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Endogenous Protection in General Equilibrium: estimating political weights in the EU

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Abstract: We examine the political economy underpinnings of import protection in general equilibrium. Starting from a dual theoretical representation of production, trade, and consumption, we map a general representation of the real economy to underlying political processes aka the political support function to derive a general representation of the determinants of import protection. This includes the relatively standard approach of examining the pattern of tariffs in a Grossman-Helpman framework, as well as recent extensions linked to upstream and downstream linkages between sectors. Because we start from a relatively generic general equilibrium model of production, we have an immediate bridge between the theory and general equilibrium-based estimates of the welfare effects and rents generated by tariffs. We therefore follow the development of our generalized theoretical framework by introducing the use of general equilibrium estimates of the direct and indirect marginal impacts of protection at the sector level for econometric estimation of the revealed pattern of policy weights. This GE approach yields direct estimates of political weights based on economic effects, including cross-industry effects. The resulting weights lend insight into relative protection of agriculture and manufacturing. Working with data on the European union, we find that the strength of downstream linkages matters for policy weights and rates of protection, as does the national posture of industry. We also find support for a general political support function in the determination of tariffs, though results are mixed for the more narrow Grossman-Helpman specification. In the EU, nationality of industry seems to play a role in the setting of Community-wide import protection.

Keywords: political weights, political economy of import protection, Grossman-Helpman model

JEL classification: : F13, F14, D72

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1 Introduction

The current structure of trade protection in the EU has several determinants that can be traced to historical factors, resource constraints, and political economy forces. Analyses of the latter, however, have been relatively scarce due to the complexities inherent in a process that engages a multitude of actors not only from Member countries, but also from the central institutions such as the European Commission. The literature has instead focused attention on the determination of trade policy in the US. In the context of the European Union, policies are influenced by both national and regional factors in ways which are hard to detect. Explicit lobbying behaviour in the Union, for instance, is particularly difficult to track. Unlike in the US, campaign contributions in most EU countries are heavily restricted, if not forbidden, so that lobbying comes in much less overt forms. This is crucial because in standard endogenous protection models, the amount of lobbying directly translates into weights attached by government to industry interests. As government choice hinges essentially on the issue of trade-off between competing societal and private interests, these weights determine where the policy chips will fall.

Even when data on campaign contributions are available, recent empirical work on US trade protection illustrates the various problems involved in capturing the extent of lobbying activities. In a survey of empirical approaches on endogenous protection, Gawande and Krishna (2001) discuss the Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) tests of the Grossman-Helpman model, where data on political contributions of corporate institutions are used as lobbying indicators. Problems pointed out by Krishna and Gawande include the difficulties inherent in isolating that part of the total financial support particularly aimed at influencing trade policy, and the exclusion of non-corporate sources of electoral financial support, such as labor unions. This may have resulted in misspecifications and underestimation of the political strength of private interests, and thus may account for some curious results found in the literature. One such result is the extremely high estimate of the weights government attaches to overall welfare relative to industry rents, spanning from 100 to 3000, and the other is the very low value of total political contributions (in the range of $30 million) relative to the large deadweight loss and producer surplus stemming from protection.

Given the prominent role assigned to lobbying, attempts must nonetheless be made to indirectly craft acceptable lobby indicators if the Grossman-Helpman test is to be extended to more countries. Several approaches emerge. One is to simply assume that industries fulfilling a certain set of criteria are more likely to be politically organized than others. In Gawande, Sanguinetti and Bohara (2001) work on Mercosur, for instance, they take industries whose imports surpass the sample mean as actively lobbying for protection. Another method is to equate membership in any industry-related organization with lobbying, as in Mitra, Thomakos and Ulubasoglu (2004) in their study of Turkey. Cadot, Grether and de Melo (2003) instead illustrate an approach where the classification of industries as being politically active or passive is endogenized in a multi-stage iterative procedure. In a more recent paper, Cadot, Dutoit, Grether, and Olarreaga (2007) identify politically organized firms using trade and production data. They apply a 3-stage process where a standard Grossman-Helpman model was estimated, producing the usual results (i.e., endogenous tariffs as a function of import penetration rates, among others). They then use the residuals of the regression to rank industries, with high residuals implying greater political organization. An arbitrary cut-off value is determined, above which industries are considered to be organized. Finally, they run a grid search over different cutoff values. One problem raised by Eshafani and Leaphart (2001) refers to the manner in which the coefficient of the output-import ratio is specified as function of political organization alone, thereby giving the lobby indicator all the chances to prove significant. It becomes even trickier in cases where certain industry characteristics such as industrial concentration and import penetration are used as proxies for lobbying activity, given the many alternative channels by which these variables may affect the policy preferences of government. Also, the dilemma posed by the high weights attached to overall welfare remains, because even taking the lowest estimates derived by Cadot, et al (2007)[1], the weights are such as to make any lobbying prohibitive. The question then lingers, what drives protection?

We re-examine this problem in this paper, and follow an alternative route to our goal of assessing the relative importance of industry against overall interests in the determination of trade policy in the EU. We adopt the Hillman (1989) and Grossman-Helpman (1994) notion of a government trading-off the industry rents stemming from protection against the losses accruing to the general population, and attempt to approximate this ordering of preferences by looking at the economic impact of actual government action as revealed by the structure of protection. Specifically, we back out the weights implied by the marginal welfare effects of the set of import policies in the EU, building on the partial equilibrium approaches of Gardner (1987), Tyers (1990) and Anderson (1980), as well as the general equilibrium approach of Tyers (2004)[2]. Employing a numerical general equilibrium model of the EU, we estimate the direct marginal effect of sector-level protection on protected industries, the indirect effect on upstream and downstream industries, and the effect on overall welfare. With these marginal effects as a starting point, we

[1] They find, for instance, that the weight given by government to social welfare relative to contributions is 3.1. This implies that each lobby should contribute $3 for each dollar of deadweight loss.

