SIEPR Discussion Paper No. 00-20

The Political Economy of International Factor Mobility

Giovanni Facchini*
Gerald Willmann**

January 2001

Stanford Institute for Economic Policy Research
Stanford University
Stanford, CA 94305
(650) 725-1874

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*Stanford University
**Christian-Albrechts Universität, Kiel, Germany
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Giovanni Facchini
Department of Economics
Stanford University
Stanford, CA 94305

Gerald Willmann
Department of Economics
Christian-Albrechts Universität
Kiel, Germany

January 9, 2001

Abstract

Economic theory suggests that free international movement of production factors is efficient. Nearly all countries, however, use their sovereignty to restrict immigration and influence the flows of foreign direct investment. In this paper we model the endogenous determination of policy towards international factor mobility. In a common agency setting, domestic interest groups bid for protection from the government and the incumbent politicians maximize a welfare function that depends both on domestic voters’ welfare and contributions collected. We characterize equilibrium policies and show how the degree of complementarity among inputs determines the outcome. For the strategic environment under consideration, we also establish a general equivalence result between tariffs and quotas. The predictions of the model are then tested on a sample of OECD countries. Political contributions impact policies, although the weight attached to social welfare is estimated to be far larger than that of contributions in the government’s objective function. JEL classification: F2

*The first author gratefully acknowledges financial support provided by a John M. Olin Foundation Dissertation Fellowship. We would like to thank B. Douglas Bernheim, Peter J. Hammond and Assaf Razin for their advice and encouragement. Very useful comments on a previous draft of the paper were provided by Kevin Davis, Hiro Nakata, Luigi Pistaferri, Luis Rayo, Ravi Singh, Valter Sorana and Marco Sorge, as well as by seminar audiences at Stanford and at a conference on “Immigrant Societies and Modern Education”, organized by the National University of Singapore. All remaining errors are ours.
1 Introduction

Economic theory suggests that free international movement of production factors is efficient, but countries invariably use their sovereignty to restrict migration and influence the flows of foreign direct investment. Notwithstanding Lady Liberty’s promise “Give me your tired, your poor, your huddled masses, yearning to breathe free”, virtually no nation has ever adopted an “Open Door” policy towards international migration. Movements of capital, and in particular the flow of Foreign Direct Investment, have also been the object of government regulation. At times in the past they were severely restricted, whereas more recently they have been actively subsidized.¹

There is substantial evidence regarding the role of pressure groups in shaping the attitude of governments towards factor mobility. Labor Unions have consistently played an important role in determining US migration policy. The enactment of the first legislative measure to systematically limit immigration from a specific country — the Chinese Exclusion Act in 1882 — was the result of the efforts of the recently founded Federation of Organized Trade and Labor Unions. Similarly, the American Federation of Labor (AFL) played an important role in the introduction of the Literacy Test provision in the 1917 Immigration Act, with the explicit intent to “screen and reduce the inflow of unskilled workers in the U.S labor force” (Briggs (1998), page 125). More recently, the AFL-CIO supported measures to reduce illegal immigration, that culminated in the 1986 Immigration Reform and Control Act.

Complementarities among factors are also important in understanding pressure group behavior. Analyzing the recent surge in immigration into the United States, Goldsborough (2000) notes that “Immigration policy today is driven by businesses that need more workers — skilled and unskilled, legal and illegal [...] During the annual debate on H1-B visas two years ago, Silicon Valley executives trooped before Congress, warning of a Y2K computer

¹See Oman (2000).
disaster unless the number of H1-B visas was increased.” At the same time, competition for Foreign Direct Investment has become a global phenomenon. Both advanced and developing countries offer large financial and fiscal incentives to attract foreign corporations. In the United States, commentators have talked of an “economic war among states”. In this respect, the case of the heavily unionized automobile sector is particularly revealing. Recent estimates show that the incentives offered to attract new plants have risen from the roughly $4,000 per job paid by Ohio to secure Honda’s plant in 1980 to the $168,000 per job paid by Alabama to convince Daimler-Benz to build a factory near Tuscaloosa. Internationally, Portugal offered an even more substantial package to guarantee a large investment by Ford and Volkswagen in 1992 and the list could go on. We can summarize this evidence as follows: on the one hand, organized factors lobby governments for protection; on the other, complementarities between factors matter in determining the amount of protection granted in equilibrium.

Building on these stylized facts, we formulate what – to the best of our knowledge – is the first general theory that endogenizes the formation of policies towards international factor movements. We model the strategic interaction between organized factors competing for protection and the government as a common agency problem in the spirit of Bernheim and Whinston (1986) and Grossman and Helpman (1994). In the first stage of the game, lobbies offer the incumbent politician contribution schedules that are contingent on the degree of 

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2The Minneapolis Federal Reserve Bank has set up a web site dedicated to this debate — see http://woodrow.mpls.frb.fed.us/sylloge/econwar.

3See Oman (2000), page 80.

4To build a more general model, we would need to distinguish between two forms of factor mobility. On the one hand, there is the mobility of the production factor itself, without the owner changing country of residence (examples are the movement of capital, or the so called guest worker phenomenon). On the other, there is the movement of the factor together with its owner, and this is typically the case of migration. Such a distinction is particularly relevant if one wants to capture the impact of labor movements on the welfare system of the host country or other non economic explanations of the behavior towards migration. These very interesting considerations lie however beyond the scope of this paper. We refer the interested reader to Razin and Sadka (2000) for a discussion.
protection granted to different factors. In the second stage, the government trades off social welfare against contributions in choosing the optimal policy. This policy can take the form of either price controls or quantitative restrictions on the inflow and outflow of factors. We establish a general equivalence result of tariffs and quotas for the strategic environment under consideration. Given the divergent outcomes of Cournot and Bertrand competition, this result may come as a surprise.

The equilibrium protection level granted to a particular factor depends on the structure of production and on the political characteristics of the economy, according to a modified Ramsey rule. In particular, protection is higher for a lobbying than for a non-lobbying factor and is increasing in the relative importance of the factor while decreasing in the proportion of the population involved in lobbying. Furthermore, the equilibrium protection level is determined by the degree of complementarity between inputs. For example, suppose that two complementary factors, A and B, both lobby for protection. Admitting more imports of factor A increases the marginal product of factor B. Therefore, factor B has an incentive to lobby against protection for factor A, to secure a higher wage for itself. More generally, the lobbying of a factor has a detrimental effect on the degree of protection granted to its complements. This argument is reversed in the case of lobbying substitutes.

