Abstract: A political economy model of protection is constructed to explain the endogenous determination of export taxes and subsidies in the presence of intermediate goods. The *Protection for Sale* model (Grossman and Helpman 1994) is extended to include a supply chain that creates a political rivalry among organized special interest groups. The model predicts that an export tax is imposed on intermediates in two cases: when the only organized interest is producers of final goods, and when both industries are organized but the production of final goods is larger than the production of intermediate goods. The model is tested using a novel measure of political organisation of industries based on the WTO Dispute cases. The empirical test confirm the theory, but the low overall fit of the model suggests that channels other than political economy may play an important role.

JEL codes: D04, D72, E62

Keywords: Export taxes, export duties, export subsidies, political economy, trade policy, supply chain, intermediates, organized interests, rent-seeking, lobbying, WTO disputes.
1. Introduction

Taxing exports is on rise, with more than 110 countries applying export taxes on multilateral or bilateral basis.\(^1\) Export-side instruments reduce welfare to a higher degree than the ones regulating imports (Figure 1). Their application has intensified since the 2008 crisis\(^2\) and is likely to remain high, as export duties are a legitimate instrument under the WTO law, while other trade policies are restricted.

Figure 1 Contributions of various instruments to the border component of the welfare reduction index (WRI) for developing countries, 1960–2010 (%).

![Figure 1 Contributions of various instruments to the border component of the welfare reduction index (WRI) for developing countries, 1960–2010 (%).](image)

*Source: Anderson, Rausser, and Swinnen (2012).*

As export duties hurt taxed industries by driving domestic prices down and reducing profits, what can possibly motivate governments to resort to taxing exports? Trade Policy Reviews (TPRs) regularly conducted by the WTO Members and the Secretariat contain a number of stated policy objectives, ranging from environmental concerns and food security to price stabilisation, revenue generation and

\(^1\) For a detailed description and recent trends on export taxes see Solleder (2013a), and for an estimation of the trade effects on tax imposing countries refer to Solleder (2013b).

\(^2\) According to the Global Trade Alert (http://www.globaltradealert.org), a website monitoring trade policies since 2008 (the start of the financial crisis).
favouring downstream producers.³ Improving terms of trade (ToT) is rarely evoked by tax imposing countries, but is likely to be among motives behind export taxes.⁴

Export taxes as an industrial policy are often justified by a need for export diversification, upgrade along the value chain (adding value domestically), infant industry protection, attracting investments and ensuring a sufficient supply of inputs for existing processing capacities. Furthermore, public policy objectives linked to the development of the processing industries such as job creation are often cited in conjunctions with export taxes. All arguments essentially hinge upon a wedge between international and domestic price created by an export tax and a subsequent redistribution of income from upstream producers to downstream producers and consumers.

This paper proposes a theory of export taxes imposed only for industrial policy purposes. On the one hand this is a serious limitation; on the other hand, industrial policy is an important motive for taxing exports, attested by prima facie evidence drawn from the new dataset on export taxes. The upper part of Table 1 shows that unprocessed and semi-processed products are taxed more frequently than finished goods (3.7% of unprocessed products are taxed versus 0.2% for finished goods) and the tax rate is higher (around 22% for unprocessed and semi-processed goods and 10% for finished goods).

The standard deviation of the rates applied to unprocessed goods is very high (53.4, that is more than double of the tax rate) suggesting that the revenue generation motive is not paramount. Tax rates on unprocessed products are so high that they are likely to interrupt export flows and consequently export tax revenues. To eliminate potential ToT motive and food security considerations, products with large market share and staple food items (together constituting around 30% of the dataset) were dropped from the calculations. The resulting distribution of export taxes by the level of processing remains unchanged, with tax rate and incidence being considerably higher for unprocessed and semi-processed goods (The lower part of Table 1).


⁴ The EC suggested disciplines for preventing the “beggar thy neighbour” measures adopted by a few major suppliers and other large economies’ in its proposal under the current NAMA negations on non-tariff barriers to trade which aims at preventing the use of export taxes for industrial or trade policy purposes (EC 2008).
Table 1 Number of taxed goods and average export tax rate by level of processing

<table>
<thead>
<tr>
<th></th>
<th>(a) Number of goods (HS6)</th>
<th>(b) Export tax rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Taxed</td>
<td>Total</td>
</tr>
<tr>
<td>I. All products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprocessed</td>
<td>420</td>
<td>11365</td>
</tr>
<tr>
<td>Semi-processed</td>
<td>742</td>
<td>31590</td>
</tr>
<tr>
<td>Finished</td>
<td>79</td>
<td>51066</td>
</tr>
<tr>
<td>II. Products excluding staple food and goods with large market share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprocessed</td>
<td>214</td>
<td>4990</td>
</tr>
<tr>
<td>Semi-processed</td>
<td>463</td>
<td>23401</td>
</tr>
<tr>
<td>Finished</td>
<td>45</td>
<td>37186</td>
</tr>
</tbody>
</table>

Source: The table is based on the general export tax rates applied by 20 countries in one time period (2001-2011), sourced from the PET dataset (Solleder 2013).