[2] In general, the partial equilibrium and general equilibrium computational literature has used numerical models to calibrate policy weights for use in numerical modelling. In contrast, here we use a numerical model to estimate raw marginal policy impacts, but then turn to econometrics for analysis.

then econometrically calculate the apparent weights of industry in policymaking given the current tariff structure. We also aim for a more detailed view of the EU political market by further deconstructing these weights along the lines of industry nationality and other related sector characteristics. Unraveling national preferences is particularly important in the EU context, because while the supply of regional protection obviously corresponds to the sum of individual national demands, the common trade policy in the EU and the complexities surrounding it conceal the interplay of private, national and aggregate regional interests.

This approach has a number of clear advantages. First of all, the effects of protection on overall welfare are fully captured, and are not solely limited to tariff revenue effects as implied by import demand elasticities. Hence, the valuation of the marginal costs and benefits of protection more adequately takes into account the economy-wide repercussions of sectoral policies. The policy weights are also backed by data. Consequently, unlike previous empirical studies, the values we obtain for these weights tie in with theoretical expectations: revealed policy weights given to industry profits, in general, tend to be around 2 to 3 times that assigned to national income or welfare. We also find that the high protection received by an industry is not necessarily always explained by greater political value attached to that sector. Indeed, our results show that the policy weights of less protected sectors are comparable to those that enjoy high protection. Once again, these outcomes may have been the product of a better coverage of aggregate welfare effects, so that tariffs are not only explained by sectoral profit gains but by the societal costs of protection as well. In the context of a customs union such as the EU, we also find that nationality matters, so that industries important to certain Member States in terms of relative output shares, consistently acquire higher levels of protection. Finally, the agricultural bias of EU protection emerges as a by product, in part, of a tendency to assign importance to the strength of intermediate linkages, with upstream industries receiving relatively lower tariffs weights for a given policy weight. We have organized the paper as follows. Section 2 provides background. In Section 3 we examine basic patterns of EU import protection, using a relatively standard political economy framework for testing the relationships between sectoral tariff variations and selected industry characteristics identified as important by theory. In Section 4, we then examine what drives the observed patterns by employing a computational model to produce estimates of the general equilibrium marginal income effects given the actual rates and pattern of protection and production across the EU. From these marginal estimates, we estimate econometrically the implied weights for individual sectors relative to the weight assigned to overall economic welfare. This allows a ranking of industries according to the assigned relative weights. In Section 5 we explore how national and EU-wide industry characteristics, especially the nationality of various industries, bears on the determination of the EU-wide industry coefficients. This provides some indication of the individual policy preferences of Member States. In Section 6 we offer some final observations, and then conclude.

2 Background

The evolution of European tariffs, reveals not only trends in trade protection, but also gives some indication of the liberal and protectionist forces at play across the continent. The 1968 common external tariffs (CET) of 10.4% is the arithmetical average of the Italian and French high tariffs (16.8% and 15.3%, respectively), and the lower ones of Germany and the Benelux countries (5.8% and 8.7%). The same differentiation can be seen in the old EFTA as well, with the UK and Austria being relatively more protectionist (14.9%, 11.4%), compared to their Scandinavian counterparts (Sweden, 6.3%; Denmark, 5.2%).

After four and one-half decades, tariff protection in industrial goods has markedly declined in importance, with the simple average CET posting at a historically low 4.1% in 2001. However, aside from tariff peaks in chemicals, footwear, transport vehicles, more opaque protectionist instruments have been introduced, so that when these non-tariff barriers are accounted for, the rate of overall protection almost doubles to 7.7% (Messerlin, 2001).

Agricultural protection is typically a different story, and in the European case, it even merits a distinct Community-wide sectoral policy, the Common Agricultural Policy (a.k.a. the CAP). Free internal agricultural trade has been accompanied by a substantial increase in external protection that for years has proven to be resistant to any reform. Liberalization did make some headway in the 1990s , but Messerlin still reports a high overall protection rate of 31.7[3]%.

Table 1 in the Appendix presents data on EU applied import protection, import shares, and output shares for 2001.[4] Processed sugar and dairy products, which were excluded from the 1992 CAP Reform, register some of the highest rates of protection, at 110%, and 38% respectively. Processed rice production is likewise heavily protected (108%), as is beef (46%). Tariff peaks in the manufacturing sector are fewer in number (and except for trucks, mostly agro-related: processed foods, beverages and tobacco) and at much lower rates.

In terms of output shares, services dominate the EU, with 62 percent of output by value. In manufacturing, the four largest sectors in the EU, in terms of the sectoring scheme of our data, are chemicals, other machinery, motor vehicles, and electrical equipment. They account for almost 50% of manufacturing output value and 16% of all output. In each of these sectors, Germany is the

[3]See Pelkmans (2001), chapter 11, pp. 219 -222.

[4]The source of these data is discussed below, in Section 3.

largest producer. However, Germany is likewise a major producer of some important agricultural sectors: it supplies 22% of total production of milk and dairy products, 44% of oil seed oils, 25% of other grains and 23% of the most politically sensitive product, sugar. Italys interest is particularly concentrated in textiles (supplying 24% of output), apparel (35%) and leather (includes footwear, 43%). However, compared to other EU Members, these industries account for a greater share in Portugals total output. In other tariff peak products such as rice, Italy (supplying 54%) and Spain (31%) greatly benefit, while in meat, the four big members: France (18%), UK (16%), Germany (16%), and Italy (12%), receive the most producer surplus from protection.