We test the predictions of our model on a sample of 20 OECD countries. The data supports our model. All estimated coefficients are of the expected sign and significant, thus underlining the theoretical relationships discussed above. The empirical evidence suggests that lobbying by complementary factors is important in determining policy, even if the weight attached to social welfare in the government’s objective function is far larger than the weight of contributions.

The paper proceeds as follows. In section 2, we review the existing literature on the

\footnote{This mirrors the results obtained by Grossman and Helpman (1994) for trade in final goods and corresponds in our model to the special case when the production function is additively separable.}
political economy of factor mobility. Section 3 describes the factor protection game, while section 4 characterizes the equilibrium protection structure. In section 5, we establish the equivalence of tariffs and quotas, and in section 6, we test the implications of the model. Section 7 concludes the paper.

2 Literature Review

While a large body of literature is devoted to understanding the political economy of protection in international trade, studies that analyze the politics of distortions in international factor movements are rare, and a unified framework has yet to emerge. In what follows, we review the existing literature, starting with papers that deal with international migration.

In most recent studies, the political economy of migration has been modeled as a univariate median voter decision problem. Benhabib (1996) considers the capital and skill requirements that would be imposed on potential immigrants by an income maximizing polity. In his model, the median voter chooses to admit individuals supplying a set of factors (labor, human and physical capital) that are complementary to the endowments of the natives.

The inflow of migrants into a developed economy naturally has an impact on the country’s welfare system — an issue taken up in several papers. Mazza and van Winden (1996) explicitly consider income redistribution in an influence function setting where the key determinant of the political process is the size of the conflicting interest groups. In their specification, the weights in the influence function are assumed to be endogenously determined by the size of the immigrant population. Interestingly, if the original redistribution is biased towards capital, higher immigration reduces the tax burden on labor, making both domestic factors better off. Unskilled immigration may reduce the amount of redistribution.

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7See Drazen (2000) for an overview of this approach.
also in the model proposed by Razin, Sadka, and Swagel (1998), in which policies are chosen by a median voter and human capital accumulation is made endogenous. In contrast to Mazza and van Winden (1996), this result holds exactly when income is already redistributed from the highly skilled to the unskilled, and empirical evidence from a sample of European countries is provided in support of the argument.

The aging population of many OECD countries puts in doubt the viability of pay-as-you-go social security systems. Scholten and Thum (1996) ask what immigration policy a median voter will choose in an overlapping generations model with intergenerational transfers. According to their analysis, the median voter is not able to internalize intergenerational externalities and the outcome of the political process involves inefficiently low immigration. Razin and Sadka (1999), looking at a similar question, show that with perfect capital markets and a redistributive pension system, an Open Door policy towards unskilled immigration is actually Pareto improving.

The recent phenomenon of competition for Foreign Direct Investment has so far received surprisingly little attention in the political economy literature. Haaparanta (1997) uses a menu auction approach to model intergovernmental bidding wars to attract foreign multinationals. The government uses FDI as a way of reducing unemployment. Intuitive results emerge concerning the distortionary effects of interjurisdictional competition, but the model is partial equilibrium in nature and the interaction between domestic capital and FDI is completely ignored. Another paper addressing this issue in the public economics literature is Biglaiser and Mezzetti (1997). Here, subsidies for a new project (e.g. for a new firm setting up a plant within the jurisdiction) are used by an incumbent politician seeking reelection to signal his “ability” in providing public inputs. It is shown that their strategic use generally leads to inefficient outcomes, and in particular incumbents at risk of losing an election tend to support too many projects while incumbents that are likely to be reelected, adopt too few.
3 The Factor Protection Game

This section presents our model and describes the factor protection game. We consider a small country, i.e. a country that faces exogenously given international factor prices. For simplicity, and since the focus of the paper is on factor movements, there is a single final good produced using a set of inputs $I = \{1, ..., n\}$.8

The home country is populated by $M$ domestic residents, each of whom owns only one type of factor. In other words, there are $M_i$ domestic agents inelastically supplying factor $i$ and $M = \sum_{i \in I} M_i$. We can then define the ratio $\alpha_i = \frac{M_i}{M}$ representing the percentage of the population owning factor $i$ and that will be used as a distribution rule later.9

Let $\ell_i$ be the domestic supply of input $i$. Factor imports (exports if negative) are denoted by $m_i$ and the supply of factors available domestically amounts to $L_i^S = \ell_i + m_i$. Output is produced from these inputs according to the production function $Y = F(L_1, ..., L_n)$ and $L_i^D$ is domestic input demand. We assume decreasing returns to scale in production or, alternatively, one can think of constant returns to scale and an additional fixed factor10, equally shared by the domestic population, who then earns a wage for this additional factor instead of claiming the residual profit. Let $\pi$ be the corresponding profit function and $\pi^Y$ the restricted profit function, i.e. the profit function defined for a given level of output.

As for prices, we choose aggregate output as the numéraire and normalize its price to one. Let $W$ be the set of real domestic input price vectors. We bound $W$ so that each domestic price $w_i$ must lie between a minimum $\underline{w}_i$ and a maximum $\overline{w}_i$.11 Let $w = (w_1, ..., w_j, ..., w_n)$

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8A possible extension of the model would also include multiple final goods, thus allowing for the joint determination of policies towards factor movements as well as towards trade in final goods. In this paper we limit ourselves to the tractable one sector – many factors case and emphasize the imperfect substitutability of factors across sectors when we come to the empirical part.

9From a purely technical perspective there is no need to explicitly introduce agents. Without them the $\alpha$s would simply specify an abstract distribution rule across factors. Ownership of multiple factors is therefore possible in our framework but we abstract from it here out of notational convenience.

10Land would be the natural example in this context.

11Notice that although Bernheim and Whinston (1986) consider the case where players bid for a finite set
be the generic domestic price vector, while \( w^* = (w^*_1, \ldots, w^*_j, \ldots, w^*_n) \) indicates the vector of real factor prices prevailing on the world market.