Note: Large market share refers to the good in the upper quartile (in sample), staple food with respective HS codes are defined in Table 5 of the Annex. The classification by the level of processing is created by the WTO Secretariat.5

This paper provides a theoretical framework that can rationalize this stark difference in the application of export taxes across upstream and downstream industries. This leaves other important aspects of export taxes, i.e. restricting exports for improving ToT and ensuring domestic supply of staple food, for further research.

The remainder of the paper is structured as follows. Section 2 contains literature review, section 3 describes the model and its predictions, section 0 outlines empirical strategy section 5 describes data section 6 provides empirical result and section 7 reports on the robustness check and section 8 concludes the paper.

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5 The classification is downloadable from World Integrated Trade Solutions (WITS) of the World Bank at http://wits.worldbank.org/wits/data_details.html
2. Literature review

This section briefly describes leading political economy approaches to the formation of trade policies, followed by models that explicitly include intermediaries in the analysis. A political economy model requires specification of individual preferences and interest groups, policymaker preferences and the structure of the government, as well as description of how individual preferences are aggregated to political demands for a particular policy and channelled to the government (Rodrik 1995).

Several approaches link political interests to trade policy outcomes. The tariff-formation function relates outcomes to the amount of lobbying resources used by organized groups (e.g. Findlay and Wellisz 1982). The political support function adds a loss of efficiency into government consideration by modelling trade policy as a trade-off between the gains from protection and the losses to general population (e.g. Hillman 1989 and Van Long and Vousden 2012). The median-voter approach assumes that the trade policy is determined by direct vote and is a function of individual endowments and the cost of voting (Mayer 1984).

The campaign contribution approach (Magee, Brock and Young 1989) and the political contribution approach pioneered in Protection for Sale (referred as PFS hereafter) by Grossman and Helpman (1994) introduced a transfer of resources from lobbies to the government. In the former, the transfer increases the probability that preferred party wins the election and in the latter the contributions aim at influencing trade policies of the incumbent government. Grossman and Helpman (1995) extend PFS by endogenizing world prices and allowing policy-setting governments to collude. This paper will use the approach developed in PFS as it allows for a concentration of special interests necessary for modelling trade policy aimed at industrial objectives.

Systematic differences exists in the patterns of protection across countries, sectors and industries (Cadot, de Melo and Olarreaga 2004). Anderson (1995) explains the cross-sector patterns of protection between rich and poor countries by political economy variables. In poor countries food expenditures represent a much larger share in the total household consumption and the agricultural sector exhibits a greater labour intensity and employs more people. Protection of agriculture in these countries would result in a raise of food prices and wages with relatively small gains per farmer and a large cost for manufacturing. Thus, agricultural sector in poor countries are often taxed. The results are empirically

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6 Helpman (1995) provides a reviews of political economy approaches in a comparable specific-factor framework.

7 Export taxes motivated by other reasons may require a different link. For example, a median-voter approach could be more suitable for modelling trade policy aimed at keeping staple food prices low. Alternatively, McMillan (2001) explains self-defeating taxes on agricultural exports by a dynamic model of predatory taxation where government takes into account the sunk costs incurred by the farmers.
confirmed by Gawande and Hoekman (2009) based on the new data on the nominal rates of assistance (NRA).\(^8\)

In political economy models, trade policy is a tool for redistribution of income among different groups inside and outside the country, based on the idea by Olson (1965) that organized interest groups can exploit unorganized ones.\(^9\) In PFS, unorganized export industries are subject to export duties because organized industries lobby for lower overall level of prices and higher tax revenues (in addition to higher profits in their own industry). In Grossman and Helpman (1995), in addition to consumer surplus and revenue consideration, government takes into account endogenous world prices and therefore has incentives to restrict exports of industries that face inelastic foreign import demand.

If supply chain relations are taken into account, organized interests will have yet another reason for bidding government to impose an export tax. Organized industries that consume intermediate goods are expected to lobby for lower prices of intermediates, i.e. through export taxes if intermediates are exported (or import subsidies if intermediates are imported).\(^10\) This hypothesis have been proven theoretically and empirically in Gawande, Krishna, and Olarreaga (2012), referred to GKO hereafter, where authors extend PFS to include multiple intermediate goods, with each good potentially using intermediates inputs and serving itself as an intermediate input.

Earlier papers that include intermediate inputs into PFS, aimed at demonstrating the link between the protection of final goods and the policies on inputs. Tariffs on inputs are expected to increase protection level for the final goods. The results have been confirmed by Gawande and Bandyopadhyay (2000) for the US using the data on non-tariff barriers, and by McCalman (2004) for Australia. In a similar line of argument, Cadot, de Melo, and Olarreaga (2003) show that duty drawbacks on imported intermediates decrease incentives of processing industries to counter-lobby against high tariffs, and find empirical evidence for their hypothesis (higher tariffs on inputs eligible for duty drawbacks in Mercosur).