Early empirical tests on the European pattern of protection have shown that despite the differences in the market and production structures across members, the level of Community tariffs did not significantly change the relative protection between different sectors. Constantopoulos (1974) noted that while European countries have followed different tariff regimes, the national structure of protection in the 6 original EEC countries did not actually differ very much. Her results also show that extra-EEC protection displayed positive correlation with the relative share of unskilled labor and the level of R&D content. This implies that regardless of differences in specialization, the same Stolper-Samuelson effects seemed to be at play in the determination of trade regimes, and that some congruence of industrial policy goals existed among the original Members.

More recent analytical and empirical work also underscores the role of political economy determinants. Examples of properties that map well with political influence, and hence, with protection trends, are those that facilitate collective action among producers. A high concentration of ownership, for instance, implies few players and thus less likelihood of free-riding. Greater industry size, on the other hand, raises the stakes involved in cooperation among producers to secure protection.

There are models of endogenous protection that instead stress the supply incentives, such as the electoral need of governments to win as many votes as possible. In this instance, total employment (i.e. voting strength) of the sector is key. Still others draw attention to the (conservative) politicians aversion to changing the prevailing level and distribution of income, so that tariffs are used to compensate for the income shifts brought about by unemployment or surges in import penetration. Thus, it is the changes, not the composition or the absolute levels of employment and imports, which explain the supply of protection. However, evidence on the extent and direction of tariff effects associated with some industry characteristics is ambiguous. Consider for example the case of the role of industry size. Larger industries are said to be politically important because of the votes they deliver. Hence, one can expect to find higher rates of protection in larger industries. (Finger, Hall & Nelson, 1982; Lee & Swagel, 1997). On the other hand, these sectors face more collective action problems, so that tariffs are likely to be lower (Trefler, 1993). Cadot, de Melo & Olarreaga (1999) also predict protection to drop in these industries as a result of general equilibrium adjustment in the labour market.[5] In the Grossman-Helpman model (1994), industry size is not at all important if sector lobbying is zero. There is also an endogeneity problem, as industries that receive protection will then expand.

In recent empirical work on the EU, Tavares (2004), found support for the hypothesis that the movement towards deeper integration, ushered in by the 1987 Single Market programme, did lead to a more centralized tariff-setting process. Technically, this means that the specification wherein national size or influence do not play a role (i.e. industry characteristics are merely summed up or averaged to form the EU characteristics used for estimation), would seem to explain the structure of protection better than those where the preference of the decisive country voter is what counts. In an earlier work however, Tavares (2001) reported opposite results. He then reported that policymaking reflects bargaining between members who are themselves influenced by national lobbies. In fact, the best specification the author finds in that paper is one where the exogenous variables are weighted according to the share of votes accorded to each country in the Council of Ministers. This implies, for instance, that the preferences of larger countries, having more votes, are given more weight in decision-making.

3 Tariffs and Industry Characteristics

As a preliminary step, we now revisit the basic approach of the existing literature with regard to tariff patterns. We focus on relationships between protection and some of the political determinants earlier mentioned, testing for the importance of nationality on the sectoral variation in tariffs. In particular, we examine the role of industry size both EU-wide and with respect to the 12 individual national economies making up the EC12.[6] In both the adding-machine and in the Grossman-Helpman models, size is expected to enhance the political value of industry rents to national leaders, who collectively exercise tariff-setting powers in the Council of Ministers.[7] In theory, large industries are hindered only by free-riding in launching an effective lobby. In practice, as long as the stakes are high enough, even with many firms, the collective action problem

[5] Wages, and production costs rise because of the output increase initially triggered by tariffs, so that eventually the demand for protection falls.

[6] Namely: Belgium (Bel), Denmark (Den), Finland (Fin), France (Fra), Germany (Ger), Great Britain (GBR), Greece (Gre), Ireland (Ire), Italy (Ita), Luxembourg (Lux), Netherlands (Ned), Portugal (Por), Spain (Spa), and Sweden (Swe). As Austria, Sweden, and Finland were outsiders when current rates were set, we leave them out of the present assessment.

[7] Industry size also impacts on the government objective function through its effect on aggregate welfare, so that protection imposed on larger industries also leads to larger deadweight losses.

is solved through industry associations, cooperation across lobbies, and leadership by the very large firms, so that rent-seeking activities extend to influence the regional agenda-setting body (European Commission) as well. Tavares quotes Lehmanns (2003) report that in 2000, about 2,600 interest groups were active in Brussels, composed of European trade federations (±30%), commercial consultants (±20%), European companies (±10%), national business (±10%), European NGOs (±10%), labor organizations (±10%), regional representations (±5%), international organizations (±5%), and think tanks (±1%).

We also include a variable for strength of downstream linkages, INT_SHARE. This variable measures the share of output that goes to intermediate rather than final demand, and is based on the intermediate use matrix included in our social accounting data. As pointed out by Cadot, de Melo and Olarreaga (2004), input-output linkages introduce inter-sectoral rivalries, and it thus becomes a point of interest how government weighs the welfare of upstream against downstream industries.

3.1 Tariff and protection data sources

For our estimates, we work with a set of integrated social accounting data that combine import protection with input-output structures, intermediate and final demand, bilateral trade flows, and tariff protection. These are the global social accounting data organized by the Global Trade Analysis Project (GTAP), a research consortium that includes international organizations like the World Bank, OECD, European Commission, and several UN and national agencies. We use the GTAP version 5 and version 6 databases, which are for 1997 and 2001 respectively. (See Dimaranan and McDougall, 2002). Within this database, European industrial production and employment flows are based on sets of Member State social accounting data originating, ultimately, with Eurostat. These are supplemented by data on bilateral import protection, including adjustments for non-reciprocal preferential import protection and bilateral free trade agreements. In the case of agriculture, the data also include ad valorem equivalents of specific tariffs. The 2001 protection data are based on Bouet et al (2004). The 1997 protection data are from the World Bank and UNCTAD. In the case of both the 1997 and 2001 data, tariffs are drawn from the WTOs integrated database of tariffs and bindings, and well as the UNCTAD TRAINS dataset and national schedules.

