.

2. The model

Consider a small open economy with three types of industries: an import-competing (m), an export (x) and a numeraire industry(o) that produces a good whose domestic price is 1 and also traded at the world price of 1. The import-competing and the export industries use two factors of production, labor and capital, while the numeraire industry uses only labor. Labor is mobile across industries and supplied inelastically.

The two non-numeraire industries are represented by interest groups that lobby an incumbent government for trade policies on behalf of their respective industries. The gov-

ernment is assumed to be in power for T periods and trade policies in a given period are determined by interactions between the government and the industry interest groups. Policy instruments available to the government are import tariffs and export subsidies. Technologies, endowment of capital and lobby memberships are assumed time-invariant over the T periods. The specifics of the structures of production and the mechanism by which trade policies are determined are developed below.

2.1. Production

The numeraire industry is assumed to produce output y_o with constant return to scale technology using only labor. There is sufficient supply of labor so that it is possible to produce all the goods in the economy, implying the wage rate can be set equal to 1.

In the import-competing and the export industries, firms are assumed identical with the measure of firms in each industry fixed initially. The fraction of firms in the import-competing industry is s and that in the export industry is $(1 - s)$. The total measure of import-competing and export industries is normalized to 1. Firms in each industry produce with constant returns to scale technology assumed given by the function:

$$y_j = K_j^{\frac{1}{2}} L_j^{\frac{1}{2}} \quad j = m, x \quad (1)$$

For each firm in industry j , profit maximization implies that output is a linear function of price. The first order condition with respect to labor given a fixed capital is:

$$\frac{1}{2} p_j K_j^{\frac{1}{2}} L_j^{-\frac{1}{2}} = 1 \quad \text{in industry } j \quad (2)$$

where p_j is the domestic price. Solving for L and substituting into the production function gives

$$y_j = \frac{1}{2} K_j p_j \quad (3)$$

Since all the firms are identical, the sizes of industries, represented by s and $(1 - s)$, are also the fractions of capital used in the industries. Therefore, the output in each industry can be expressed as:

$$\begin{aligned} y_m(p_m) &= \delta_m p_m s \\ y_x(p_x) &= \delta_x p_x (1 - s) \end{aligned} \tag{4}$$

Here, $\delta_m = \delta_x = \frac{1}{2}K$ since each firm uses the same amount of fixed capital and $0 \leq s \leq 1$. So, the amount of total output is a function of price for a given s , i.e., $y_j = y_j(p_j; s)$.

With these production functions, producer surplus in each industry is given by:

$$\begin{aligned} PS_j &\equiv \Pi_j + PS_j^w \\ &= \frac{1}{2} (p_j - p_j^w) (y_j(p_j) + y_j(p_j^w)) + \frac{1}{2} p_j^w y_j(p_j^w) \end{aligned} \tag{5}$$

where PS_j^w is the producer surplus at the world price and Π_j is the additional producer surplus if the domestic price is different from the world price. p_j^w denotes the exogenous world price and y_j denotes the production of each good.

2.2. Consumer preferences

All consumers have identical preferences with utility given by:

$$U = c_o + u_m(c_m) + u_x(c_x) \tag{6}$$

where c_o is consumption of the numeraire good and c_m, c_x are consumptions of the import-competing and export goods, respectively. The subutility functions, $u_j(\cdot)$, are assumed differentiable, increasing and concave. With these preferences, individuals demand $d_m(p_m)$ and $d_x(p_x)$ units of the nonnumeraire goods. The demands are assumed to be linear in

prices⁶: $d_m(p_m) = \beta_m - \epsilon_m p_m$ and $d_x(p_x) = \beta_x - \epsilon_x p_x$ where β_j, ϵ_j are positive. The consumer surplus is defined as:

$$CS(p_m, p_x) \equiv u_m[d_m(p_m)] - p_m d_m(p_m) + u_x[d_x(p_x)] - p_x d_x(p_x) \quad (7)$$

The trade revenue (tariff revenues and export subsidies) is given by:

$$TR = (p_m - p_m^w)(d_m(p_m) - y_m(p_m)) + (p_x - p_x^w)(d_x(p_x) - y_x(p_x)) \quad (8)$$

The trade revenue is redistributed equally to the population in a lump-sum fashion.

2.3. Composition of industries, lobby groups and welfares

The population consists of people who are endowed with the capital only and others who are endowed with labor only. The population is normalized to 1. The fraction of the population who are endowed with capital is denoted κ . The sunk capital has no mobility in the sense that if the sunk capital is located in the export (import-competing) industry, it stays in the export (import-competing) industry⁷. The non-sunk capital can move from one industry to the other. The number of the sunk capital owners, as a fraction of the population, is denoted μ . So, $\kappa - \mu$ is the fraction of population who has the mobile capital. Let α_{ms}, α_{xs} be the numbers of owners of sunk capital in the import-competing and the export industry as fractions of population. How many of the mobile capital owners are located in each industry is determined by industry composition, s , as following:

$$\begin{aligned} \text{in import industry} \quad \alpha_{mn} &= \kappa \left(s - \frac{\alpha_{ms}}{\kappa} \right) \\ \text{in export industry} \quad \alpha_{xn} &= \kappa \left(1 - s - \frac{\alpha_{xs}}{\kappa} \right) \end{aligned} \quad (9)$$

⁶This amounts to assuming that $u_m(c_m)$ and $u_x(c_x)$ have quadratic forms.

⁷To some extent, the sunk capital may be considered as physical capital which is hard to relocate, and the non-sunk capital as human capital which has some mobility across industries.

where $\frac{\alpha_{ms}}{\kappa} \leq s \leq \frac{\kappa - \alpha_{xs}}{\kappa}$ ⁸. The total number of capital owners as a fraction of population in the import-competing industry is $(\alpha_{mn} + \alpha_{ms})$ and in the export industry $(\alpha_{xn} + \alpha_{xs})$.

The two nonnumeraire industries are organized to form lobby groups. However, not every capital owner is a member of lobbies. Only the owners of sunk capital are members of lobbies⁹. The mobile capital owners free ride on lobbying efforts of the sunk capital owners. The free riders can always free ride regardless of the industry in which they are located. Total per-period gross welfare of each industry is given by:

$$\begin{aligned} W_m(\mathbf{p}) &= W_m^{lob}(\mathbf{p}) + W_m^{mob}(\mathbf{p}) & (10a) \\ &= \frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} PS_m(p_m) + \alpha_{ms} [TR(\mathbf{p}) + CS(\mathbf{p})] \\ &\quad + \frac{\alpha_{mn}}{\alpha_{ms} + \alpha_{mn}} PS_m(p_m) + \alpha_{mn} [TR(\mathbf{p}) + CS(\mathbf{p})] \end{aligned}$$

$$\begin{aligned} W_x(\mathbf{p}) &= W_x^{lob}(\mathbf{p}) + W_x^{mob}(\mathbf{p}) & (10b) \\ &= \frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} PS_x(p_x) + \alpha_{xs} [TR(\mathbf{p}) + CS(\mathbf{p})] \\ &\quad + \frac{\alpha_{xn}}{\alpha_{xs} + \alpha_{xn}} PS_x(p_x) + \alpha_{xn} [TR(\mathbf{p}) + CS(\mathbf{p})] \end{aligned}$$

where $\mathbf{p} = (p_m, p_x)$ and W_j^{lob}, W_j^{mob} $j = \{m, x\}$ are welfares of sunk capital owners (lobbies) and mobile capital owners, respectively.