This model has important differences from GKO. Hereby, the intermediate goods are assumed to be produced solely from the primary factors. This assumption brings the model closer to reality as most of the taxed products are raw materials.\(^11\) Furthermore, the final goods are assumed to be purchased only by

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\(^{8}\) Anderson and Nelgen (2012).

\(^{9}\) In the models without organized interests, export taxes can be used to counter monopoly powers. For example, Deardorff and Rajaraman (2005) show that in the presence of monopsony or oligopsony power export duties can be the best available policy for the exporting country.

\(^{10}\) Baldwin and Robert-Nicoud (2007) explain asymmetric lobbying by the entry and sunk costs. Their model, combined with supply chains would also result in export taxes being amplified for exported inputs used in production of the industries with high sunk costs.

\(^{11}\) Solleder (2013a) and WTO (2010).
consumers and do not serve as inputs to any other industry. This leads to a notable asymmetry, where final goods and intermediate goods have structurally different equilibrium policies defining both the policy (protection or tax) and its level.
3. Theoretical model

3.1. Overview

I extend the PFS model by adding a stylized supply chain (intermediates’ sector). As usual, the model assumes a small competitive Ricardo-Viner economy facing exogenously given world prices. The economy produces three goods, the numeraire good A, the intermediate Y, and the final good Z. A (numeraire) is made from labour, Y (upstream) is made from labour and a sector-specific input, Z (downstream) is made from labour, a sector-specific input and Y.\textsuperscript{12} Perfect competition and constant returns are assumed for all sectors. Labour is mobile between sectors within a nation. For the ease of exposure I assume that both intermediate goods and final goods are exported.

The economy is populated by individuals who have identical preferences but different factor endowments. All individuals own labour. Few individuals also own one type of sector specific input. Owners of sector specific inputs can form a lobby to influence policy. They offer contributions to the government by taking contributions from other lobbies as given. In response, the government sets trade policy (taxes and subsidies on non-numeraire goods) – to maximize a weighted sum of aggregate social welfare and total contributions of lobbies. Tax revenue collected by the government is distributed lump-sum back to agents (can be negative in case of subsidies).

The ownership of sector-specific inputs is assumed to be concentrated. As a result, lobbyists care much more about the returns to their sector-specific capital than about their share of tax revenues and the overall level of prices they face as consumers. Thus, lobbies take only their profits into account while calculating their contributions. In a model without supply chain, this would imply that lobbies influence policies only for their own sector, and in equilibrium all organized industries receive some protection.

In the presence of a supply chain, profits in sector Z depend on the prices of inputs, including the price of the intermediate good Y. Furthermore, exports of good Y depends on the quantity of Y absorbed for the production of the final good Z. Thus, it is expected that each organized industry will lobby for policies for their own sector and for policies affecting other sectors within the supply chain. All deviation from free trade in sectors other than the lobbyists’ own sector can be thus attributed to the supply chain relations (as consumer surplus and tax revenue channels are ruled out by assumptions).

\textsuperscript{12} Mnemonics for Y and Z: letter Z comes after Y, as the final good Z comes after the intermediate good Y.
3.2. **Formal framework**

Individuals have different factor endowments and identical quasi-linear preferences. Each individual maximizes

\[ U = C_A + U_Y(C_Y) + U_Z(C_Z) \]

where \( C_A \) is consumption of good A, \( C_Y \) is consumption of good Y and \( C_Z \) is consumption of good Z. Sub-utility functions \( U_Y(\cdot) \) and \( U_Z(\cdot) \) are increasing, differentiable and strictly concave. The indirect utility function is:

\[ V(P_Y, P_Z, E) = E + S_Y(P_Y) + S_Z(P_Z) \]

where \( S_Y \) and \( S_Z \) are consumer surpluses derived from consumption of Y and Z respectively.

Maximising utility subject to budget constraint (individual’s expenditure E), individuals consume:

\[ C_Y(P_Y) = \left[ \frac{\partial U_Y(C_Y)}{\partial P_Y} \right]^{-1} \]
\[ C_Z(P_Z) = \left[ \frac{\partial U_Z(C_Z)}{\partial P_Z} \right]^{-1} \]
\[ C_A(P_A) = E - \left[ P_Y C_Y(P_Y) + P_Z C_Z(P_Z) \right] \]

where good A – the untaxed numeraire good – has a price of unity, and the domestic prices for two other goods are denoted \( P_Y \) and \( P_Z \).