Policy towards the inflow and outflow of production factors is endogenously determined as the result of competition among organized factors to obtain protection from the government. We model the strategic interaction as a menu auction à la Bernheim and Whinston (1986), e.g. as a two-stage common agency problem. In the first stage, bidders announce to an auctioneer a menu of offers that are contingent on the latter’s possible actions. In the second stage the auctioneer chooses an action, and the bids associated with that action are actually paid. In the context at hand, the bidders are the lobbying factors who seek protection from the common agent, i.e. the government. In this paper we follow the literature by assuming that the subset of factors actually lobbying is exogenously given and denote it by \( \Lambda \subseteq I \).\(^{12}\)

Every organized lobby presents the government with a contribution schedule \( B_i(w) \), that is, these factors specify their monetary contributions contingent on the entire domestic factor price vector. The auctioneer, on the other hand, is the government who grants or denies protection by setting the domestic factor price vector\(^ {13}\) and then collects the contributions from the lobbying factors.

Having described the strategy spaces of the actors, let us turn to their respective payoffs, expressed in monetary terms. Each factor (lobbying or not), receives a gross payment given by

\[
g_i(w) = w_i\ell_i + \alpha_i \left( \pi(w) + \sum_{k \in I} (w_k - w^*_k)(L^D_k - \ell_k) \right) \quad \forall i \in I
\]

where the first term on the right hand side represents its income and the second its share \( \alpha_i \)

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\(^{12}\)A theory of the endogenous formation of pressure groups has been proposed, for instance, by Mitra (1999). But the individual decision to join a lobby is not explicitly modeled and in this way, the fundamental free-rider problem remains overlooked. For a skeptical view see also Persson and Tabellini (1999), page 74.

\(^{13}\)Note that fixing the domestic factor price vector is equivalent to imposing a set of tariffs and subsidies.
of profits and of the revenue from protection.\footnote{Note that relaxing the assumption of equal profit shares would not change the qualitative implications of the model, provided that the profit shares are strictly positive.}

In determining the degree of protection to be granted to each factor, the government weighs the sum of domestic citizens’ welfare against the monetary contributions paid by the lobbies. As in Grossman and Helpman (1994), we choose a linear functional form for the government’s objective function:

\[
S = a \sum_{i \in I} g_i(w) + \sum_{i \in \Lambda} B_i(w) \quad a \geq 0
\]

Notice that \(\sum_{i \in I} g_i(w)\) would be the objective function of a Pigouvian social planner. Furthermore, \(a > 0\) implies that the government values campaign contributions more than the actual cost to the lobbies.\footnote{To see this point, define the net payoff of factor \(i\) as \(n_i(w) = g_i(w) - B_i(w)\) if \(i \in \Lambda\) and \(n_i(w) = g_i(w)\) if \(i \notin \Lambda\). Then, the objective function of the government can be rewritten as \(S = a \sum_{i \in I} n_i(w) + (1 + a) \sum_{i \in \Lambda} B_i(w)\) and every dollar being contributed by a lobby is worth \(1 + a\) dollars to the incumbent politician.}

### 4 The Equilibrium Protection Structure

We are now ready to characterize the equilibrium protection structure emerging from this game. Let \(\Lambda_{-i} = \Lambda \setminus \{i\}\). We are looking for a subgame perfect Nash equilibrium of the factor protection game, defined as follows:

**Definition 1** The collection \(\{B_i^0(w)\}_{i \in \Lambda}, w^0\) is a subgame perfect Nash equilibrium of the factor protection game if \(B_i^0\) is feasible for all \(i \in \Lambda\), \(w^0 \in \arg \max_w a \sum_{i \in I} g_i(w) + \sum_{i \in \Lambda} B_i^0(w)\), and, given \(\{B_j^0(w)\}_{j \in \Lambda_{-i}}\), no lobby \(i\) has an alternative feasible strategy \(B_i(w)\) that would yield a higher (net) payoff.
Bernheim and Whinston (1986) provide a useful characterization of subgame perfect Nash equilibria for menu auctions, which we restate here using our notation:

**Proposition 1** \( (\{B_0^i(w)\}_{i \in \Lambda}, w^0) \) is a subgame perfect Nash equilibrium for the factor protection game if and only if:

i) \( B_0^i(w) \) is feasible \( \forall i \in \Lambda \),

ii) \( w^0 \in \arg \max_{w \in W} a \sum_{k \in I} g_k(w) + \sum_{k \in \Lambda} B^0_k(w) \),

iii) \( w^0 \in \arg \max_{w \in W} a \sum_{k \in I} g_k(w) + \sum_{k \in \Lambda} B^0_k(w) + g_i(w) - B_0^i(w) \forall i \in \Lambda \),

iv) \( \forall i \in \Lambda, \exists w^i \in W \text{ that maximizes } a \sum_{k \in I} g_k(w) + \sum_{k \in \Lambda} B^0_k(w) \text{ such that } B_0^i(w^i) = 0 \).

Condition i) requires that the schedules proposed are feasible, i.e. that at every price vector the lobbies receive enough gross payoff to afford the contribution. Condition ii) states that in equilibrium the government (or auctioneer) must be maximizing its objective function. The important condition iii) implies that in equilibrium the government and each lobby respectively must be jointly maximizing the sum of their net payoffs.16 Finally, condition iv) is a technical requirement assuring that the lobbies do not pay more than necessary to convey their preferences.17

For the derivation of the equilibrium protection levels it will prove convenient to introduce one additional assumption. From now on we will only consider contribution schedules \( \{B(w)\}_{i \in I} \) that are differentiable, at least around the equilibrium price vector.18 We can then prove

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16In light of this condition it is not surprising that Goldberg and Maggi (1999) show how Nash bargaining can lead to exactly the same outcome as a menu auction.

17After all, adding a constant to a given contribution schedule does not change the preferences conveyed but represents a sub-optimal transfer to the auctioneer.

18We acknowledge that this assumption (or refinement) is not as innocuous here as differentiability usually is. The reason lies in the contribution schedules that are bounded from below to be non-negative. Where they hit zero they need not be differentiable. We effectively rule out equilibria at such (measure zero) points as do for example Grossman and Helpman (1994).
Proposition 2 If the equilibrium factor price vector lies in the interior of $W$, then the government chooses a domestic price vector $w$ that satisfies

$$w - w^* = (\nabla^2 \pi^Y)^{-1}z = -\nabla^2 Fz$$

(2)

where $\nabla^2 \pi^Y$ denotes the Hessian of the restricted profit function, $\nabla^2 F$ the Hessian of the underlying production function, and $z$ a column vector whose $j^{th}$ element is

$$z_j = \frac{(I_j - \alpha \Lambda)\ell_j}{a + \alpha \Lambda}.$$ 

and $I_j$ is an indicator that equals 1 if factor $j$ is lobbying and 0 otherwise.