The lobbying game is based on the menu auction model of Bernheim-Whinston (1986). Lobby groups are assumed to choose contribution schedules, $C_j(\mathbf{p})$, specifying the level of

⁸As fractions of population there are α_{ms} and α_{xs} number of sunk capital owners in import and export industry, respectively. In terms of capital the amount of which is normalized to be 1, sunk capital owners in import industry have $\frac{\alpha_{ms}}{\kappa}$ fraction of total capital, and sunk capital owners in export industry, $\frac{\alpha_{xs}}{\kappa}$ fraction. Non-sunk capital owners in both industries together have $\frac{\kappa - \alpha_{ms} - \alpha_{xs}}{\kappa}$ fraction of total capital. Since $\frac{\alpha_{ms}}{\kappa}$ and $\frac{\alpha_{xs}}{\kappa}$ are fixed, the minimum s can be is $\frac{\alpha_{ms}}{\kappa}$ and the maximum is $\frac{\alpha_{ms}}{\kappa} + \frac{\kappa - \alpha_{ms} - \alpha_{xs}}{\kappa} = \frac{\kappa - \alpha_{xs}}{\kappa}$.

Also note that $\alpha_{ms} + \alpha_{xs} = \kappa - \mu$.

⁹The amount of sunk capital (or fraction of sunk capital owners) in each industry is taken as exogenously given. An equilibrium amount of lobby group members is not a focus of this paper. Presumably, welfare of sunk capital owners is tied to an industry they are located in. Therefore, they are willing to lobby for the industry. On the other hand, each owner of non-sunk capital sees himself as a very small part of an economy, hence unable to influence equilibrium outcomes by joining a lobby. Since each non-sunk capital owners does not think he can change anything by joining a lobby and pay contribution, he does not join any lobby.

contributions by the lobby groups for all possible price vectors \mathbf{p} to maximize the present value of the stream of net-of-contribution utility over T periods. Lobby groups cannot commit to future contribution schedules.

Utility of mobile capital owners depends on lobbying efforts of the lobby groups (i.e., domestic prices) and the industry in which their capital is located. Mobile capital owners maximize their discounted utility over T periods by choosing an industry to be located in.

2.4. Government objective

The government has an utility function defined over T periods with a discount factor ρ . The government decides the domestic consumer prices, p_m and p_x , in each period to maximize its utility given by:

$$G = \sum_{t=1}^T \rho^{t-1} [C_m(\mathbf{p}_t) + C_x(\mathbf{p}_t) + aW(\mathbf{p}_t)] \quad (11)$$

where C_m , C_x denote contributions from the lobby groups of the two industries, W is social welfare, a represents the value of the social welfare relative to the contributions and \mathbf{p}_t denotes a vector of domestic prices at time t . The social welfare in each period is given by:

$$W = PS_m + PS_x + TR + CS. \quad (12)$$

2.5. Adjustment costs

Mobile capital owners relocate to maximize their utility. This relocation may involve some adjustment costs. The adjustment costs may come from costs of searching for a new employment in a new industry or need to acquire new skills suitable for the new industry. The adjustment costs increase as more mobile capital is relocated because it may become more costly to search for new employment. The adjustment costs of relocation are denoted as AC . The adjustment costs of θ_t , $AC(\theta_t)$ where θ_t is the amount of change in s in either direction between periods t and $t + 1$, are the total adjustment costs to the capital owners

who relocate, which are assumed equally shared by the mobile capital relocated. The adjustment cost function is an increasing function of the change in s . The adjustment cost function is assumed to be differentiable with $\frac{dAC(\theta)}{d\theta} > 0$ for $0 < \theta < 1$, $\frac{dAC(\theta)}{d\theta} = 0$ for $\theta = 0$, and $AC(0) = 0$.

3. Determination of domestic prices in one-shot game

Before considering the repeated game version of the model it is useful to consider a static version in which the political game is played once and s is fixed. This section describes, first, how a set of domestic prices is determined for a given level of s . These prices tell how much protection is given to each industry for given s . Once the prices are derived for a given level of s , how the level of protection varies as s changes is examined.

It is assumed that lobby groups use differentiable and truthful contribution schedules. A contribution schedule is locally truthful around a price vector \mathbf{p} if, at the margin, the change in lobby contribution induced by a change in government policy equals the change in lobby group's gross welfare resulting from the policy change, i.e., the contribution schedule reveals lobby's true preferences in the neighborhood of the price \mathbf{p} . More formally, a contribution is locally truthful around \mathbf{p} if $\nabla C_j(\mathbf{p}) = \nabla W_j^{lob}(\mathbf{p})$. A contribution schedule that everywhere reveals the true preferences is a truthful contribution schedule.

The contribution schedules of the two industries are given by¹⁰:

$$\begin{aligned} C_m(\mathbf{p}^e) &= W_x^{lob}(\mathbf{p}^{-m}) + aW(\mathbf{p}^{-m}) - [W_x^{lob}(\mathbf{p}^e) + aW(\mathbf{p}^e)] \\ C_x(\mathbf{p}^e) &= W_m^{lob}(\mathbf{p}^{-x}) + aW(\mathbf{p}^{-x}) - [W_m^{lob}(\mathbf{p}^e) + aW(\mathbf{p}^e)] \end{aligned} \quad (13)$$

where \mathbf{p}^{-j} denotes the vector of domestic prices when interest group j does not participate in the political game and \mathbf{p}^e an equilibrium vector of prices when both lobbies participate in

¹⁰See Grossman-Helpman (1994) for details.

the lobbying game. An equilibrium is defined by a pair of contribution schedules such that each maximizes the welfare of the given interest group members, taking the contribution of the other interest group as given. The Nash equilibrium contribution schedules implement equilibrium domestic prices.

In order for contributions and \mathbf{p}^e to be a subgame-perfect Nash equilibrium, \mathbf{p}^e should maximize

$$C_m(\mathbf{p}) + C_x(\mathbf{p}) + aW(\mathbf{p}) \quad (14a)$$

$$W_m^{lob}(\mathbf{p}) - C_m(\mathbf{p}) + \sum_j C_j(\mathbf{p}) + aW(\mathbf{p}) \quad (14b)$$

$$W_x^{lob}(\mathbf{p}) - C_x(\mathbf{p}) + \sum_j C_j(\mathbf{p}) + aW(\mathbf{p}) \quad (14c)$$

for the government, the import-competing and the export industry, respectively. In essence, for a price vector to be an equilibrium, it must maximize the government welfare (14a), and the sum of net of contribution industry lobby welfare and the government welfare for each lobby given the contribution schedule of the other lobby, (14b) and (14c)¹¹. For a given s , the equilibrium prices are determined by solving the equation system. The first order