Consumer surplus is:

\[ (3.a) \quad S_Y(P_Y) = U_Y(C_Y) - P_Y C_Y(P_Y) \]
\[ (3.b) \quad S_Z(P_Z) = U_Z(C_Z) - P_Z C_Z(P_Z) \]

I assume that good A is produced using only labour with constant returns to scale, \( Q_A = f_A(L_A) \), and I choose units such that the labour input coefficient equals unity. Assuming the nation is large enough that some A is produced in equilibrium, the wage is pinned to unity (due to competition for labour with the A sector). The wage thus does not appear in the profit functions.
Intermediate good Y’s production function is:

\[ Q_Y = f_Y(K_Y, L_Y) \]

where \( K_Y \), the sector-specific input, is available in fixed supply. As the wage rate is fixed at one, profits in sector Y are:

\[ (3) \quad \pi_Y(P_Y) = Q_Y P_Y - L_Y \]

Final good Z is produced using labour, a sector-specific input and one unit of Y (e.g. one engine is required for each car), so its constant-returns Leontief production function is:

\[ Q_Z = \min \{ f_Z(K_Z, L_Z), Q_Y^Z \} \]

where \( Q_Y^Z \) is the quantity of Y used in production of Z, and \( Q_Y^Z = Q_Z \).

Note that this is the PFS model, except of the assumption of the fixed proportions production function with one of the goods as input. Furthermore, this assumption makes the paper different from GKO where there is no intermediate and final goods ex-ante. I choose to model Y as using only primary factors (labour and sector-specific capital) since it is viewed as a primary good – the type of goods that are often subject to export taxes. The good Y is referred to as “intermediate good” and “raw good” interchangeably.

As usual, returns to Z-specific capital consist of profits in sector Z, namely:

\[ (4) \quad \pi_Z(P_Y, P_Z) = Q_Z P_Z - Q_Z P_Y - L_Z \]

Export is defined as positive numbers (balance between domestic production and consumption) and imports as negative numbers, i.e.:

\[ (5.a) \quad X_Y = Q_Y - (C_Y + Q_Z) \]
\[ (5.b) \quad X_Z = Q_Z - C_Z \]

This paper abstracts from a choice of policy instruments. Government options are restricted to trade taxes and subsidies. Given exogenous world prices protection from the government implies that domestic price is higher than the world price. For an imported good the respective policy will be an import tariff, for an
exported good the policy is an export subsidy. Correspondingly, an export tax on an exported good and an import subsidy on an imported good will make their domestic prices fall below their respective world prices, thus reducing the profits in the regulated sector.

As I assume a small economy, an export tax reduces the domestic price to the point where producers are indifferent between selling abroad at the tax-laden price and selling domestically tax free. Thus, ignoring transport costs the export taxes are defined as:

\[(6.a) \quad T_Y = P_Y^w - P_Y\]
\[(6.b) \quad T_Z = P_Z^w - P_Z\]

Negative T’s imply an export subsidy.

The government collects tax revenue and redistributes it lump-sum to all individuals, with negative revenue representing subsidies. Total tax revenues equals exports multiplied by an export tax:

\[(7.a) \quad R_Y(P_Y, P_Z) = [Q_Y - C_Y - Q_Z][P_Y^w - P_Y]\]
\[(7.b) \quad R_Z(P_Z) = [Q_Z - C_Z][P_Z^w - P_Z]\]

Each individual has income from wages transfers of tax revenues, and possibly from the sector-specific inputs. The ownership of the sector-specific inputs is assumed to be indivisible, non-tradable and concentrated. Individuals who own sector-specific inputs will see their income rise if the domestic price of the good produced with this sector-specific input increases. Provided that the ownership of the sector-specific input is concentrated, individuals will disregard the income derived from government transfers and prices they face in other sectors as consumers. This assumption is presented in PFS under “Example 3: Represented Special Interests Are Highly Concentrated”.13

Owners of sector-specific inputs will have interest in influencing domestic prices of their goods by offering government incentives for policies. Organized owners will form a lobby to offer incentives to the government for setting favourable policies (taking all other contributions as given). As the world prices are exogenous, favourable policies are the vector of domestic prices \((P_Y, P_Z)\). Unorganized owners of sector-specific inputs (if any) and individuals that do not own sector specific inputs do not lobby, as they are too dispersed to influence policy. As in PFS, the model leaves aside the discussion how lobbies avoid

13 Baldwin and Robert-Nicoud (2006) refer to the opposite situation as an “ice cream clause” – as if producers of steel would agree for a slightly lower protection of the steel industry if government reduces the prices of ice cream. The assumptions of the “Example 3” of the PFS are more empirically appealing than the “ice cream clause”.

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a free riding problem and why some sectors are organized and others are not. The latter assumption is not critical as all possible combination of organized industries will be studied.

As in PFS, the model takes a lobbying approach to endogenous trade policy assuming that incumbent government reacts to incentives (while elections and voting are out of the model). The lobbying is modelled as a menu auction (Bernheim and Whinston 1986), where each industry announces contributions $B_i$, which are “truthful” i.e. the marginal change in contribution for a small change in policy matches the impact of the policy change on the gross welfare of the lobbyists.