A great advantage of these data is that we have a consistent mapping of economic flow data (intermediate demands, final goods production, imports, exports, and final demand) to corresponding trade policy data. In the case of the EU, our focus here, the pattern of protection vis--vis external trading partners will, overall, reflect the politics that has driven the EU to leave out sensitive sectors in bilateral negotiations on free trade areas, and also the sensitivity of these same sectors as reflected in MFN tariff schedules.

3.2 Results

We rely on the data as outlined above for the 12 European Union Members in 2001. As a measure of protection we use extra-EU trade weighted tariff rates that reflect the pattern of preferential trade arrangements, WTO concessions, and the exclusion of sectors from these arrangements. Industry size is measured by shares in total EU output value, and denoted as EU_SHARE. To gauge for the intensity of unskilled labour use, we include it here as $UNSKL$, using the shares of unskilled wages in total wages by sector as a proxy. To capture the nationality of each industry, we once again use industry size, but now national sector output shares S. Where relevant (i.e. when not using dummies) variables are in logs. We assign a dummy to agricultural products, $FOOD$, given the special historical and political circumstances surrounding its protection that cannot be captured in our estimation.

Variations in sector tariffs are tested against the above-mentioned industry characteristics in a straightforward fashion:

$$\begin{aligned} \ln(1+\tau)_i = C + \beta_1 EU\_SHARE_i + \beta_2 FOOD_i + \beta_3 UNSKL_i \\ + \beta_4 INT\_SHARE_i + \sum_m \beta_m S_{Member} + \varepsilon_i \end{aligned} \quad (1)$$

Our dataset contains observations for 12 EU countries, and for 41 agricultural, manufacturing and extraction sectors, and taken for 2001. Robust regression results are reported in Table 1. The results at this stage can be summarized as follows:

- Large sectors have lower rates of protection.
- Controlling for size and nationality of industry, food sectors are not disproportionately protected.
- Unskilled labor-intensive sectors do not receive higher protection rates. Indeed the opposite seems to hold.
- The intensity of downstream linkages matters for protection levels.
- Nationality does matter.

Our results support the notion that larger sectors are harder to organize in Europe. All other things equal, the sectoral demand for protection is less likely to be accommodated, the larger is the size of its output. Intermediate linkages imply that more deeply integrated sectors receive less protection than do final goods sectors. Contrary to previous results in the literature, however, sectors where unskilled earnings are important do not appear to invite higher tariffs. What is clear from the table is that the nationality of industries is highly correlated with the extent of protection received. For instance, sectors where Germany, Britain, and especially, France, have higher output shares relative to the EU average, also get relatively higher protection, holding importance across other Members constant.

The results in Table 1 represent the standard approach, prior to the recent empirical literature that has emerged following Grossman and Helpman (1994). In a Grossman-Helpman lobbying framework, tariffs are positive for industries that lobby successfully. They receive the tariff:

$$\tau_i = \gamma \frac{X_j}{-M'_j} + \varepsilon_i \tag{2}$$

where γ is positive for protected industries and identical across protected industries, and the tariff is higher the greater output X and the flatter the import demand curve, represented here by the slope M. Table 2 presents estimates of equation (2) in logs. Even at our level of aggregation, we have sectors with zero protection. Therefore, we report both equation (2) estimated using OLS, and using a Heckman selection framework to allow for the fact that industries must receive protection first before the level is then determined, in the Grossman-Helpman framework. In the table, the variable SIGMA is the elasticity of import demand (represented by Armington elasticities, as taken from our CGE model data). Broadly speaking, the results are consistent with the mixed results in the literature. As predicted by almost all endogenous protection models, the elasticity of demand has a positive sign. Industry size has a negative sign, which may be more consistent with Olson-type models of organization challenge than the Grossman-Helpman model. We also find that intermediate linkages matter in this setup. This is consistent with the results reached by Cadot, de Melo, and Olarreaga (2004).

4 Estimating industry weights

We now take a step away from current practice, focusing on explaining observed patterns by explicitly estimating the objective function of the reduced-form regional policymaker, say for simplicity, an EU Über-Commissioner. Our goal is to express the level of EU-wide protection as the outcome of the Commissions maximization problem with respect to this objective function. This has the advantage of capturing the general equilibrium effects of protection, where for example steel protection may hurt motor vehicles, thereby providing more insight into the interaction of policy choice and the cost and benefits that this choice implies.

We proceed by employing a stylized Grossman-Helpman political influence model, specifying the objective function for the Commission as follows:

$$\Omega = aW + \sum_i b_i W_i \tag{3}$$

where a and b correspond to the weights attached by the Über-Commissioner to Community (W) and industry welfare (W_i), respectively. Assuming that tariffs (and potentially other policy instruments) are set to maximize this function, the equilibrium tariff rates will map to the following set of first order conditions [8] :

$$\frac{\partial \Omega}{\partial T_j} = a\frac{\partial W}{\partial T_j} + \sum_i b_i \frac{\partial W_i}{\partial T_j} = 0 \tag{4}$$

Rearranging, we then have,

$$\frac{\partial W}{\partial T_j} = -\frac{b_j}{a}\frac{\partial W_j}{\partial T_j} - \sum_{i \neq j} \frac{b_i}{a}\frac{\partial W_i}{\partial T_j} \tag{5}$$

Our data for the left- and right-hand sides of equation (5) come from the marginal shocks to tariffs in our model of the EU economy for 1997 and 2001. We derive this by applying small (1%) changes in EU external tariffs sector by sector within a general equilibrium model incorporating the data outlined above, and using the model to then estimate the direct and indirect impact of each tariff on overall economic welfare (measured as equivalent variation) and also on capital income within each sector.