Proof (See Appendix 1).

Expanding the $j^{th}$ component of equation (2) we have

$$w_j - w_j^* = -\frac{1}{a + \alpha \Lambda} \sum_{i \in I} F_{ji}(I_i - \alpha \Lambda)\ell_i \quad \forall j \in I.$$ 

(3)

Consider first the diagonal elements, i.e. that element in each sum for which $j = i$. Strict concavity of the production function implies that $F_{ii}$ is negative. Therefore, leaving aside the other terms in the sum for a moment, if the factor under consideration lobbies ($I_i = 1$) we see an import tariff (an export subsidy) because $\alpha \Lambda \leq 1$. If, on the other hand, this particular factor does not lobby then it has to endure an import subsidy (an export tax). The tariff (export subsidy) — or the absolute value of the import subsidy (export tax) — is increasing in $F_{ii}$ and $\ell_i$ but decreasing in $a$ and $\alpha \Lambda$. The direction of these effects is intuitively appealing. The more weight the government places on social welfare (parameter $a$) the lower the tariff. The larger the share of the domestic population involved in lobbying activities, ($\alpha \Lambda$) the lower the tariff each obtains because their efforts partially offset each other. The
greater the curvature of the production frontier (\(| F_{ii} |\)) the higher the tariff according to a modified Ramsey rule. And, finally, the greater the domestic supply or importance of a factor the higher the tariff it can obtain.

Suppose the off-diagonal terms are indeed zero, i.e. \( \frac{\partial^2 F}{\partial w_i \partial w_j} = \frac{\partial^2 \pi}{\partial w_i \partial w_j} = 0 \) \( \forall i \neq j \). Then the production function is additively separable. We briefly discuss this special case to explore the connection between our result and what Grossman and Helpman (1994) obtain for trade in final goods. Define the proportional tariff imposed on factor \( i \) as \( t_i = \frac{w_i - w_i^*}{w_i^*} \). Then, for all \( i \in I \), these tariffs are implicitly given by

\[
\frac{t_i}{1 + t_i} = \frac{I_i - \alpha_A}{a + \alpha_A} \times \frac{f_i/m_i}{\epsilon_{m_i, w_i}}
\]

where \( \epsilon_{m_i, w_i} = -\frac{\partial m_i}{\partial w_i} \times \frac{w_i}{m_i} \)

This is exactly the result obtained by Grossman and Helpman (1994) in their paper where tariffs apply to trade in final goods.\(^{19}\)

Departing from this special case, let us emphasize that we view a full matrix of substitution (and complementary) effects as essential on the production side. If two factors \( i \) and \( j \) are complements (substitutes) then increasing the quantity of one of them will increase (decrease) the marginal product of the other, that is \( F_{ij} > 0 \) (\( F_{ij} < 0 \)).\(^{20}\) Land and labor, for example, will likely be complements in agricultural production, while labor and capital could be substitutes. Either the field is harvested by seasonal workers or by the latest in agro-technical equipment. How do these relations affect the equilibrium protection levels? A lobbying substitute will have a positive effect on the protection level obtained by the other factor. Letting in more imports of either factor would not only decrease the marginal prod-

\(^{19}\)In their framework, the assumptions that lead to this result are the existence of sector specific factors and a quasilinear, separable utility function.

\(^{20}\)There is also an alternative definition that is based on the conditional factor demands. The reader will agree that the definition we use is more easily applicable to our model.
uct — and thereby the real wage — of the factor itself but also that of its substitute. The substitute therefore also has an incentive to lobby for protection on behalf of its “partner”. In the extreme case of perfect substitutes we could combine both into a single factor and the increased weight of this new single factor would lead to a higher tariff as seen above. A lobbying complement, on the other hand, will be detrimental to the other factor’s equilibrium protection level because letting in more imports increases the marginal product of the complement. It therefore has an incentive to lobby against protection for the other factor to secure a higher marginal product and consequently real wage for itself. If the substitute or complement does not lobby then the effects are reversed. The existence of a substitute (complement) makes demand for the factor in question more (less) elastic. The government will therefore set a lower (higher) tariff than it would have in the additively separable case.

Let us now turn our attention to the contribution schedules. How much does a particular lobby pay the government to obtain its preferred policy? To answer this question suppose the factor $i \in \Lambda$ did not lobby or offered a zero contribution. Given the equilibrium contribution schedules of the other lobbies, the government would then choose a price vector

$$w^{-i} \in \underset{w \in W}{\arg \max} \quad a \sum_{i \in I} g_i(w) + \sum_{i \in \Lambda_{-i}} B^0_i(w).$$

In equilibrium — with factor $i$ lobbying — the government must attain at least this payoff level. Since lobby $i$ will not pay more than necessary to make the government take into account its interests, it follows that

$$a \sum_{i \in I} g_i(w^{-i}) + \sum_{i \in \Lambda_{-i}} B^0_i(w^{-i}) = a \sum_{i \in I} g_i(w^0) + \sum_{i \in \Lambda} B^0_i(w^0).$$

Hence

$$B^0_i(w^0) = a \sum_{i \in I} g_i(w^{-i}) + \sum_{i \in \Lambda_{-i}} B^0_i(w^{-i}) - a \sum_{i \in I} g_i(w^0) - \sum_{i \in \Lambda_{-i}} B^0_i(w^0)$$

12
By optimality of $w^{-1}$ this must be (weakly) positive. We can therefore conclude that all lobbies pay non-negative contributions in equilibrium.\footnote{If we want to go beyond this simple result — contributions could not be negative, after all — we need to limit ourselves to globally truthful contribution schedules. One can then solve for the reservation utilities of all the lobbies and subsequently their actual (globally truthful) contribution schedules.}