The incumbent government is assumed to be responsive to contributions because they can be used, for example, to finance campaign spending. Furthermore, government also cares about the aggregate welfare $W$ because this may impact the probability of being re-elected. Assuming a linear form, the government objective function is the following:

\[
G = \sum_{i \in \Lambda} B_i(P_Y, P_Z) + \alpha W(P_Y, P_Z)
\]

where $\alpha$ is the weight government attaches to social welfare, capital lambda $\Lambda$ is the set of sectors that are organized politically and thus make lobbying contributions, and $B_i$ are contributions by organized industries.\(^{14}\)

The aggregate welfare comprised of income, trade tax revenues and consumer surplus:

\[
W(P_Y, P_Z) = S_Y + S_Z + R_Y + R_Z + \pi_Y + \pi_Z
\]

In equilibrium, the policies are selected to simultaneously maximize government objective function ($G$) and the welfare of the lobbies net of contributions. As in the example 3 of PFS, I will include only profits in the welfare calculation of lobbies. This assumption is necessary not only because it significantly simplifies the model, but also because it allow focusing the model on the impact of the supply chain. If organized individuals do not care about their consumer surplus (which is an incentive to lobby for lower prices in sectors other than their own), all export taxes (lowering the domestic price of the taxed good) can be attributed to the presence of the supply chain.

\(^{14}\) Baldwin (1987) demonstrates a mathematical correspondence between the political economy approach and deus ex machina tariff formation approach.
Contributions are cancelling out, and the joint surplus can be expressed as:

\[ (10) \quad \Omega = \alpha W + \int_{i \in \Lambda} \pi_i \]

The vector of domestic prices that maximizes the joint surplus \( \Omega \) must satisfy the following first-order conditions, obtained by taking a partial derivative of equation (10) with respect to domestic prices (\( P_Y \) and \( P_Z \)) and solved as a system:

\[
\begin{align*}
(11.a) \quad & \alpha \frac{\partial W}{\partial P_Y} + \int_{i \in \Lambda} \frac{\partial \pi_i}{\partial P_Y} = 0 \\
(11.b) \quad & \alpha \frac{\partial W}{\partial P_Z} + \int_{i \in \Lambda} \frac{\partial \pi_i}{\partial P_Z} = 0
\end{align*}
\]

Capital lambda \( \Lambda \) is the set of sectors that are organized politically. In the current model two numeraire sectors (Y and Z) include sector-specific capital and thus can be organized politically given rise to four cases described below.

3.3. Results

Case 1. No lobbying

In case when neither producers of intermediate good Y nor producers of the final good Z producers are organized (no lobbying), the first order conditions are:

\[
\begin{align*}
\frac{\partial S_Y(P_Y)}{\partial P_Y} + \frac{\partial R_Y(P_Y, P_Z)}{\partial P_Y} + \frac{\partial \pi_Y(P_Y)}{\partial P_Y} + \frac{\partial \pi_Z(P_Y, P_Z)}{\partial P_Y} &= 0 \\
\frac{\partial S_Z(P_Z)}{\partial P_Z} + \frac{\partial R_Z(P_Z)}{\partial P_Z} + \frac{\partial R_Y(P_Y, P_Z)}{\partial P_Z} + \frac{\partial \pi_Z(P_Y, P_Y)}{\partial P_Z} &= 0
\end{align*}
\]

Note that profits of the final goods sector (\( \pi_Z \)) is a function of both \( P_Y \) and \( P_Z \) through the costs of the intermediates used as inputs. Revenue from taxes on the intermediates (\( R_Y \)) is a function of both \( P_Y \) and \( P_Z \), as \( Q_Z \) enters the definition of the exports of Y.
By using equations (1)-(7) and recognizing that \( \frac{\partial S_i(p_i)}{\partial p_i} = -c_i \); \( \frac{\partial \pi_i}{\partial p_i} = q_i \); \( \frac{\partial \pi_z(p_Y,p_Z)}{\partial p_Y} = -q_Z \), results in

\[
\begin{align*}
\frac{\partial R_Y}{\partial p_Y} &= C_Y - Q_Y + Q_Z + T_Y \frac{\partial X_Y}{\partial p_Y}; \quad \frac{\partial R_Y}{\partial p_Z} = T_Y \frac{\partial X_Y}{\partial p_Z}; \quad \text{and} \quad \frac{\partial R_Z}{\partial p_Z} = C_Z - Q_Z + T_Z \frac{\partial X_Z}{\partial p_Z},
\end{align*}
\]

results in

\[
\begin{align*}
(12.a) & \quad T_Y \frac{\partial X_Y}{\partial p_Y} = 0 \\
(12.b) & \quad T_Y \frac{\partial X_Y}{\partial p_Z} + T_Z \frac{\partial X_Z}{\partial p_Z} = 0
\end{align*}
\]

Expression \( T_Y \frac{\partial X_Y}{\partial p_Z} \) in (12.b) makes the results distinct from the PFS. The optimal policy for the final good \( Z \) depends on the optimal policy for the intermediates \( Y \) and on the impact of the change in price of \( Z \) on the export of \( Y \). The results are intuitive. The expression \( \frac{\partial X_Y}{\partial p_Z} \) being negative, a higher tax on \( Y \) decreases the tax on \( Z \) when industries have opposing interests as in lobbying competition over trade policy (GKO). The impact is amplified by the size of the change in export of \( Y \) from a change in the prices of \( Z \).