The basic modeling framework, as implemented, is quite complex, and we refer the reader to Hertel et al (1997) for the blow-by-blow on algebraic structure.[9] For our purposes, the key features of the numerical model can be summarized as follows. First, we define composite or aggregate goods in each region r that are either purchased as intermediates or consumed as final goods. The set of prices for these composite or aggregate goods within a region $\mathbf{P^r_A}$ will be a function of the set of prices for domestic goods within a region $\mathbf{P^r_d}$ and the set of prices for imported goods $\mathbf{P^r_m}$.

$$\mathbf{P^r_A} = f^r_A\left(\mathbf{P^r_d}, \mathbf{P^r_m}\right) \tag{6}$$

[8]Note that while we are working with tariffs, one could add other industrial and tax policies to the mix. In theory, for each policy in isolation, the corresponding version of equations (3) and (4) should hold.

[9]The actual model files used to estimate the marginal effects are available for download.

Equation (6) involves a CES composite of domestic and imported goods. The internal price for imports will in turn be a function of the set of tariffs, where $T = 1 + \tau$, and also the set of world prices for imports.

$$\mathbf{P}_m^{\mathbf{r}} = \mathbf{T}'\mathbf{P}_{\mathbf{m}}^{*} \tag{7}$$

The domestic price will depend on the price of primary inputs indexed over factors v, $\mathbf{P}_{\mathbf{v}}^{\mathbf{r}}$, as well as the price of composite goods used as intermediates, $\mathbf{P}_{\mathbf{A}}^{\mathbf{r}}$. This is shown as equation (8):

$$\mathbf{P}_d^{\mathbf{r}} = f_d^r\left(\mathbf{P}_v^{\mathbf{r}}, \mathbf{P}_A^{\mathbf{r}}\right) \tag{8}$$

The cost function in equation (8) follows from CES technologies for value-added, combined with a Leontief-nest between intermediate goods and value added. Given domestic prices for inputs and outputs, the demand for primary inputs v will be a function of unit input coefficients (determined by relative input prices) and by total demand for domestic output $\mathbf{Q}$.

$$\mathbf{v}^{\mathbf{r}} = \left(\mathbf{Q}^{\mathbf{r}}\right)'\left(\mathbf{c}_{\mathbf{v}}^{\mathbf{r}}\left(\mathbf{P}_{\mathbf{v}}^{\mathbf{r}}\right)\right) \tag{9}$$

The input coefficients c follow from the CES production technology for value added. Demand for goods will be a function of the entire set of global incomes $\mathbf{I}$ and prices $\mathbf{P}$,

$$\mathbf{Q} = f_q\left(\mathbf{P}, \mathbf{I}\right) \tag{10}$$

where incomes are an outcome of the full general equilibrium solution across final and intermediate demands within the model. Incomes in each region are the sum of factor incomes and taxes collected Ψ. Tax collections are a function of tax rates ψ.

$$I^r = \left(\mathbf{P}_{\mathbf{v}}^{\mathbf{r}}\right)'\left(\mathbf{v}^{\mathbf{r}}\right) + \Gamma\left(\mathbf{P}_{\mathbf{m}}^{*}, \mathbf{P}_{\mathbf{v}}^{\mathbf{r}}, \psi\right) \tag{11}$$

Finally, welfare u is then defined in terms of an aggregate consumer with standard preferences, such that we can write an expenditure function e ($e\left(.\right)$ defined over consumer prices and welfare.

$$e\left(u^r, P_A^r\right) = I^r \tag{12}$$

We apply the model with a two-region version of the dataset, the two regions being the EU and the rest of the world. Conceptually therefore, if we take one of the regions r as the European

Union, and we differentiate the entire system with respect to a given EU tariff, we will arrive at a marginal impact of this tariff on reduced form national income (equation 11) and also factor incomes (equation 9). Operationally, we apply 1% changes in the power of the tariff $T = 1 + \tau$ to estimate such marginal changes. In the context of the model, this yields changes to capital income to each sector (where we treat capital as fixed to a sector) as well as changes in overall national income I. This in turn lets us calculate the corresponding marginal impact in social welfare, measured by equivalent variation. Our sectors are those in Table 1. Equipped with an assessment of welfare effects, we are then able to evaluate econometrically the relative weights, b_i/a, given the actual pattern of tariff protection in the EU.

The estimated relative industry weights for our 33 commodities are reported in Table 3. The full estimating equation also includes indirect service sector effects (not shown).[10] Several points are striking from the results. First, unlike the recent literature based on U.S. political contributions data, we do not get unbelievably high national income/welfare weights. Indeed, in general, industry weights tend to be around 2 to 3 times the corresponding weight on national income/welfare. In other words, special interests receive a higher weight than Community welfare does.

Another striking point is that while manufacturing sectors all receive considerably less protection compared to agriculture, their policy weights are actually comparable. This implies that there is not much correlation between tariffs and weights, a rather counter intuitive result underscored by Figure 1. In the Figure, we map estimated weights against 2001 tariff rates. As noted earlier, agricultural protection in Europe has deep political and historical roots, and results here seem to suggest that tariffs are now currently high in agriculture, not strictly because of the political power of farmer groups, but because of the low economy-wide effects that agricultural protection implies. To anticipate the econometric results reported below, giving in to the demands of the food industry carries relatively little negative implications for other industries compared, for example, to steel.[11] However, in manufacturing, tariffs and weights move in a more congruent way. The higher weights attached to iron and steel, apparel, textiles, and leather are reflected in the higher protection they receive relative to other non-farm products. Still, tariffs are considerably lower in manufacturing to begin with, and hence, so are their contributions to overall equilibrium distortion patterns.

The bottom of the table also reports test statistics for Chi-squared tests on linear re-

[10] Out of curiosity, we also experimented with including a measure of rest-of-world welfare effects. The rest of world receives no significant weighting, based on those regression results.