5 Equivalence of Tariffs and Quotas

So far we have measured protection as the difference between the world market and domestic prices. For a factor such as capital this seems natural. Taxes on external capital transactions are used to manage financial flows.\footnote{Cf. Mathieson and Rojas-Suarez (1994).} Central banks sometimes impose extra deposit requirement on foreign loans. In addition, fiscal incentives to attract foreign direct investment are a global phenomenon that has become more and more relevant in the last decade.\footnote{According to Oman (2000) “Data on the direct financial and/or fiscal ‘cost–per–job’ of incentives received by investors in the automobile industry reveal orders of magnitude [...] that often exceeds $100,000”.} But tariffs constitute only one of the policy instruments available to governments for controlling the international flow of production factors. Where the migration of labor is concerned, quotas seem to be the norm while immigration taxes are rare.\footnote{It is worth pointing out, though, that many tax codes (the US is no exception) include special provisions for foreign workers. Furthermore, during earlier waves of mass migration, the use of fiscal instruments to control inflows of foreign workers was rather common. The United States, for example, introduced a head tax of 50 cents per migrant in 1882, that was progressively raised to $8 in 1917. Canada was even more proactive in using taxes and subsidies to control the composition of the immigrant population. In 1870, it introduced a travel fund of C$30 per adult for Mennonites that agreed to build settlements, while in 1885 an Immigration Act was passed by Parliament to “restrict and regulate Chinese immigration” by assessing a tax of C$50 per head. This tax was raised to C$200 in 1910. For more details on past immigration policies we refer the reader to the interesting work of Timmer and Williamson (1996).} It is well known that, in non-strategic environments, tariffs and quotas are equivalent instruments provided that the quota rent is captured by the domestic government who would otherwise receive the tariff revenue. In international political economy, on the other hand, a large literature attempts to provide a rationale for choosing one policy instrument over the other.\footnote{Cf. Hillman (1989).} We do not address...
this question here in the context of factor mobility. Instead, we will show that tariffs and quotas yield an equivalent equilibrium outcome in our political economy model, provided the quota rent is captured by the domestic government. Given the divergent outcomes of Cournot and Bertrand competition, this result may come as a surprise.

Let us start by describing the quota game. Define \( \phi(w) \equiv -\nabla \pi : W \rightarrow L \), that is, \( \phi \) denotes the negative gradient of the profit function which, by Hotelling’s Lemma, equals the factor demands. Furthermore, let \( L^\ast \equiv \text{Range}(\phi(W)) \). Then, under the quota game, every organized lobby presents the government with a contribution schedule \( \tilde{B}_i(L) \), that is, a function of the vector of factor quantities \( L \). The government, on the other hand, chooses factor quantities (and thereby implicitly the quotas) and collects the contributions from the lobbies. In terms of payoffs, every lobby receives

\[
\tilde{g}_i(L) = \phi_i^{-1}(L)\ell_i + \alpha_i \left( \pi(\phi_i^{-1}(L)) + \sum_{k \in I}(\phi_k^{-1}(L) - w_k^*)(L_i^D - \ell_k) \right),
\]

and the government

\[
\tilde{S} = a \sum_{i \in I} \tilde{g}_i(L) + \sum_{i \in \Lambda} \tilde{B}_i(L).
\]

A subgame perfect Nash Equilibrium in this quota game is defined as follows:

**Definition 2** The collection \( \{\tilde{B}_i(L)\}_{i \in \Lambda}, L^0 \) is a subgame perfect Nash equilibrium of the quota game if \( \tilde{B}_i^0 \) is feasible for all \( i \in \Lambda \), \( L^0 \in \arg \max_L a \sum_{i \in I} \tilde{g}_i(L) + \sum_{i \in L} \tilde{B}_i^0(L) \), and, given \( \{\tilde{B}_j^0(L)\}_{j \in \Lambda \setminus i} \), no lobby \( i \) has an alternative feasible strategy \( \tilde{B}_i(L) \) that would yield a higher (net) payoff.

As a preliminary step we establish the following lemma that will be instrumental in proving the equivalence of tariff and quota.
Lemma 1  Let $W_J$ be a subset of $W$ where $J \subset \mathbb{N}$ components are fixed, and similarly define $L_J \subseteq L$. Then, for all $J$, the mapping $\phi_J : W_J \rightarrow L_J (= L^*_J)$ is a bijection.

Proof (See Appendix 1).

We are now able to prove the main result of this section:

Proposition 3  The tariff game is strategically equivalent to the quota game.

Proof. Define $\tilde{B}_i(L) = B_i(\phi^{-1}(L))$ for all $i \in \Lambda$ and apply Lemma 1.

The intuition for this result is straightforward. Lemma 1 guarantees that the government can control the outcome in the factor market – i.e. the combination of factor employment and prices – by either setting domestic prices or domestic employment. The lobbies’ contributions depend then only on the outcome, not on the policy variable used to achieve it. It is worth pointing out that using our more general lemma 1, the result of proposition 3 can be easily extended to a mixed case, where the government chooses a combination of prices in some markets and quotas in others. This is particularly appealing from a descriptive point of view, since as we pointed out earlier on, real world intervention in factor markets takes both the form of quantity as well as price controls.

6 Empirical Application

In this section we test the predictions of our model using a sample of 20 OECD countries.\textsuperscript{26} We find qualitative support for the idea that organized groups influence policy towards international factor movements. Complementarities between factors play an important role in the degree of protection actually granted. Furthermore, our findings suggest that in the

\textsuperscript{26}For a list of countries included in the sample and for a detailed description of the data we refer the reader to Appendix 2.
government’s objective function, aggregate welfare receives a weight that is many times higher than the weight attached to political contributions. The estimated share of the population actively involved in political lobbying appears to be rather modest, reaching approximately 13% of the total.

Taking into account the limited availability and quality of the data used, our empirical results should be considered with the appropriate care. For instance, the key variable of the model, the indicator for lobbying activity, is typically unobservable. So, it must be inferred from proxies that are correlated with it. Similarly, the lack of adequate instruments makes an appropriate consideration of the endogeneity issue rather difficult.

Equation (3), appropriately modified, constitutes the basis of our analysis. In particular, we estimate

$$t_j = \psi \left( \sum_i F_{ij} I_i \ell_i \right) + \gamma \left( \sum_i F_{ij} \ell_i \right) + \epsilon_j \tag{4}$$

where $t_j = \frac{w_j - w_j^*}{w_j}$ represents the “observable” tariff rate on factor $j$, $F_{ij}$ are the second order partial derivatives of the production function, $I_i$ is the indicator for lobbying on behalf of factor $i$, $w_j$ is the domestic price of factor $j$ and $\ell_i$ is the domestic supply of factor $i$. $\psi = -\frac{1}{\alpha + \alpha \Lambda}$ and $\gamma = \frac{\alpha \Lambda}{\alpha + \alpha \Lambda}$ are the coefficients we seek to estimate and $\epsilon_j$ captures measurement errors in the dependent variable and – potentially – variables that may affect protection and that have been left out of the theoretical model. The testable implications of our model are that $\psi < 0$, $\gamma > 0$, and $\gamma - \psi > 0$.