¹¹Condition (14a) says that given the contribution schedules, the government sets the domestic prices to maximize its utility. Conditions (14b) and (14c) state that the equilibrium domestic prices must maximize joint welfare of an interest group (import-competing or export) and the government. If this condition is not satisfied, there is an opportunity for a lobby group to make profit just by redesigning its contribution schedule to induce the government to choose prices which maximize joint welfare and capture the surplus from the switch in policy. As explained in Bernheim-Whinston(1986) or G-H(1994), suppose $\tilde{C}_j(\mathbf{p})$ is the contemplated contribution schedules for lobby groups which induced the government to choose $\tilde{\mathbf{p}} \neq \hat{\mathbf{p}} \in \arg \max (W_j - \tilde{C}_j) + G$ given $\tilde{C}_i, i \neq j$. The lobby j can reformulate its C_j as $\hat{C}_j(\mathbf{p}) = \sum_i \tilde{C}_i(\tilde{\mathbf{p}}) + aW(\tilde{\mathbf{p}}) - \sum_{i \neq j} \tilde{C}_i(\mathbf{p}) - aW(\mathbf{p}) + \varepsilon h(\mathbf{p})$ where $\varepsilon > 0$ and $h(\cdot)$ is a nonnegative function which is maximum at $\hat{\mathbf{p}}$. With the new contribution schedule by the lobby j , the government will choose $\hat{\mathbf{p}}$ because $G(\hat{\mathbf{p}}) = G(\tilde{\mathbf{p}}) + \varepsilon h(\hat{\mathbf{p}})$. Let Λ be the increase in joint welfare, i.e. $\Lambda = (\hat{W}_j - \hat{C}_j + \hat{G}) - (\tilde{W}_j - \tilde{C}_j + \tilde{G})$. Rearranging one gets, $(\hat{W}_j - \hat{C}_j) - (\tilde{W}_j - \tilde{C}_j) = \Lambda - (\hat{G} - \tilde{G}) = \Lambda - \varepsilon h$. For a small enough ε , $\Lambda - \varepsilon h > 0$. In other words, the lobby j can gain by redesigning its contribution schedule. In the equilibrium, no such opportunity can be left unused.

conditions for (14a)-(14c) are as follows:

$$\nabla C_m(\mathbf{p}^e) + \nabla C_x(\mathbf{p}^e) + a\nabla W(\mathbf{p}^e) = 0 \quad (15a)$$

$$\nabla W_m^{lob}(\mathbf{p}^e) + \nabla C_x(\mathbf{p}^e) + a\nabla W(\mathbf{p}^e) = 0 \quad (15b)$$

$$\nabla W_x^{lob}(\mathbf{p}^e) + \nabla C_m(\mathbf{p}^e) + a\nabla W(\mathbf{p}^e) = 0 \quad (15c)$$

Solving the first order conditions above gives the equilibrium prices¹²

$$p_m^e - p_m^w = -\frac{\left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} - \alpha_{ms} - \alpha_{xs}\right) y_m}{(a + \alpha_{ms} + \alpha_{xs}) m'_m} \quad (16a)$$

$$p_x^e - p_x^w = -\frac{\left(\frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} - \alpha_{ms} - \alpha_{xs}\right) y_x}{(a + \alpha_{ms} + \alpha_{xs}) m'_x} \quad (16b)$$

where $m_j = d_j - y_j$ and $m'_j = \frac{\partial m_j}{\partial p_j}$.

From the equations above, p_m^e and p_x^e can be found:

$$p_m^e = \frac{p_m^w (\varepsilon_m + \delta_m s)}{\varepsilon_m + \delta_m s - A_m \delta_m s} \quad (17a)$$

$$p_x^e = \frac{p_x^w (\varepsilon_x + \delta_x (1 - s))}{\varepsilon_x + \delta_x (1 - s) - A_x \delta_x (1 - s)} \quad (17b)$$

where $A_m = \frac{\left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} - \alpha_{ms} - \alpha_{xs}\right)}{(a + \alpha_{ms} + \alpha_{xs})}$ and $A_x = \frac{\left(\frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} - \alpha_{ms} - \alpha_{xs}\right)}{(a + \alpha_{ms} + \alpha_{xs})}$. Substituting y_j and m'_j into above equations and taking a derivative with respect to s ¹³, one obtains

$$\frac{dp_m^e}{ds} = \frac{-\delta_m p_m^w \left(\frac{\mu \varepsilon_m}{a + \mu} + \frac{\alpha_{ms}}{\kappa(a + \mu)}\right)}{(\varepsilon_m + \delta_m s - A_m \delta_m s)^2} < 0 \quad (18a)$$

$$\frac{dp_x^e}{ds} = \frac{\delta_x p_x^w \left(\frac{\mu \varepsilon_x}{a + \mu} + \frac{\alpha_{xs}}{\kappa(a + \mu)}\right)}{[\varepsilon_x + \delta_x (1 - s) - A_x \delta_x (1 - s)]^2} > 0. \quad (18b)$$

The domestic equilibrium price, p_j^e , is maximal when there is only sunk capital in industry

¹²See Appendix 1 for details.

¹³See Appendix 2 for details.

j .

Several things about the level of protection are worth noting. First, since $m'_j < 0$ ¹⁴, $y_j > 0$ and $a + \alpha_{ms} + \alpha_{xs} > 0$, the sign of $p_j^e - p_j^w$ depends on the sign of $\frac{\alpha_{js}}{\alpha_{js} + \alpha_{jn}} - \alpha_{ms} - \alpha_{xs}$. It is not necessarily true that the existence of a lobby group for an industry results in a protection for that industry. If the proportion of the sunk capital owners is low enough compared to the proportion of the mobile capital owners in an industry, there can be no protection ($p_j^e = p_j^w$) or even a negative protection ($p_j^e < p_j^w$) for that industry¹⁵. It is easy to see that at $s = \frac{\alpha_{ms}}{\kappa\mu}$, the import-competing industry gets no protection ($p_m^e = p_m^w$) and at $s = 1 - \frac{\alpha_{xs}}{\kappa\mu}$, the export industry gets no protection ($p_x^e = p_x^w$). Note that $\frac{\alpha_{ms}}{\kappa\mu} - (1 - \frac{\alpha_{xs}}{\kappa\mu}) = \frac{\alpha_{ms} + \alpha_{xs}}{\kappa\mu} - 1 = \frac{1}{\kappa} - 1 > 0$. Hence, there is no s for which both industries are in free trade situation and no s such that both industries get negative protections. For any possible s , either both industries are protected or at least one is protected. Which case arises depends on the values of κ , α_{ms} and α_{xs} .

Second, a smaller industry is more likely to get a greater protection.¹⁶ If s is smaller than the point where $(p_m^e - p_m^w) = (p_x^e - p_x^w)$, the import industry gets higher protection than the export industry. The reverse is also true. Therefore, relative to the point of intersection, the smaller industry is protected more.¹⁷ For example, if the import industry is very small, the import industry is highly protected while the large export industry's protection level is small or even negative.

The basic intuition is as follows. When an industry is small, the lobby members capture most of the rents generated by protection. Therefore, the value of protection becomes larger

¹⁴ $m'_m = -\epsilon_m - \delta_m s < 0$ and $m'_x = -\epsilon_x - \delta_x(1 - s) < 0$.

¹⁵This is different from Grossman-Helpman. In their model, an existence of a lobby group representing an industry results in a protection for the industry.

¹⁶Related to this is the work by Mitra (1999) who, using Grossman-Helpman approach, argues that more concentrated industries are successful in lobbying for protection. In this model, size of an industry correspond to the number of firms.