[11] Put another way, heavy protection for steel would have heavy ramifications for construction, motor vehicles, and the machinery sector, whereas protection of rice only hurts consumers, and not so much competing industries.

strictions across parameters. In particular, if the EU is working like a strict Grossman-Helpman world, with agents playing locally truthful strategies, then the estimated political weights, when significant and with the correct sign, should be zero. We reject this restriction quite strongly.

5 Deconstructing the Industry Weights

We now proceed by once again inspecting the influence of individual members, this time on the determination of the implicit policy weights assigned by the EU on various industries from Table 3. This is done by regressing the estimated relative industry weights, b_i/a, against the same political determinants employed in section 2, and the industry size indicator per EU-12 country. In addition, we also estimate tariffs as a function of revealed policy weights from Table 3, and as a function of the importance of intermediate linkages $-INT\_SHARE-$ and whether or not the sector is a food sector $-FOOD$. In formal terms, we estimate equations (13) and (14) as a system of two equations using iterated SUR least squares:

$$(b_i/a) = C + \beta_1 EU\_SHARE_i + \beta_2 FOOD_i + \beta_3 UNSKL_i \tag{13}$$
$$+\beta_4 INT\_SHARE_i + \sum_m \beta_m \Delta_{Member} + \varepsilon_i$$
$$\ln(1+t)_i = \alpha_1 WEIGHT_i + \alpha_2 INT\_SHARE_i + \alpha_3 FOOD_i + e_i \tag{14}$$

Regression results are reported in Table 4. The results further underscore the findings of low weights being attached to agricultural products, and greater value assigned to larger sectors. This time, however, the negative correlation between unskilled-labour intensity and the policy influence of an industry registers as statistically insignificant. Basically, in terms of policy weights, skill intensity does not appear to matter. Neither does sector size. What does matter is nationality, agricultural orientation, and also the strength of intermediate linkages. In particular, sectors that are important for downstream production receive lower policy weights.

Turning next to tariff rates themselves, we get as good a fit using the industry weights, INT_SHARE, and $FOOD$ as we did with the full specification in Table 4. In other words, the weights do a good job catching the impact of variations in national influence within the EU when the overall rate of protection is set. In addition, as we would expect if our Über-Commissioner cared about direct and indirect effects, we find that the intensity of intermediate linkages matters, and with the expected sign. The INT_SHARE term also provides insight into agricultural protection. Processed foods are not inputs to industry. They are consumed directly. As such, they are easier to protect, in a political sense, than sectors like steel and chemicals.

One final appeal of this exercise is an examination of how the stance of protection in 1958 maps to the influence on EU tariffs in 2001. In Figure 2, we have plotted actual and predicted weights against 1958 tariff rates prior to the CET for the EC12 countries in Figure 1. It is clear that the countries with the highest revealed policy weights in 2001 (France, Britain, Italy) are the ones that had the highest tariffs in 1958, while the general pattern is one of more protectionist Members continuing to influence the policy process in Brussels. [12]

Finally, we revisit the Grossman-Helpman specification in equation (2) and Table 2, now reported in Table 5. We now drop the intercept (theoretically equal to the identical industry weights) and again apply a selection model, where tariffs are now modeled as being a direct function of our estimated weights. Based on the Chi-squared and F statistics, the specification in Table 5 does a much better job than the specification in Table 2. Tariffs vary positively with estimated industry weights, and negatively with the importance of downstream linkages. However, we have already rejected the restriction that the coefficients/weights are identical across industries, while the size and demand elasticity coefficients again have the wrong sign. Like the results in Table 5, we find support for a political weighting scheme driving protection, but not one following strict Grossman-Helpman type restrictions on the disposition of lobbying rents.

6 Conclusions

The applied literature on political economy determinants of import protection is largely focused on the US. Yet the EU offers a contrasting model. Both are customs unions, though they differ in age. They also differ in that national governments play a more direct role in the EU than do state governments in the US. There are numerous difficulties one can expect in directly observing the political economy underpinnings of trade policy in such a Union, where overt lobbying and political contributions can be illegal, and where the policy mechanisms themselves have evolved in both ambition and complexity. We work around this problem by using an alternative approach – general equilibrium estimates of the impact of EU trade policy – to directly estimate the relative political weights assigned to industry. From this starting point, we have explored basic correlations found and discussed in the literature. Results show that industry size may cause coordination problems, leading to less protection. The country origin of industry also matters. Looking at the revealed policy preferences of the individual EU-12 countries, it is possible to make a distinction between high- and low- tariff countries. What is interesting is that this mirrors more or less the early

[12] For Figure 2, the $R^2 = .678$ and $F, Pr > F$: $12.673, 0.01$. The tariff coefficient is 14.72 (t=3.56).

classification of countries even before the CET was established in 1968. [13] This suggests that trade policy preferences of countries relative to each other, have remained fairly constant through almost five decades of European integration.

To further understand how sectoral interests are valued by policymakers, we have estimated the marginal effects of protection on overall and industry incomes as they are specified in the objective maximization problem of an influence-driven government model. Using a general equilibrium framework to explicitly derive these estimates, we are then able to extract the apparent weights of various industries in the policy process. This also allows us to further deconstruct these weights along the lines of industry nationality, and other related characteristics.

Results show several factors reflected in the estimated political weights. First is the role of output size. Standard political economy models, working under the assumption of constant-returns-to-scale, consider the marginal impact of protection on factor incomes to be neutral to size. Hence, the importance attached to industry size is conditional on the amount of lobbying in the sector, as in Grossman & Helpman, or conditional on the amount of nominal votes it can deliver. Our estimates show that the specification where output plays a focal role provides a very good fit, suggesting the role of size supports the notion in the literature of coordination problems. Second, the depth of intermediate linkages matters. In particular, in the complex dance of interests that defines the pattern of tariffs, and the resulting political weights, the likelihood of protection if lower (and net influence is weaker) if special consideration leads to negative consequences downstream.