Provided that the estimated $\psi$ is non-zero, the structural parameters can be identified as $\alpha \Lambda = -\frac{\gamma}{\psi}$ and $a = \frac{\gamma - 1}{\psi}$. Obviously, our theory also requires that the share of the population lobbying ($\alpha \Lambda$) is positive and below 1.

Testing equation (4) requires careful attention to several issues. First of all, as we mentioned earlier, advanced countries use an array of measures to control the international flow

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27 This last inequality follows from $\gamma - \psi = \frac{\alpha \Lambda + 1}{\alpha + \alpha \Lambda}$, where $\alpha \Lambda$ is the share of the population actively involved in lobbying the government.
of production factors. These measures go beyond the simple use of tariffs. In the case of labor migration, as we pointed out earlier in the paper, controls overwhelmingly take the form of quantitative restrictions, whereby the particular regimes implemented vary substantially across countries. Similar questions arise in international trade, where non-tariff barriers have become the most common form of government intervention in the past decades. To quantify the degree of protection granted to domestic firms, a substantial body of literature addresses the issue of constructing the tariff equivalent of non tariff barriers. In order to test our model, we will borrow some of the ideas developed there.

The simplest procedure to measure $t_j$, i.e. the degree of protection granted to a domestic production factor, consists in calculating the wedge between the domestic and world prices. If international factor markets were perfectly integrated and there were no relocation costs, then the return on comparable factors would be the same across countries, and any remaining difference should be imputable to an artificially introduced distortion. Straightforward as it seems, a direct application of this procedure requires substantial information. First of all, the prices used for the comparison should refer to exactly the same typology of factor. Consider the case of labor: ideally, to assess the degree of protection granted to an engineer in Silicon Valley, the researcher would need information concerning the wage paid to an equally skilled individual in any potential country of emigration. Needless to say, the availability of comparable earnings figures by skill level is very limited even when the relevant source country is an advanced economy. If we turn to developing countries, the case is hopeless. Secondly, whenever aggregation is involved, one has to take into account that import weighting may lead to seriously downward biased estimates of tariffs or tariff equivalents and that domestic weights are probably a better measure.

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30 See Laird (1997) for a recent survey.
31 See Laird (1997), page 47 for a discussion of this point.
Given these difficulties, our empirical strategy focuses on using intersectoral differences as a proxy for factor characteristics and domestic factor employment shares as the relevant weights to compute the international prices. Returning to the example of a Silicon Valley engineer, its potential competitor in the international marketplace is more likely to be the employee of a software house in Bangalore rather than the latter’s compatriot who cultivates rice for subsistence purposes. If the attention turns to foreign direct investment, a multinational setting up a plant abroad is naturally going to supply the same (broadly defined) category of goods being produced for the domestic market.

Regarding those intersectoral differences, limited data availability forces us to consider sectors only at the rather coarse one digit ISIC level. To obtain the information on production technology needed for the estimation of equation (4), we first fit an aggregate Cobb-Douglas production function, \( Y = \prod_{j=SIC} K^{\alpha_j} L^{\beta_j} \), assuming imperfect substitutability of production factors across sectors. Since we deal only with advanced economies, technology is assumed to be identical across countries. The estimates for the parameters of the production function are then used to construct the Hessian matrix of the production function contained in equation (4).\(^{32}\)

To estimate our main equation, we compute the tariff rates \( t_j \) on labor and capital according to the price gap procedure described above.\(^{33}\) Labor income is measured using average hourly earnings by sector. To construct a macroeconomic measure of the returns on capital we aggregate returns on assets at the sectoral level, using firm level data from the Compustat Global Vantage database. To smooth out transitory shocks to asset returns figures, we use a five year average for the period 1993-1997. Domestic factor demands and supplies are calculated using OECD data. Finally, we construct the binary variable that describes

\(^{32}\)Of course, in doing so, we incur in the problem arising from the use of generated regressors, first discussed by Pagan (1984). However, correcting the standard errors of the estimators has a negligible impact.

\(^{33}\)Again see appendix 2 for a more detailed description.
the lobbying activities of a factor. In previous studies that implemented “influence–driven” models of international trade, Political Action Committee contributions have been used to proxy for lobbying activity. This choice is problematic, however, since contributions are endogenous in this type of model. Secondly, Political Action Committees contributions (or their equivalent) are legal in only a few countries, and therefore this information cannot be collected for the purpose of our study. To address – at least in part – both difficulties, we use sectoral gross union density figures to describe organized lobbying on behalf of labor. Ideally, we would like to use membership rates in employers’ associations to capture the degree of organization of capital in the same manner. Unfortunately, of the many central organizations we contacted for the relevant figures, only Sweden’s SAF (Svenska Arbetsgivareföreningen) provided us with the necessary information. To proxy for organized capital we therefore use the stock of capital per employee. Admittedly, the link is indirect but robust evidence has been found, at least for the United States, concerning the positive relation between corporate political action committees contributions and the capital–labor ratio characterizing the industry.

A literal interpretation of our theory would require that every factor exhibiting some form of lobbying activity should be considered as “organized”. On the other hand, this would as well reflect a simplifying assumption of our model, namely that any form of pressure group activity should be directed at influencing policies towards international factor movements. In reality, lobbying often takes place mainly to influence domestic policies and therefore a more flexible way of approaching the problem is called for. We use a rather simple strategy. Looking for discontinuities in the cross-sectoral distribution of the variables describing lob-

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35This should be considered a reasonable approximation for labor’s lobbying activities, although in some countries union density and union coverage differ substantially (France is the obvious example). We had to resort to union density since coverage rates are not available, at the sectoral level, for all countries considered.