¹⁷The intersection is where the two industries get the same level of protection. For example, if the two industries are identical in the sense that $\alpha_{ms} = \alpha_{xs}$, $\epsilon_m = \epsilon_x$, then $(p_m^e - p_m^w)$ and $(p_x^e - p_x^w)$ curves intersect at $s = \frac{1}{2}$. In other words, when the two industries are identical, the protection level is the same for both industries if they are of the same size. If one industry is smaller, the industry gets a higher protection.

as an industry gets smaller, and the value of protection is the highest when an industry is composed only of lobby members. This translates into more lobby activities by the small industry lobby group and a large amount of contribution. So the small industry gets high protection and the big industry gets low protection. If there is a lot of the mobile capital in an industry, the rents must be shared by large number of capital owners among which lobby members are only of a small fraction. Therefore, the lobby members care less about the protection level if there are many free-riding mobile capital owners. Hence, the contribution by a lobby group gets higher as the industry becomes smaller (i.e., less mobile capital) and is the highest when there are only lobby members in that industry. This translates into higher protection level for a relatively small industry.

Third implication is that as an industry becomes more capital intensive, i.e., the ratio of labor to capital ($\frac{L}{K}$) gets smaller, the level of protection becomes smaller. From profit maximization, demand for labor is given by $L_j = \frac{1}{4}p_j^2 K_j$ where $j = \{m, x\}$, the labor/capital ratio is: $\frac{L_j}{K_j} = \frac{1}{4}p_j^2$. As s increases, p_m^e decreases and p_x^e increases. For the import industry, this implies a lower $\frac{L}{K}$ and for the export industry a higher $\frac{L}{K}$. Therefore, a lower(higher) protection level corresponds to a lower(higher) $\frac{L}{K}$.

4. Two period game

Consider now a 2-period version of the previous model in which mobile capital can move between industries after the initial period. At the initial period, s is set exogenously at s_1 . Given s_1 , government decides domestic price vector, \mathbf{p}_1 , and this price vector determines the welfares of lobby groups, the mobile capital owners in each industry, and of the government. At the end of the initial period, mobile capital owners can adjust capital levels between the two industries. Capital owners who relocate correctly anticipate the equilibrium level of capital in each industry in the second period and how these levels affect government policy in the second period.

To simplify the analysis, it is assumed that world prices are identical in the two industries

(i.e., $p_m^w = p_x^w$). Also it is assumed that there are no adjustment costs.

4.1. Capital relocation

Once capital relocation has occurred at the end of initial period, the second period lobby game is played as described in the previous section. Thus, to determine capital owner's relocation decision we need only to determine how the equilibrium in the one-shot lobbying game is affected by changes in s . Because the mobile capital owners receive the advantage of any effect that lobbies have on equilibrium prices but do not pay contributions, the welfare of the mobile capital owners for a given s is:

$$\begin{aligned} W_m^{mob} &= \frac{\kappa\left(s - \frac{\alpha_{ms}}{\kappa}\right)}{\kappa\left(s - \frac{\alpha_{ms}}{\kappa}\right) + \alpha_{ms}} PS_m + \kappa\left(s - \frac{\alpha_{ms}}{\kappa}\right) (TR + CS) \\ W_x^{mob} &= \frac{\kappa\left(1 - s - \frac{\alpha_{xs}}{\kappa}\right)}{\kappa\left(1 - s - \frac{\alpha_{xs}}{\kappa}\right) + \alpha_{xs}} PS_x + \kappa\left(1 - s - \frac{\alpha_{xs}}{\kappa}\right) (TR + CS) \end{aligned} \quad (19)$$

for import and export industry, respectively. Shares of welfare per mobile capital owner can be found by dividing the welfares in the expressions above by $\kappa\left(s - \frac{\alpha_{ms}}{\kappa}\right)$ for import industry and $\kappa\left(1 - s - \frac{\alpha_{xs}}{\kappa}\right)$ for export industry. Given the possibility of free-riding, the decision to relocate or not depends on difference in shares of welfares. The difference in the share of the gross welfares ($\equiv DGW$) per mobile capital owner is given by:

$$\begin{aligned} DGW &\equiv \frac{W_m^{mob}}{\kappa\left(s - \frac{\alpha_{ms}}{\kappa}\right)} - \frac{W_x^{mob}}{\kappa\left(1 - s - \frac{\alpha_{xs}}{\kappa}\right)} \\ &= \frac{\Pi_m}{\kappa s} - \frac{\Pi_x}{\kappa(1-s)}. \end{aligned} \quad (20)$$

That is, the welfare difference is just the difference in profits from protection. The difference in shares per unit of capital is $DGWC = \kappa(DGW) = \frac{\Pi_m}{s} - \frac{\Pi_x}{(1-s)}$. The effect of a change in

s on $DGWC$ is given by¹⁸

$$\frac{d(DGWC)}{ds} = \frac{d}{ds} \left[\frac{\Pi_m}{s} \right] - \frac{d}{ds} \left[\frac{\Pi_x}{1-s} \right] < 0, \quad (21)$$

so that the difference in shares per unit of capital is a decreasing function of s .

The initial composition of industries, s_1 , can be anywhere between $\frac{\alpha_m s}{\kappa}$ and $\frac{\kappa - \alpha_x s}{\kappa}$. The mobile capital owners have an incentive to relocate if, when they relocate, the payoff of relocation is greater than the payoff from staying. For example, some mobile capital in the export industry will relocate to the import-competing industry if at s_1 (i.e., at \mathbf{p}_1) the following is true¹⁹

$$DGWC(s_1) = \frac{\Pi_m(s_1)}{s_1} - \frac{\Pi_x(1-s_1)}{1-s_1} > 0. \quad (22)$$

The magnitude of $DGWC$, either positive or negative, represents the potential gain from relocation.

With no adjustment costs, the equilibrium industry composition is simply where $DGWC = 0$. If $DGWC(s_1) = 0$, then there is no incentive for any capital owner to relocate. If $DGWC(s_1) > 0$, mobile capital owners in the export industry have an incentive to relocate to the import industry, hence increasing s . As s increases, $DGWC$ decreases. As long as $DGWC$ remains positive, some capital moves to the import industry. Relocation will stop where $DGWC = 0$. Therefore, the equilibrium industry composition in period 2, s_2 , occurs at the point where $DGWC(s_2) = 0$ as long as there is enough mobile capital to reach s_2 . The same argument applies for a case where $DGWC(s_1) < 0$.

¹⁸See Appendix 3 for details.

¹⁹From continuity if $f(x) - g(x) > 0$, then $f(x + \varepsilon) - g(x + \varepsilon) \geq 0$ for small ε . Consider capital as infinitely divisible. Then, if $DGWC > 0$, it pays for a small amount of capital to relocate to the import industry. Relocation will continue until $DGWC$ at a new s is equal to zero.

4.2. Price vectors

Consider, next, the equilibrium price vectors in the two-period game. These vectors can be solved for by backward induction. In period 2, s_2 is fixed and so the government chooses price vector $\hat{\mathbf{p}}_2$ given by the solution to the one-shot game with $s = s_2$. Given $\hat{\mathbf{p}}_2$ chosen in the second period, the government chooses the price vector $\hat{\mathbf{p}}_1$ associated with one-shot game in which $s = s_1$ in the first period. To see why, suppose the government deviates and chooses $\tilde{\mathbf{p}}_1 \neq \hat{\mathbf{p}}_1$. Then, as explained in Section 3 (see Footnote 10), a lobby group can redesign its contribution schedules such that $G_1(\tilde{\mathbf{p}}_1) = G_1(\hat{\mathbf{p}}_1) - \varepsilon h(\hat{\mathbf{p}}_1)$ where $\varepsilon h(\hat{\mathbf{p}}_1) > 0$. Hence, the one-shot game price vectors are the price vectors chosen in the two-period game.