A third point is that national priorities and industry characteristics matter not only for tariffs, but also for the assignment of policy weights. Explaining why the experiments done here consistently point to both the French and British as the most prominent players in EU trade policymaking (at least on the import protection side) is beyond the scope of this paper. However, the French result confirms popular beliefs. The British (and Italian) results are fully consistent with the original tariff stance in 1958, before the birth of the common external tariff. Indeed, the history of European integration is replete with political ordeals related to efforts to cope with British, French and Italian insistence on special treatment (the British rebate) and resistance to liberalisation (France at the end of the Uruguay Round and during the Doha Round). The most infamous example is perhaps the adoption of the Common Agricultural Policy, commonly regarded as a condition tied by the French government in 1964 to the second round of liberalization in intra-EC manufacturing trade.

Finally, it is worth noting that tariff protection, at least in manufacturing, has indeed

[13] An exception is Germany, which appears to have increased its preference for protection. However, the statistical significance of the German coefficient is rather low in our estimates, thereby making it difficult to pose any definitive judgement.

become less important for the EU as compared to the past. Only non-Europe OECD and non-WTO countries now face the MFN and tariff peak rates, and even in agriculture, further reforms are being introduced (i.e. in sugar). Still, what our results illustrate is that the political economy bedrock of policy making is more complex than a more simple analysis would suggest. Moreover, due to the general equilibrium approach taken here, trade policy can be used to deduce the political weights that could be reflected in other policies as well. Hence, while direct evidence on national and regional preferences might not be in place, this exercise does convey some indications of the general industry weights behind a wider range of policies.

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Figure 1

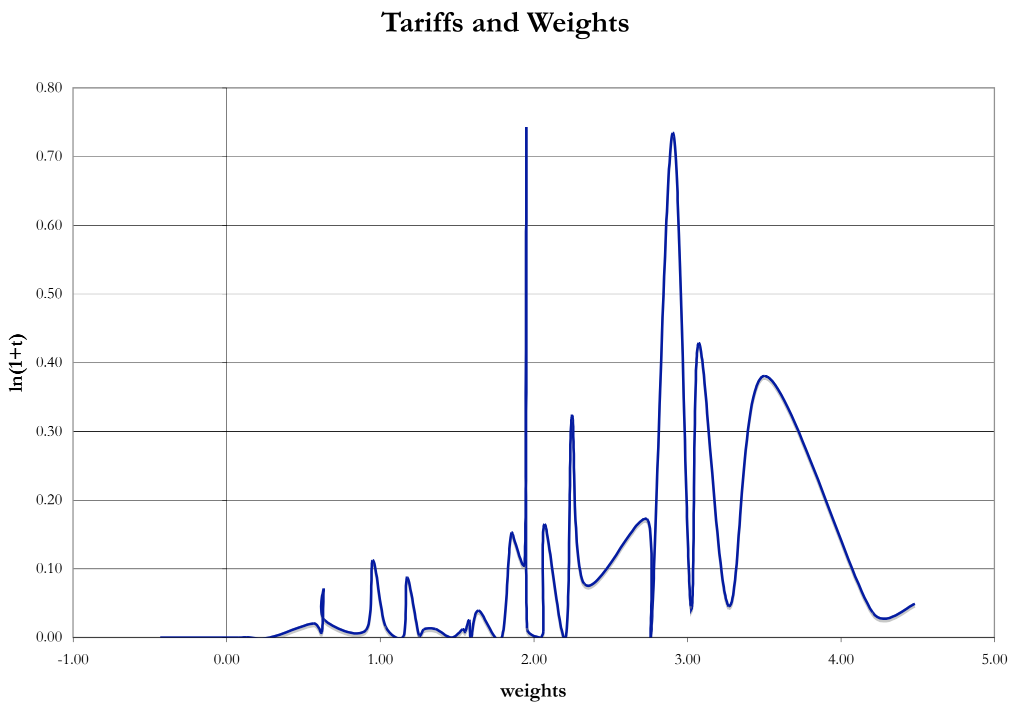

Figure 2

Table 1

Tariffs $ln(1+t)$ regressed on structural and regional variables

RHS variables	coefficient	$t-ratio$	
$Sigma$	-0.001	-(0.82)	
$Size$	-20.110	-(2.79)	***
$FOOD$	-0.001	-(0.28)	
$UNSKL$	-0.027	-(1.59)	
INT_SHARE	-0.693	-(6.07)	
BEL	0.941	(0.15)	
DNK	0.272	(0.39)	
FRA	4.931	(2.50)	**
DEU	4.589	(2.37)	**
GBR	4.429	(2.43)	**
GRC	0.199	(0.90)	
IRL	-0.057	-(0.30)	
ITA	1.529	(1.33)	
LUX	1.201	(5.23)	**
NLD	1.135	(1.51)	
PRT	1.923	(3.39)	**
ESP	1.664	(1.90)	*

Estimates are based on robust regressions

OLS R-sq: 0.48, obs: 42

$F(16,25): 7.96, Pr > F: 0.00$

*:significant at the .01 level, **: .05 level, ***: .01 level.

Table 2

Tariffs $ln(1+t)$regressed on Grossman-Helpman variables

RHS variables	single equation OLS		Heckman ML		Heckman Probit	
$Sigma$	1.331		1.331			
	(1.41)		(2.12)	**		
$Size$	-0.344		-0.325		0.492	
	-(1.80)	*	-(1.53)		(2.13)	**
INT_SHARE	-2.457		-2.495		-2.299	
	-(3.50)	***	-(3.82)	***	-(0.85)	
$Unskl$			0.525			
			(1.24)			
$Food$			-0.423			
			-(0.34)			
OLS $R^2: obs: 34$	0.42					
$F(3,31), Pr > F: 0.00$	12.25, 0.00					
Obs, censored obs				42,7		
Wald $\chi^2(3)$, $Pr > \chi^2$				24.57,0		

OLS Estimates are based on robust regressions, t-ratios in parentheses

*:significant at the .01 level, **: .05 level, ***: .01 level.