36See Gawande (1997) for a recent study.
bying activities, we set the indicator to 1 if the variable takes a value above a given threshold. As Figures 1 and 2 show, there is a clear break for union density at 68% and for capital at 414,000 US dollars per employee and we use these values as the threshold levels for the organizational dummy. In other words, we define

\[ I_{L_i} = \begin{cases} 1 & \text{if union density} \geq 0.68 \\ 0 & \text{otherwise.} \end{cases} \]

and

\[ I_{K_i} = \begin{cases} 1 & \text{if } \frac{K_i}{L_i} \geq 414000 \text{ USD} \\ 0 & \text{otherwise.} \end{cases} \]

From an econometric standpoint, the estimation of equation (4) presents obvious difficulties, and very limited data availability has forced us to take substantial shortcuts. We view as particularly problematic the endogeneity of factor prices. Good instruments (e.g., energy prices, protection granted to employees in courts etc.) are available only at the aggregate, national level. In our sample, a substantial portion of the overall variability has its source in within country, cross-sectoral differences, and the results obtained using aggregate instruments were not satisfactory. The reader should be aware of these important limitations and consider the results of the estimation with the due caution.

Table 1 reports the results of the estimation of equation (4) by ordinary least squares. It also gives the implied values of the structural parameters \( \alpha \) and \( a \) and the associated standard errors, computed using the \( \delta \)-method. The first column reports the results for prices that were converted using the exchange rate while in the second column purchasing power parity was used for the conversion.

As can be seen from the table, the coefficients are significant at the one percent level
and match the qualitative predictions of our theory. In particular, both $\psi$ and $\gamma$ are of the expected sign. When testing the third implication of the model, i.e. that $\gamma - \psi = 0$ the corresponding $F$ statistic is 27.52 for the first column and 27.82 for the second. We can therefore reject the null at the 1% level, in accordance with our theory. Our findings support the prediction that the relation between the “importance” and the degree of protection granted to one factor depends on whether it is organized or not. The negative and statistically significant sign of $\psi$ confirms that organized factors enjoy a distinct pattern of protection. Furthermore, it is evidence that lobbying complements are detrimental to the degree of protection granted to an organized factor. The positive sign of $\gamma$ highlights that the opposite is true for non-lobbying factors. The third implication of the model, i.e. that protection, ceteris paribus, is increasing in the importance of the lobbying factor (and decreasing in the importance of lobbying complements) is also supported by the model ($\gamma - \psi > 0$).

The interpretation of the implied structural parameters is that political contributions matter in determining policy, even if the weight of social welfare in the government’s objective function is far larger ($a = 93.8$) than the weight of contributions. Furthermore, we estimate

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Tariff (USD)</th>
<th>Tariff (PPP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
<td>0.001403</td>
<td>0.001407</td>
</tr>
<tr>
<td></td>
<td>(0.000085)</td>
<td>(0.000085)</td>
</tr>
<tr>
<td>$\psi$</td>
<td>-0.01063</td>
<td>-0.01064</td>
</tr>
<tr>
<td></td>
<td>(0.00063)</td>
<td>(0.00064)</td>
</tr>
<tr>
<td>$\alpha_A$</td>
<td>0.1316</td>
<td>0.1319</td>
</tr>
<tr>
<td></td>
<td>(0.00072)</td>
<td>(0.00072)</td>
</tr>
<tr>
<td>$a$</td>
<td>93.8</td>
<td>93.9</td>
</tr>
<tr>
<td></td>
<td>(5.624)</td>
<td>(5.607)</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.751</td>
<td>0.752</td>
</tr>
<tr>
<td>Observations</td>
<td>93</td>
<td>93</td>
</tr>
</tbody>
</table>

Table 1: Estimation Results
that the share of the overall population involved in lobbying activities to be 13 percent, a proportion that appears more in line with intuition than much higher results previously obtained in the literature.\textsuperscript{37}

7 Conclusions

In this paper, we have addressed two questions: Why do we observe so much government intervention in cross-border factor markets? What are its determinants? To provide an answer, we develop a political economy model of international factor mobility and present a simple test of its empirical implications. Policy is endogenously determined by the interaction of an electorally driven government and domestic pressure groups. In a menu auction à la Bernheim and Whinston (1986), organized factors present the government with contribution schedules that specify payments conditional on the degree of protection to be granted by the government. The government then trades off social welfare against contributions, choosing the protection levels — either in terms of prices or quantities — for all the different factors.

Since we allow for multiple factors, our model is of considerable generality. Both immigration as well as FDI policy can be explored within our framework. Solving for the equilibrium protection levels reveals how tariffs or quotas that apply to the inflow of foreign factors are determined: they depend, in an important way, on the production structure, the “importance” of the different factors, and a set of political characteristics of the destination country.

When testing these theoretical predictions on a sample of 20 OECD countries we find strong empirical support. The coefficient estimates of our main equation are of the expected sign and highly significant. Furthermore, they allow us to identify the structural parameters

\textsuperscript{37}In their empirical test of Grossman and Helpman’s (1994) model, Goldberg and Maggi (1999) estimate their equivalent of \( \alpha_A \) to be above 84%.
of interest. In particular, we estimate the implied share of the population involved in factor lobbying to be about 13%; we also find that the government places a much higher weight on social welfare than on contributions, although the latter clearly play a role.

There are several possible extensions of the model. First of all, introducing multiple final goods would allow us to study the joint determination of policy towards factor mobility and trade. Secondly, extending the model to a multicountry setting would enable us to analyze the domestic determinants of interjurisdictional competition for FDI. Such an extension would capture some of the recent debates behind the Schengen agreement on migration towards the European Union. Finally, a more realistic model of the political process could be developed, in which the form of the social welfare function is endogenized through electoral competition.

8 Appendix 1: Proofs

Proof of Proposition 2

Concentrating only on differentiable schedules, condition \( ii \) of Proposition 1 translates into

\[
a \sum_{k \in I} \nabla g_k(w^0) + \sum_{k \in \Lambda} \nabla B_k^0(w^0) = 0,
\]

(5)

and condition \( iii \) into

\[
a \sum_{k \in I} \nabla g_k(w^0) + \sum_{k \in \Lambda} \nabla B_k^0(w^0) + \nabla g_i(w^0) - \nabla B_i^0(w^0) = 0 \quad \forall i \in \Lambda
\]

(6)
Combining equations 5 and 6 we have

\[ \nabla g_i(w^0) = \nabla B_i^0(w^0) \quad \forall i \in \Lambda \quad (7) \]

Notice that this establishes that the contribution schedules chosen by the lobbies are locally truthful, i.e. the contribution a lobby is willing to pay for a marginal change in the domestic price vector is equal to the marginal change in its gross welfare in a neighborhood of the equilibrium price vector.\textsuperscript{38} Summing equation 7 over \( i \in \Lambda \) and substituting into equation 5 gives

\[ a \sum_{i \in I} \nabla g_i(w^0) + \sum_{i \in \Lambda} \nabla g_i(w^0) = 0 \quad (8) \]

Taking a closer look at the gradient of the factors’ gross payoff function, we note (cf. equation 1) that

\[ \frac{\partial g_i(w)}{\partial w_j} = \delta_{ij} \ell_j + \alpha_i \left( -\ell_j + \sum_{k \in I} (w_k - w_k^*) \frac{\partial D_i^P}{\partial w_j} \right), \]

where the indicator \( \delta_{ij} = \begin{cases} 1 & \text{if } i = j \\ 0 & \text{otherwise} \end{cases} \).