Since the price vectors in the two-period game are the same as the price vectors in the one-shot game, the results found in the one-shot game are valid for the two-period game. Consider, for instance, a situation where the initial industry composition is smaller than the period 2 steady-state level (i.e., the import-competing industry is relatively small). If there is no change in industry structure (i.e., if there is no relocation), the import-competing industry gets higher protection than the export industry in period 2 and so the mobile capital owners in the import-competing industry would receive higher rents per capital than those in the export industry. As a consequence, at the end of the first period, some mobile capital owners in the export industry relocate to the import-competing industry. This relocation occurs up to the point at which the difference in rents is zero (i.e., until $DGWC(s_2) = 0$). This relocation process expands the import-competing industry and shrinks the export industry. Using the findings from the one-shot game, in period 2, the level of protection for the import-competing industry decreases and that for the export industry increases. Put it differently, a declining industry becomes more protected than before and an expanding industry becomes less protected than before. The declining (expanding) industry will be more labor (capital) intensive in the period 2 than in period 1 as its price increases (decreases).

If the initial industry composition is larger than the period 2 steady-state level (i.e., the

import-competing industry is relatively big), the import-competing industry gets a lower level of protection than the export industry ($DGWC(s_1) < 0$). Some of the mobile capital in the import industry relocates to the export industry, expanding the export industry and shrinking the import-competing industry. In period 2, the level of protection for the import-competing industry increases and that for the export industry decreases. Again, a declining industry will be more protected than before and will be more labor intensive in the period 2 as its price increases.

4.3. Movement of s and government welfare

Because industry composition affects lobby contributions, the government has preferences over how industry composition evolves. The fact that the price path in the two-period problem is given by simple repetition of the one-shot game means the government cannot link trade policies across periods, and so it has limited ability to influence second period industry composition. The implication is that industry composition may evolve in a way that the government finds undesirable but nonetheless unavoidable. This subsection explores this possibility in more detail. It begins by determining the government's preferences over industry composition.

Suppose that government has freedom to choose the optimal industry composition, but does so subject to the lobbying game described previously (i.e., the government chooses optimal domestic prices for every given s subject to political pressures). Equilibrium government welfare for a given s is then $G(p_m^e(s), p_x^e(s), s)$. Define this function as $\phi(s)$. In order to find out how government welfare changes as s varies, we need to know the property of the function $\phi(s)$. As the following proposition shows, the government wants one industry to have all mobile capital and the other only lobby members.

Proposition 4.1. *When government chooses optimal domestic prices for every given s , the government's indirect objective function $\phi(s)$ is convex in s .*

Proof. See appendix 4.

To gain some intuition about this result, consider contributions by the lobby groups. As explained in Section 3, the contribution offered by each industry is the highest when there are only lobby members in an industry, i.e., C_m decreases in s and C_x increases in s . Government utility improves in terms of contribution it collects from a small industry as the industry composition goes to extreme levels. The total contribution is the highest at either extreme and consideration of the contributions dominates social welfare consideration. Therefore, the government utility is the highest at an extreme level of s .

We can get some ideas about the industry which the government would want to have all mobile capital by comparing lobby memberships. If the two industries are identical, the government would want the export industry to have all the mobile capital because the government will want high tariffs and collect tariff revenue rather than high subsidies. If the export industry lobby gets bigger, the government can collect more contribution from the export lobby when the size of export industry becomes smaller. If the size of export lobby group gets large enough, then the government would want the import-competing industry to have all the mobile capital because a large contribution from the export industry lobby compensates for the loss in tariff revenue and an increase in subsidy cost. As a general tendency, the government tends to want a smaller lobby industry to have all the mobile capital.

While the government prefers to have all mobile capital in one industry, because of its inability to commit to trade policies across periods, it may not be able to achieve this outcome. To see this, consider a symmetric case (i.e., $\alpha_{ms} = \alpha_{xs}$, and $\epsilon_m = \epsilon_x$). At $s = \frac{1}{2}$, domestic prices of the two industries are the same and at these prices, $DGWC = 0$. Hence, the steady-state industry composition is $\frac{1}{2}$. As explained above, the government wants the export industry to have all mobile capital. Suppose that period 1 industry composition is less than $\frac{1}{2}$. Due to political pressure, the government chooses higher protection for the

import-competing industry than the export industry. Knowing that in the second period the government will choose levels of protection subject to political pressure, some of the mobile capital in the export industry will relocate to the import industry until the second period industry composition is $\frac{1}{2}$. Thus, while the government prefers the mobile capital in the import-competing industry to relocate to the export industry, government's inability to link trade policies across periods generates the policies that prompt the mobile capital in the export industry to relocate to the import-competing industry against government interest.

It is also interesting to compare this result to the case in which there are no lobbies and a government maximizes social welfare. A social welfare maximizing government cares only about producer and consumer surplus and will choose free trade prices. Since, with identical world prices, the industry composition does not matter to social welfare, the social welfare maximizing government does not care about the industry composition. Hence, the proposition above is the outcome of the political equilibrium.

5. Extensions

This section considers two extensions to the basic model: (i) positive adjustment costs and more than two periods, and (ii) different world prices.

5.1. T-period repeated game with adjustment costs

In the finitely repeated game, the government and the mobile capital owners maximize their discounted utility defined over T periods. Consider the equilibrium domestic price vectors and the relocation decision by the mobile capital owners when the lobbying game is repeated for T periods with positive adjustment costs.

Suppose the political game is played repeatedly over a finite time horizon, T . The government utility is given by:

$$G = \sum_{t=1}^T \rho^{t-1} G_t \quad 0 < \rho < 1 \quad (23)$$

where G_t is the government utility at time t given by $(C_m(\mathbf{p}_t) + C_x(\mathbf{p}_t) + aW(\mathbf{p}_t))$. Let $\hat{\mathbf{p}}_t \in \{\hat{\mathbf{p}}_1, \hat{\mathbf{p}}_2, \dots, \hat{\mathbf{p}}_T\}$ be the stream of the domestic price vectors in the one-shot game. Now, consider the repeated game. The backward induction argument used in finding price vectors in the two-period game applies to the T -period game. Hence, the price vectors of the one-shot game are the price vectors chosen in the T -period finitely repeated game.

The relocation decision is made by the mobile capital owners who maximize their discounted utility given by:

$$U = \sum_{t=1}^T \lambda^{t-1} u_t \quad 0 < \lambda < 1 \quad (24)$$

where $u_t = \varphi[\frac{\Pi_{mt}}{s_t} + \frac{PS_m^w}{s_t} + \kappa(TR + CS)_t]$ if in m and $u_t = \varphi[\frac{\Pi_x}{1-s_t} + \frac{PS_x^w}{1-s_t} + \kappa(TR + CS)_t]$ if in x (φ denotes number of units of capital each owner has). The mobile capital owners choose an industry to locate in such a way as to maximize their discounted profits over T periods. The discount factor for the mobile capital is denoted λ and is assumed to be identical for all the mobile capital owners. The relocation mechanism is described for the case where $DGWC(s_1) > 0$. The analysis is analogous when $DGWC(s_1) < 0$. Recall that the mobile capital owners correctly anticipate the effects of their relocation.