Given the regularity conditions: \(^{15} \)

\[
\begin{align*}
(13.a) & \quad \frac{\partial X_i}{\partial p_i} > 0, \quad i \in Y, Z \\
(13.b) & \quad \frac{\partial X_Y}{\partial p_Z} < 0 \\
(13.c) & \quad \left| \frac{\partial X_Y}{\partial p_Z} \right| < \frac{\partial X_Y}{\partial p_Y} \\
(13.d) & \quad \frac{p_Y}{p_Z} < 1
\end{align*}
\]

The taxes for both \( Y \) and \( Z \) must be zero:

\[
\begin{align*}
(14.a) & \quad T_Y^0 = 0 \\
(14.b) & \quad T_Z^0 = 0
\end{align*}
\]

As expected, the optimal taxes in a small open economy without lobbying are zero.

\( ^{15} \) If expressions (13.a) and (13.b) are applied to imports \( (M_i = -X_i) \), the inequalities flip sign.
Case 2. Final goods sector (Z) is organized

In case producers of the final good Z are organized, the first order conditions are:

\[
(15.a) \quad \frac{T_Y^o}{P_Y^o} = \frac{1}{\alpha \varepsilon_Y} \frac{Q_Z}{X_Y}
\]

\[
(15.b) \quad \frac{T_Z^o}{P_Z^o} = -\frac{1}{\alpha \varepsilon_Z} \frac{Q_Z}{X_Z} \left( \frac{\varepsilon_{YZ} P_Z^o}{\varepsilon_Y P_Y^o} + 1 \right)
\]

where \(\varepsilon_Y\) and \(\varepsilon_Z\) are the price elasticity of export supply of good Y and Z respectively and \(\varepsilon_{YZ}\) is the cross-price elasticity of export supply of the intermediate good Y, defined as follows:

\[
(16.a) \quad \varepsilon_i = \frac{p_i}{x_i} \frac{\partial x_i}{\partial p_i}, \quad i \in Y, Z
\]

\[
(16.b) \quad \varepsilon_{YZ} = \frac{p_Z}{x_Y} \frac{\partial x_Y}{\partial p_Z}
\]

Recall that a positive \(T\) implies an export tax. Assuming that intermediates Y are exported and their producers are not organized while producers of final goods are organized, in equilibrium the export of Y will be taxed at the rate specified in expression (15.a). The denominator of the expression is identical to that of PFS. Everything else equal, the government will divert less from free trade if it attributes higher weight to the aggregate welfare (\(\alpha\)), if the export-supply elasticity (\(\varepsilon_Y\)) is low (to reduce the deadweight loss of the policy, which is smaller in inelastic sectors for Ramsey pricing reasons). Likewise, the distortions created by the policies are smaller if the export \(X_Z\) is smaller. Thus the policy is proportionate to the inverse of exports.

The production of the final good \(Q_Z\) in the numerator distinguishes the results from PFS (which contains the production of the good that is being taxed). The tax is proportionate to the production of the final good Z, which can be interpreted as a negotiating power of the sector Z, and also the size of the absorption of the intermediate Y in the production of Z (recalling one-to-one assumption on the unit input requirement for intermediates).

Final goods sector Z receives protection in the form of an export subsidy, as equation (15.2) is negative (given that expression in parenthesis is positive based on the regularity conditions). The size of an export subsidy is inversely related to the importance of the social welfare for the government, export and elasticity of export supply, and directly related to the size of the production of Z, indicating that everything else being equal larger industries receive higher protection.
The size of the subsidy is reduced by the expression in parenthesis of the equation (15.b), which is positive but smaller than one. The higher cross-price elasticity of the supply of intermediate to the prices of the final goods ($\varepsilon_{YZ}$), or higher the relative price of the intermediates ($P_Y^0/P_Z^0$), the lower is the export subsidy for the final good.