Using this derivative we can rewrite the two sums from equation 8 as

\[ \sum_{i \in \Lambda} \nabla g_i(w^0) = I_j \ell_j + \alpha_i \left( -\ell_j + \sum_{i \in I} (w_i - w_i^*) \frac{\partial D_i^P}{\partial w_j} \right), \quad (9) \]

\[ \sum_{i \in I} \nabla g_i(w^0) = \sum_{i \in I} (w_i - w_i^*) \frac{\partial D_i^P}{\partial w_j}, \quad (10) \]

\textsuperscript{38}If we are willing to assume that the contribution schedule represents everywhere the true preferences of the lobbies, the corresponding equilibrium selected exists and is focal in the sense of being coalition–proof. For a more detailed discussion, see Bernheim and Whinston (1986).
where \( \alpha_\Lambda = \sum_{i \in \Lambda} \alpha_i \) and \( I_j = \begin{cases} 1 & \text{if factor } j \text{ is lobbying,} \\ 0 & \text{otherwise.} \end{cases} \)

Substituting equations 9 and 10 into equation 8 results in a system of equations that we solve for the column vector of equilibrium protection, thus establishing the result.

**Proof of Lemma 1**

Consider the two price vectors \( w_J, \tilde{w}_J \in W \) and, without loss of generality, assume that the two vectors share the first \( j \) components, i.e.

\[
\begin{align*}
w_J &= \begin{pmatrix}
w_1^* \\
\vdots \\
w_j^* \\
w_{j+1} \\
\vdots \\
w_n 
\end{pmatrix} \\
\tilde{w}_J &= \begin{pmatrix}
w_1^* \\
\vdots \\
w_j^* \\
\tilde{w}_{j+1} \\
\vdots \\
\tilde{w}_n 
\end{pmatrix}
\end{align*}
\]

where \( w_{j+k} \neq \tilde{w}_{j+k} \ \forall 0 < k \leq n - j \). Suppose now that \( \phi_J(w_J) = \phi_J(\tilde{w}_J) \). This implies that

\[
(w_J - \tilde{w}_J)(\phi_J(w_J) - \phi_J(\tilde{w}_J)) = 0.
\]

But this contradicts the fact that \( \phi_J \) is monotonic by virtue of \( \pi \) being strictly convex.\(^{39}\)

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\(^{39}\)For details on this last step see Hildenbrand (1994, appendix 1).

25
9 Appendix 2: Data

The empirical analysis of the model involves the following OECD countries: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, The Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United States and United Kingdom. In estimating the production function we used figures from the OECD’s Main Industrial Indicators. The figures on the stock of capital have been made comparable across countries by Jo van Biesebroeck, whom we thank for letting us use his data.

To estimate the first order condition of the model we collected price figures for production factors at the one digit level for the year 1995. For labor, the main data source is the International Labor Organization Laborsta database. The database contains figures of average earnings for all employees at the one digit ISIC level. For some countries data were not reported by the ILO and we used other sources. In particular, for Belgium, Ireland, France, Germany, and Italy the source is Eurostat. For the United States the source is the Current Population Survey, in particular the Union Membership and Earnings Data Book, 1996.

The various surveys conducted at the country level are not strictly comparable, so we harmonized the available figures, using hourly wages as the relevant unit. Concerning the international price of labor we followed a procedure that is similar to the construction of a terms of trade index. Let $n_{ic}$ be the number of foreign residents in country $c$ who are citizens of country $i$ and let $n_c = \sum_{i \neq c} n_{ic}$ denote the total number of foreign residents in country $c$.

The international price of factor $j$ for country $c$ is then defined as $w^*_c, j = \sum_{i \neq j} \alpha_i w_{ij}$, where $\alpha_i = \frac{n_{ic}}{n_c}$ and $w_{ij}$ is the price of factor $j$ in country $i$. The OECD collects figures on the stock of foreign residents by country of origin in its “Trends in International Migration” and we use these to compute the weights $\alpha_i$. For 80% of the identifiable foreigners the corresponding wage figures were available in Laborsta. The international prices are denominated in US dollars, converted at the prevailing exchange rate in 1995 or, alternatively, at the prevailing
Table 2: Compustat Data

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<th>Country</th>
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</thead>
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<td>9</td>
</tr>
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<td>Austria</td>
<td>82</td>
<td>7</td>
</tr>
<tr>
<td>Belgium</td>
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<td>9</td>
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<tr>
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<tr>
<td>Spain</td>
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<td>United States</td>
<td>2984</td>
<td>9</td>
</tr>
</tbody>
</table>

purchasing power parity. Both these exchange rates are taken from the World Bank *World Development Indicators*.

As a measure of the return on capital at the one digit industry level, we used returns on assets. The source of these figures is the *Compustat Global Vantage* database. The figures collected concern all companies in the database and the country/sector specific ROA is just a weighted average, where total assets are used as weights. As table 2 shows, the dataset provides a rather comprehensive sectoral coverage of the countries in our sample, even though US companies appear to be over represented in the sample.

The international rates of return are computed as in the case of labor and the weights are
obtained from the stock of (gross) foreign direct investment by country of origin contained in the OECD’s *International Direct Investment Statistics Yearbook*.

For lobbying activities on behalf of labor we used sectoral gross union density for 1995. The figures have been obtained from various sources. For Denmark, Finland and New Zealand we contacted directly the central union organizations. For Canada the source is Statistics Canada, for the United States the Current Population Survey, for Ireland the Central Statistics Office and for Japan the Bureau of the Census. For the remaining countries, we used figures from Ebbinghaus and Visser (2000).

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Figure 1

Gross Union Density

Figure 2

Capital per employee