Let's suppose, for now, that the mobile capital owners know that $\frac{\Pi_{mt}}{s_t} + (TR + CS)_t > \frac{\Pi_{xt}}{1-s_t} + (TR + CS)_t \quad \forall t$. Let's first look at the location decision by the mobile capital which is initially in m . The mobile capital in m will not relocate to x because the return to capital in every period is higher in m than in x . The mobile capital which is initially in m remains in m .

Consider, next, the location decision by the mobile capital in x . The location decision can be solved backward. At the final period, the industry composition is s_T . At $t = T - 1$, given s_T , the mobile capital in x relocates until:

$$\begin{aligned} & \frac{\varphi}{\theta_{T-1}} \theta_{T-1} \left[\frac{\Pi_{m(T)}}{s_{T-1} + \theta_{T-1}} + (TR + CS)_{T-1} \right] - \frac{\varphi}{\theta_{T-1}} AC(\theta_{T-1}) \quad (25a) \\ & = \frac{\varphi}{\theta_{T-1}} \theta_{T-1} \left[\frac{\Pi_{x(T)}}{1 - s_{T-1} - \theta_{T-1}} + (TR + CS)_{T-1} \right] \end{aligned}$$

where θ_{T-1} is the amount of mobile capital relocated to m , $\frac{\varphi}{\theta_{T-1}}\theta_{T-1}\left[\frac{\Pi_{m(T)}}{s_{T-1}+\theta_{T-1}}\right]$ is the share of the total return to the capital relocated to m for each mobile capital owner, $\frac{\varphi}{\theta_{T-1}}AC(\theta_{T-1})$ is the share of the adjustment costs for each capital owner and $\frac{\varphi}{\theta_{T-1}}\theta_{T-1}\left[\frac{\Pi_{x(T)}}{1-s_{T-1}-\theta_{T-1}}\right]$ is the share of the total return to the capital if remains in x . The equation above says that at $t = T - 1$, some of the mobile capital in x (i.e., θ_{T-1}) relocates to m until the net return in m when relocated is equal to the return if remains in x . From the equation above the amount of relocated mobile capital can be found to be:

$$\frac{AC(\theta_{T-1})}{\theta_{T-1}} = \frac{\Pi_{m(T)}}{s_T} - \frac{\Pi_{x(T)}}{1-s_T} \quad (25b)$$

So, s_{T-1} can be determined to be: $s_{T-1} = s_T - \theta_{T-1}$. At $t = T - 2$, given s_{T-1} and s_T , the amount of relocation can be found by²⁰:

$$\begin{aligned} & \theta_{T-2} \left[\frac{\Pi_{m(T-2)}}{s_{T-2} + \theta_{T-2}} \right] - AC(\theta_{T-2}) + \lambda \theta_{T-2} \frac{\Pi_{m(T)}}{s_T} \\ = & \theta_{T-2} \left[\frac{\Pi_{x(T-1)}}{1-s_{T-2}-\theta_{T-2}} \right] + \lambda \theta_{T-2} \left[\frac{\Pi_{x(T)}}{1-s_T} \right] \end{aligned} \quad (26a)$$

where the left-hand side is the return if relocates to m and the right-hand side is the return if remains in x . The amount of relocated mobile capital at $t = T - 2$ can be found by:

$$\frac{AC(\theta_{T-2})}{\theta_{T-2}} = \left(\frac{\Pi_{m(T-1)}}{s_{T-1}} - \frac{\Pi_{x(T-1)}}{1-s_{T-1}} \right) + \lambda \left(\frac{\Pi_{m(T)}}{s_T} - \frac{\Pi_{x(T)}}{1-s_T} \right) \quad (26b)$$

which also determines s_{T-2} . The amount of relocation in the initial period is, then,

$$\begin{aligned} \frac{AC(\theta_1)}{\theta_1} = & \left(\frac{\Pi_{m2}}{s_2} - \frac{\Pi_{x2}}{1-s_2} \right) + \lambda \left(\frac{\Pi_{m3}}{s_3} - \frac{\Pi_{x3}}{1-s_3} \right) + \dots \\ & \dots + \lambda^{T-2} \left(\frac{\Pi_{m(T-1)}}{s_{T-1}} - \frac{\Pi_{x(T-1)}}{1-s_{T-1}} \right) + \lambda^{T-1} \left(\frac{\Pi_{m(T)}}{s_T} - \frac{\Pi_{x(T)}}{1-s_T} \right). \end{aligned} \quad (27)$$

²⁰Since the share term, $\frac{\varphi}{\theta_t}$, and $(TR + CS)_t$ are cancelled, they will be omitted from now on.

When the mobile capital owners in x make the relocation decision, they consider future benefits of relocation and act accordingly. The amount of relocation is the highest in the initial period and becomes smaller as time goes on. Note that the direction of relocation is always towards the steady-state level of industry composition (s^s). In the process, the import-competing industry gets bigger even though the increment in each period becomes smaller. As mentioned in Section 1.3, the level of protection in the import-competing industry decreases and that of the export industry increases as the mobile capital relocates to the import-competing industry.

It was assumed that $\frac{\Pi_{mt}}{s_t} + (TR + CS)_t > \frac{\Pi_{xt}}{1-s_t} + (TR + CS)_t \quad \forall t$, i.e., the steady-state level is not reached in a finite time period. Let's show why this is the case. If $s_T = s^s$, then $\frac{AC(\theta_{T-1})}{\theta_{T-1}} = \frac{\Pi_{m(T)}}{s_T} - \frac{\Pi_{x(T)}}{1-s_T} = 0$ indicating $\theta_{T-1} = 0$ and, hence, $s_{T-1} = s_T$. One period back, $\frac{AC(\theta_{T-2})}{\theta_{T-2}} = \left(\frac{\Pi_{m(T-1)}}{s_{T-1}} - \frac{\Pi_{x(T-1)}}{1-s_{T-1}} \right) + \lambda \left(\frac{\Pi_{m(T)}}{s_T} - \frac{\Pi_{x(T)}}{1-s_T} \right) = 0$. and so on. Therefore, $s_1 = s_2 = \dots = s_{T-2} = s_{T-1} = s_T = s^s$. However, by the initial condition, it has to be the case that $s_1 < s^s$. Hence, $s_T \neq s^s$ and $\frac{\Pi_{mt}}{s_t} + (TR + CS)_t > \frac{\Pi_{xt}}{1-s_t} + (TR + CS)_t \quad \forall t$. In other words, the mobile capital owners in x will not relocate incurring adjustment costs when there is no benefit of doing so in the following periods, so relocation stops before reaching s^s .

The same argument applies to the case where $DGWC(s_1) = \frac{\Pi_{m2}(s_1)}{s_1} - \frac{\Pi_{x2}(1-s_1)}{(1-s_1)} < 0$. In this case, the mobile capital relocates to the import-competing industry and the industry composition approaches the steady-state level as above.

The findings from the two-period game carry over to the T-period game. A declining(expanding) industry gets higher(lower) protection than before and becomes more labor(capital) intensive as its domestic price increases(decreases). The political equilibrium may generate policies that lead to industry structure, which is sub-optimal for government.