Another way of writing expression (15.b):

$$\frac{T_Z^0}{P_Z^0} = -\frac{1}{\alpha\varepsilon_Z X_Z} \left( 1 - \frac{\frac{\partial X_Y}{\partial P_Y}}{\frac{\partial X_Y}{\partial P_Z}} \right)$$

The higher is the change in exports of intermediates $Y$ to the change in prices of final goods $Z$, the higher the subsidy. In other words, government would go for a subsidy to $Z$ as long as it does not have a detrimental impact on $Y$ through falling exports. As $Y$ producers are not organized, the impact goes through the aggregate welfare considerations of the government. Notice that in the absence of supply chain links (e.g. if $\varepsilon_{YZ} = 0$), the expression collapses to the classical PFS expression for organized industries with lobbies representing very small part of the population.

To sum up, final goods producers lobby for direct protection for their industry and for imposition of an export tax on intermediates which increases their profits due to reduced costs of inputs.

Case 3. Intermediate goods sector ($Y$) is organized

In case producers of the intermediates $Y$ are organized, maximizing first order conditions gives the following results:

$$\frac{T_Y^0}{P_Y^0} = -\frac{1}{\alpha\varepsilon_Y X_Y} \frac{Q_Y}{\varepsilon_Y}$$

$$\frac{T_Z^0}{P_Z^0} = \frac{1}{\alpha\varepsilon_Y X_Y} \frac{Q_Y \varepsilon_{YZ} P_Y^0}{\varepsilon_Z P_Z^0}$$

Intermediate sector $Y$ receives subsidy which is increasing with the production of $Y$ and decreasing with exports of $Y$. In other words, the size of the subsidy is inversely related to export intensity. If the export intensity is high, government is averse of policy changes as this would create a large distortion affecting the aggregate welfare. Furthermore, as in all other cases, the subsidy is decreasing with the attention government pays to the aggregate welfare and with the price elasticity of export supply of the taxed sector. Note that all assumptions for sector $Y$ are the same as in PFS and therefore the expression of the
optimal policy is equivalent to the expression in the example 3 of PFS (Represented Special Interests Are Highly Concentrated).

In case there is no link between prices of Z and export of Y ($\varepsilon_{YZ} = 0$), the optimal export tax on Z is zero. Otherwise, expression 11.3 is negative, implying that optimal policy for Z is an export subsidy. While at a first sight it is counter-intuitive that Y lobbies for protection for both sector Y and sector Z, but actually through supply side relations Y can benefit if Z expands export (and production) as this means increase in demand for Y and therefore higher prices. The higher the cross-price elasticity $\varepsilon_{YZ}$ and the relative price of Y the higher is the subsidy to Z.

Organized producers of intermediate good Z lobby for protection for both industries – to enjoy the policy that increase domestic prices directly, and indirectly – through the increased absorption of the intermediates Y in the production of final goods Z. Note that this situation can exist even in a small economy, as the burden of such policies is absorbed by unorganized groups (consumers in this model).

**Case 4. Intermediates goods sector (Y) and final goods sector (Z) are both organized**

In case both producers of the intermediates Y are final goods Z are organized and lobby for higher profits (disregarding the impact of policies on consumers surplus and trade tax revenues), maximizing first order conditions leads to the following expressions for export taxes (subsidies):

\[
\begin{align*}
(18.a) \quad \frac{T_Y}{P_Y} &= -\frac{1}{\alpha \varepsilon_Y} \frac{(Q_Y-Q_Z)}{X_Y} \\
(18.b) \quad \frac{T_Z}{P_Z} &= \frac{1}{\alpha \varepsilon_Z X_Z} \left( \frac{\varepsilon_{YZ}}{\varepsilon_Y} \varepsilon_Y \frac{P_Y}{P_Z} (Q_Y-Q_Z) - Q_Z \right)
\end{align*}
\]

If the production of intermediates Y is larger than the production of final goods, in equilibrium the good Y will receive an export subsidy (as expression (18.a) is negative). The subsidy is increasing with the production of Y and decreasing with the production of Z. As usual, parameter $\alpha$, export and its elasticity are inversely related to the size of the subsidy.

Situation where the production of final good Z exceeds the production of intermediates Y implies that the intermediate good Y is imported (recalling that the production function for Z requires a fixed one unit requirement of Y). Expression (18.a) is positive, implying an import subsidy. Thus, if the production of intermediates falls below the total input requirements for the production of final goods, and both sectors are organized, the government will subsidize imports of Y. This policy reduces domestic prices and thus
hurts owner of the Y-specific inputs. Producers of the final good Z win the lobbying competition and get access to cheaper inputs as long as production of Z exceeds production of Y.

Expression (18.b) is negative independently of the relative sizes of production of Y and Z, implying that final goods producers receive protection if both sectors are organized. The size of the export subsidy increases with both production of Y and production of Z and a cross-price elasticity of the export supply of Y, and decreases with usual parameters $\alpha, \varepsilon_Z$ and $X_Z$.

3.4. Summary of the model

In political economy models of protection policies hurting industries can arise when the welfare of the lobbyist includes consumer surplus and trade tax revenues. In such case, the unorganized exporting industries will be subject to an export tax. Furthermore, export tax is an optimal policy (even in the absence of organized interests) when a large country can influence the world price and exploits the ToT effect by restricting its exports.