Table 3
Industry weights relative to total welfare weight $-\frac{b_j}{a}$

industry	$-\frac{b_j}{a}$ weight	$t-ratio$		rate of import protection, %
rice	-3.07	-(2.62)	***	53.5
wheat	-2.06	-(6.22)	***	0.9
grains	-2.07	-(5.78)	***	17.9
horticulture	-1.85	-(8.31)	***	16.6
oilseeds	-2.04	-(5.87)	***	0.0
cane & beet sugar	-1.17	-(1.36)	*	9.1
plant fibres	-2.21	-(1.58)	*	0.0
other crops	-1.58	-(7.37)	***	2.5
cattle	-1.94	-(6.39)	***	11.6
other livestock	-1.28	-(4.59)	***	1.3
dairy products	-1.46	-(6.07)	***	0.0
animal fibres	-1.79	-(0.78)		0.0
forestry	-0.13	-(1.03)		0.1
fish	-0.64	-(4.02)	***	2.6
coal	-0.08	-(0.24)		0.0
oil	-0.28	-(0.16)		0.0
gas	-1.59	-(1.61)	*	0.0
other minerals	0.43	-(1.90)	**	0.0
beef products	-3.50	-(7.14)	***	46.3
other meat products	-2.74	-(5.82)	***	18.8
vegetable oils	-0.95	-(5.96)	***	11.9
milk products	-2.25	-(6.64)	***	38.1
processed rice	-2.91	-(2.01)	**	108.4
processed sugar	-1.95	-(5.19)	***	110.1
other foods	-2.33	-(7.90)	***	8.2
beverages & tobacco	-0.63	-(3.53)	***	7.4
textiles	-4.21	-(6.08)	***	3.8
apparel	-3.02	-(7.07)	***	4.7
leather	-4.48	-(8.10)	***	5.0
lumber	-1.25	-(3.15)	***	0.4
paper, pulp, plastics	-1.15	-(2.35)	***	0.2
petrochemicals	-0.91	-(1.35)	*	1.1
chemicals, rubber, plastics	-1.03	-(3.69)	***	1.7
non-metallic minerals	-0.56	-(2.34)	***	2.1
iron, steel	-3.27	-(4.72)	***	4.7
nonferrous metals	-2.77	-(5.45)	***	0.8
fabricated metals	-1.36	-(4.26)	***	1.3
motor vehicles	-1.64	-(2.39)	***	4.0
other transport	-1.96	-(6.81)	***	1.4
electric machinery	-0.62	-(1.27)		0.8
other machinery	-1.55	-(2.92)	***	0.9
other manufactures	-1.54	-(4.72)	***	1.2

Obs: 106, $\chi^2(57,49), PR > \chi^2$: 91836.61, 0.00
Joint test that all negative coefficients equal $\chi^2(18), PR > \chi^2$: 1113.46, 0.00
Joint test that all primary sector coefficients equal $\chi^2(9), PR > \chi^2$: 61.50, 0.00

Iterated SUR based.
*:significant at the .10 level, **: .05 level, ***: .01 level, one-tailed test.

Table 4
Iterated joint (SUR) regressions for tariffs $ln(1+t)$ and industry weights $\frac{b_j}{a}$

LHS variable	RHS variables	coefficient	$z-ratio$	
tariff	WEIGHT $\frac{b_j}{a}$	0.055	(2.96)	****
	INT_SHARE	-0.095	-(2.04)	***
	FOOD	0.130	(3.06)	****
	R^2 .4679 $\chi^2(3,39), PR > \chi^2$: 406, 0.00			
weight $\frac{b_j}{a}$	EU_SHARE	-409.290	-(1.11)	
	INT_SHARE	-2.054	-(3.49)	****
	FOOD	0.530	(1.73)	**
	UNSKL	0.674	(0.77)	
	BEL	107.995	(3.37)	***
	DNK	-54.612	-(1.53)	*
	FRA	158.951	(1.57)	*
	DEU	26.427	(0.27)	
	GBR	185.084	(1.97)	**
	GRC	-8.353	-(0.74)	
	IRL	-32.219	-(3.34)	****
	ITA	130.452	(2.20)	***
	LUX	15.784	(1.34)	
	NLD	-51.403	-(1.33)	*
	PRT	52.427	(1.79)	**
	ESP	-151.807	-(3.38)	****
	R^2 .6592 $\chi^2(16,26), PR > \chi^2$: 81.13, 0.00			

*:significant at the .15 level, **: .10 level, ***: .05 level, ****:.01 level two-tailed test.

Table 5
Tariffs $ln(1+t)$regressed on weights $\frac{b_j}{a}$ and Grossman-Helpman variables

RHS variables	single equation OLS		Heckman ML		Heckman Probit	
$lnWEIGHT$	1.299		1.135			
	(3.88)	***	(3.72)	***		
$Sigma$	-0.885		-0.849			
	-(3.26)	***	-(2.66)	***		
$Size$	-0.321		-0.253		0.577	
	-(3.19)	***	-(2.36)	***	(3.26)	***
INT_SHARE	-1.222		-1.624		-2.299	
	-(2.92)	***	-(3.45)	***	-(0.85)	
$Unskl$			-10.468			
			-(3.42)			
$Food$			-1.774			
			-(1.46)			
obs, OLS R^2 :	34, 0.753					
$F(3,31), Pr > F$: 0.00	26.36, 0.00					
obs, censored obs				42,7		
Wald $\chi^2(3)$, $Pr > \chi^2$				81.49,0		

OLS Estimates are based on robust regressions, t-ratios in parentheses
*:significant at the .01 level, **: .05 level, ***: .01 level.