5.2. Different world prices

So far, it has been assumed that world prices are the same. Having different world prices alters the preceding analysis in two ways. First, with different world prices, $DGWC$ becomes:

$$DGWC = \frac{\Pi_m}{s} - \frac{\Pi_x}{(1-s)} + \frac{1}{2}\delta_m p_m^{w2} - \frac{1}{2}\delta_x p_x^{w2} \quad (28)$$

where $\frac{1}{2}\delta_m p_m^{w2} - \frac{1}{2}\delta_x p_x^{w2}$ is some constant. Hence, different world prices shift $DGWC$ curve of identical world prices up or down.

If p_m^w is sufficiently larger than p_x^w so that $DGWC$ is positive for all possible s , then all mobile capital will relocate to the import-competing industry. If the opposite is true, then all mobile capital will relocate to the export industry. If the difference is not big enough so that $DGWC = 0$ at some s in the possible range of s , then relocation stops at that s and there will be some mobile capital in both industries.

The other change is that when $p_m^w \neq p_x^w$, the term $(PS_m^w + PS_x^w)$ in the government utility function depends on s .²¹ Thus, the difference in the world prices has an effect on the government preferences over industry compositions. In this case, the government preferences depend on two things: contributions (i.e., lobby memberships) and difference in world prices. Note that $PS_m^w + PS_x^w$ increases in s if $p_m^w > p_x^w$ and decreases in s if $p_m^w < p_x^w$.²² The difference in world prices may push government's choice of industry in the same or opposite direction as the lobby memberships. If the two effects go in the opposite direction, the government's choice depends on which effect dominates. For example, if p_x^w is sufficiently larger than p_m^w , then the government would want the export industry to have all the mobile capital.

With different world prices, there are cases (such as when the difference is sufficiently large) where relocation is always beneficial to the government and the steady-state industry structure is the one preferred by the government. However, it is possible that the steady-

²¹When the world prices are identical, $(PS_m^w + PS_x^w)$ is a constant. It does not affect government's preferences over industry structure.

²²Differentiating $(PS_m^w + PS_x^w)$ with respect to s gives $\frac{d(PS_m^w + PS_x^w)}{ds} = \frac{1}{2}\delta_j (p_m^{w2} - p_x^{w2})$.

state industry composition is not optimal for the government (such as the case when the difference in world prices is not big enough so that relocation does not reach an extreme industry composition).

This change in government preferences also means that comparison between the government's preferred industry structure in the political equilibrium with that of a social welfare maximizing government is different. The social welfare maximizing government wants only industry m if $p_m^w > p_x^w$ or industry x if $p_m^w < p_x^w$. However, it is possible that the politically motivated government's most preferred industry composition is different from that of the social welfare maximizing government. Even when $p_m^w > p_x^w$, the politically motivated government's most preferred industry composition can be a big export industry depending on lobby membership.

6. Conclusion

This paper has presented a political economy model of trade policy where some capital can move across industries in response to a set of equilibrium domestic prices determined by interactions between an incumbent government and interest groups. The model introduces dynamic features into the Grossman-Helpman (1994) model.

By incorporating dynamics, this paper is able to investigate how industries adjust to trade policies and how the industry adjustment, in turn, affects future trade policies. An industry which is declining in size, as measured by the amount of capital used in the industry, gets increasingly higher protection. Also, given the production structures, the model indicates that a high protection level corresponds to a low capital-labor ratio. The paper also examines the effects of the industry adjustment on government utility. That the mobile capital can relocate and there exists an equilibrium industry composition have direct implications for government utility. Government utility improves as one industry gets very big and the other industry gets very small. In general, however, the steady-state industry composition is not the industry structure preferred by the government.

The fact that the government may not obtain its preferred industry structure suggests that there may be a role for policy commitment via trade treaties. If, by committing to trade agreements, a government can shift resources to an industry structure preferred by the government, then the government would be willing to enter the trade agreements. It would be interesting to find out if trade agreements could provide the government a way to achieve a more preferred industry structure.

This model could also be extended to trade negotiations. Suppose there are two countries which are engaged in trade negotiation. The two countries may have different industry compositions and economic structures. Each government knows which industry it wants to expand and which industry it wants to shrink. Therefore, the two countries may have different incentives when they enter negotiations. This could give some clue as to how governments behave in trade negotiations.

7.

Appendix

1. Derivation of equations (16a) and (16b)

From equation (14a), $a\nabla W(\mathbf{p}^e) = -\nabla C_m(\mathbf{p}^e) - \nabla C_x(\mathbf{p}^e)$. Substituting this into equations (14b) and (14c) gives $\nabla C_m(\mathbf{p}^e) = \nabla W_m^l(\mathbf{p}^e)$ and $\nabla C_x(\mathbf{p}^e) = \nabla W_x^l(\mathbf{p}^e)$. Substituting these back into equation (14a) yields

$$\nabla W_m^l + \nabla W_x^l + a\nabla W = 0$$

So, the first order conditions are:

$$\frac{\partial W_m^l}{\partial p_m} = \left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} \right) y_m + \alpha_{ms} [(p_m - p_m^w) \frac{\partial (d_m - y_m)}{\partial p_m} + (d_m - y_m)] + \frac{\partial u_m}{\partial d_m} \frac{\partial d_m}{\partial p_m}$$

$$\begin{aligned}
& - \left(d_m + p_m \frac{\partial d_m}{\partial p_m} \right)] \\
& = \left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} - \alpha_{ms} \right) y_m + \alpha_{ms} (p_m - p_m^w) m'_m \\
\frac{\partial W_m^l}{\partial p_x} & = \alpha_{ms} (p_x - p_x^w) m'_x - \alpha_{ms} y_x \\
\frac{\partial W_x^l}{\partial p_m} & = \alpha_{xs} (p_m - p_m^w) m'_m - \alpha_{xs} y_m \\
\frac{\partial W_x^l}{\partial p_x} & = \left(\frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} - \alpha_{xs} \right) y_x + \alpha_{xs} (p_x - p_x^w) m'_x \\
\frac{\partial W}{\partial p_m} & = (p_m - p_m^w) m'_m \\
\frac{\partial W}{\partial p_x} & = (p_x - p_x^w) m'_x
\end{aligned}$$

Combining the above equations yields:

$$\begin{aligned}
& \left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} - \alpha_{ms} \right) y_m + \alpha_{ms} (p_m - p_m^w) m'_m + \alpha_{xs} (p_m - p_m^w) m'_m - \alpha_{xs} y_m \\
& \quad + a (p_m - p_m^w) m'_m \\
& = \left(\frac{\alpha_{ms}}{\alpha_{ms} + \alpha_{mn}} - \alpha_{ms} - \alpha_{xs} \right) y_m + (a + \alpha_{ms} + \alpha_{xs}) (p_m - p_m^w) m'_m = 0 \quad \text{and} \\
& \left(\frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} - \alpha_{xs} \right) y_x + \alpha_{ms} (p_x - p_x^w) m'_x + \alpha_{xs} (p_x - p_x^w) m'_x - \alpha_{ms} y_x + a (p_x - p_x^w) m'_x \\
& = \left(\frac{\alpha_{xs}}{\alpha_{xs} + \alpha_{xn}} - \alpha_{xs} - \alpha_{ms} \right) y_x + (a + \alpha_{ms} + \alpha_{xs}) (p_x - p_x^w) m'_x = 0
\end{aligned}$$

Writing the equations above in terms of $(p_m - p_m^w)$ and $(p_x - p_x^w)$ gives equation (16a) and (16b).

Note that since PS_j^w is independent of p_j with given s , the price equations above are the same for the cases where the world prices are identical or different.

2. Derivations of $\frac{dp_m^e}{ds}$ and $\frac{dp_x^e}{ds}$

$$\frac{dp_m^e}{ds} = \frac{\left[p_m^w \delta_m (\varepsilon_m + \delta_m s - A_m \delta_m s) - p_m^w (\varepsilon_m + \delta_m s) \right] \left(\delta_m + \frac{\mu \delta_m}{a + \mu} \right)}{(\varepsilon_m + \delta_m s - A_m \delta_m s)^2}$$

Simplifying the numerator yields:

$$\begin{aligned} & p_m^w \delta_m (\varepsilon_m + \delta_m s) - p_m^w \delta_m A_m \delta_m s \\ & - p_m^w \delta_m (\varepsilon_m + \delta_m s) - p_m^w (\varepsilon_m + \delta_m s) \frac{\mu \delta_m}{a + \mu} \\ = & -\frac{\mu}{a + \mu} (\varepsilon_m + \delta_m s) \delta_m p_m^w - A_m \delta_m s \delta_m p_m^w \\ = & -\delta_m p_m^w \left(\frac{\mu \varepsilon_m}{a + \mu} + \frac{\mu \delta_m s}{a + \mu} + \frac{\alpha_{ms} \delta_m / \kappa}{a + \mu} - \frac{\mu \delta_m s}{a + \mu} \right) \\ = & -\delta_m p_m^w \left(\frac{\mu \varepsilon_m}{a + \mu} + \frac{\alpha_{ms} \delta_m / \kappa}{a + \mu} \right) < 0 \end{aligned}$$

Therefore, $\frac{dp_m^e}{ds} < 0$. Similarly,

$$\begin{aligned} \frac{dp_x^e}{ds} = & \frac{1}{[\varepsilon_x + \delta_x(1-s) - A_x \delta_x(1-s)]^2} \left[-p_x^w \delta_x \{ \varepsilon_x + \delta_x(1-s) - A_x \delta_x(1-s) \} \right. \\ & \left. - p_x^w (\varepsilon_x + \delta_x(1-s)) \right] \left(-\delta_x - \frac{\mu \delta_x}{a + \mu} \right) \end{aligned}$$

Simplifying the numerator yields $\delta_x p_x^w \left(\frac{\mu \varepsilon_x}{a + \mu} + \frac{\alpha_{xs} \delta_x / \kappa}{a + \mu} \right) > 0$. Therefore, $\frac{dp_x^e}{ds} > 0$.

3. Derivation of $\frac{d(DGWC)}{ds}$

$$\frac{d(DGWC)}{ds} = \frac{d}{ds} \left[\frac{\Pi_m}{s} \right] - \frac{d}{ds} \left[\frac{\Pi_x}{1-s} \right]$$

Π_m and Π_x can be written as:

$$\begin{aligned}\Pi_m &= \frac{1}{2} (p_m - p_m^w) (y_m(p_m) + y_m(p_m^w)) \\ \Pi_x &= \frac{1}{2} (p_x - p_x^w) (y_x(p_x) + y_x(p_x^w))\end{aligned}$$

Therefore,

$$\begin{aligned}\frac{d(DGWC)}{ds} &= \frac{1}{2} \frac{d}{ds} [(p_m - p_m^w) (\delta_m p + \delta_m p_m^w)] \\ &\quad - \frac{1}{2} \frac{d}{ds} [(p_x - p_x^w) (\delta_x p_x + \delta_x p_x^w)] \\ &= \frac{1}{2} \left[\frac{dp_m}{ds} (\delta_m p_m + \delta_m p_m^w) + (p_m - p_m^w) \delta_m \frac{dp_m}{ds} \right] \\ &\quad - \frac{1}{2} \left[\frac{dp_x}{ds} (\delta_x p_x + \delta_x p_x^w) + (p_x - p_x^w) \delta_x \frac{dp_x}{ds} \right] \\ &= \delta_m p_m \frac{dp_m}{ds} - \delta_x p_x \frac{dp_x}{ds}\end{aligned}$$

Since, $\frac{dp_m}{ds} < 0$ and $\frac{dp_x}{ds} > 0$, $\frac{d(DGWC)}{ds} < 0$. Note that the result that $DGWC$ is a downward-sloping function of s is also true when the world prices are different.

4. Proof of Proposition 6.1

$$G = C_m(\mathbf{p}^e) + C_x(\mathbf{p}^e) + a(PS_m + PS_x + TR + CS)$$

where

$$\begin{aligned}C_m(\mathbf{p}^e) &= W_x^l(\mathbf{p}^{-m}) + aW(\mathbf{p}^{-m}) - [W_x^l(\mathbf{p}^e) + aW(\mathbf{p}^e)] \\ &= \left(\frac{\alpha_{xs}}{\kappa(1-s)} + a \right) (PS_x^{-m} - PS_x) + a(PS_m^{-m} - PS_m) \\ &\quad + (\alpha_{xs} + a) (TR^{-m} + CS^{-m} - TR - CS)\end{aligned}$$

$$\begin{aligned}
C_x(\mathbf{p}^e) &= W_m^l(\mathbf{p}^{-x}) + aW(\mathbf{p}^{-x}) - [W_m^l(\mathbf{p}^e) + aW(\mathbf{p}^e)] \\
&= \left(\frac{\alpha_{ms}}{\kappa s} + a\right) (PS_m^{-x} - PS_m) + a(PS_x^{-x} - PS_x) \\
&\quad + (\alpha_{ms} + a) (TR^{-x} + CS^{-x} - TR - CS)
\end{aligned}$$

Let $\phi(s) \equiv G(p_m^e(s), p_x^e(s), s)$ where $p_i^e(s)$ is the optimal prices given s . So, $\phi(s)$ is the indirect objective function. By definition, $\phi(s) \geq G(p_m, p_x; s)$. They are equal only when G is evaluated at the optimal prices. Define $F(p_m, p_x, s) \equiv G(p_m, p_x; s) - \phi(s) \leq 0$. The function $F(\cdot, \cdot, \cdot)$ has maximum of 0. The Hessian matrix of F is negative definite:

$$\begin{bmatrix} F_{p_m p_m} & F_{p_m p_x} & F_{p_m s} \\ F_{p_x p_m} & F_{p_x p_x} & F_{p_x s} \\ F_{s p_m} & F_{s p_x} & F_{ss} \end{bmatrix} = \begin{bmatrix} G_{p_m p_m} & G_{p_m p_x} & G_{p_m s} \\ G_{p_x p_m} & G_{p_x p_x} & G_{p_x s} \\ G_{s p_m} & G_{s p_x} & G_{ss} - \phi_{ss} \end{bmatrix}$$

The sufficient second order condition of $F(\cdot, \cdot, \cdot)$ implies $F_{ss} = G_{ss} - \phi_{ss} < 0$. Since s enters the government function G linearly, $G_{ss} = 0$, which implies $\phi_{ss} > 0$. Therefore, $\phi(s)$ is convex in s .

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