In this paper, both situations are ruled out. First, the assumption of a concentrated ownership of the sector-specific factors eliminates considerations of the overall price level from the welfare of the lobbyists. Second, a small economy assumption leads to exogenous world prices. Yet, the model shows that the domestic prices of intermediates are decreased while domestic prices of final goods are increased as a result of endogenously determined policies.\(^{16}\)

These results can, therefore, be entirely attributed to the presence of a supply chain in the model. Export taxes are imposed on the intermediates to benefit final goods producers. The situation take place when final goods producers are the only group to be organized and when all producers are organized but the production of the final goods is larger than the production of the intermediates. Final goods are never subject to an export tax as no organized interest group would benefit from such a policy.

All possible cases of political organisations in the economy and corresponding predictions of the model are summarized in Table 2 below. In the general case, equilibrium policies for intermediates goods Y and Z can be expressed as follows:

\(^{16}\) Except for the case when only intermediates’ sector is organized in which case domestic prices of both goods will increase
\[
\frac{T_Y}{P_Y} = I_Y \frac{Q_Z}{\alpha e_Y X_Y} - I_Y \frac{Q_Y}{\alpha e_Y X_Y}
\]
\[
\frac{T_Z}{P_Z} = I_Y \frac{1}{\alpha e_Y X_Y} \frac{e_Y P_Z}{e_Z P_Z} - I_Z \frac{1}{\alpha e_Z X_Z} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right)
\]

where \( I_Y \) (\( I_Z \)) is an indicator variable equal to 1 if industry \( Y \) (\( Z \)) is organized.

To avoid multiplicity of cases, the results are described here in relations to exports. They also hold for situations where either one or both goods are imported (reported in parenthesis in Table 2). Negative expressions imply protection through import tariffs or export subsidies (depending on the direction of trade), while positive expressions denote export taxes or import subsidies.

**Table 2 Trade policy in equilibrium**

<table>
<thead>
<tr>
<th>Case</th>
<th>Equation</th>
<th>Results when goods are net exporters (net importer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Policy on the intermediate good ( Y )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policy on the final good ( Z )</td>
</tr>
<tr>
<td>1. No lobbies (12.a) - (12.b)</td>
<td></td>
<td>Free trade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free trade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( T_Y^0 = 0 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( T_Z^0 = 0 )</td>
</tr>
<tr>
<td>2. ( Z ) is organized, ( Y ) is not organized (15.a) - (15.b)</td>
<td>Export tax (import subsidy)*</td>
<td>Export subsidy (import tariff)</td>
</tr>
<tr>
<td></td>
<td>( T_Y^0 ) = \frac{1}{\alpha e_Y X_Y} Q_Z \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right) )</td>
<td>( T_Z^0 ) = \frac{1}{\alpha e_Y X_Y} Q_Z \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right) )</td>
</tr>
<tr>
<td>3. ( Y ) is organized, ( Z ) is not organized (17.a) - (17.b)</td>
<td>Export subsidy (import tariff)</td>
<td>Export subsidy (import tariff)</td>
</tr>
<tr>
<td></td>
<td>( T_Y^0 ) = \frac{1}{\alpha e_Y X_Y} Q_Y \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right) )</td>
<td>( T_Z^0 ) = \frac{1}{\alpha e_Y X_Y} Q_Y \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right) )</td>
</tr>
<tr>
<td>4. ( Y ) and ( Z ) are organized (18.a) - (18.b)</td>
<td>Import subsidy if ( Q_Y &lt; Q_Z ): Export subsidy (import tariff) if ( Q_Y &gt; Q_Z )</td>
<td>Export subsidy (import tariff)</td>
</tr>
<tr>
<td></td>
<td>( T_Y^0 ) = \frac{1}{\alpha e_Y X_Y} (Q_Z - Q_Y) \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} + 1 \right) )</td>
<td>( T_Z^0 ) = \frac{1}{\alpha e_Y X_Y} \left( \frac{\epsilon_{YZ} P_Y^0}{\epsilon_Y P_Y^0} (Q_Y - Q_Z) - Q_Z \right) )</td>
</tr>
</tbody>
</table>

*Blue bold font indicates that in equilibrium the industry is hurt by the government policies (negative protection).*
Note that the model also reproduces the results of the GKO: when all industries are organized, the policy on the intermediate good Y includes a lobbying competition between upstream and downstream producers captured by the term in brackets (equation 18.a). Lobbying by upstream industries Z reduces the protection for downstream industry Y proportionately to the size of Z (which can also be viewed as a demand for Y generated by the production of Z).

The results for the final goods are distinct from GKO who assume that all industries are used as intermediate inputs, and thus have opposing interests. If this assumption is relaxed, and there is an industry which is final in a sense that the product are consumed only by consumers, in equilibrium this industry will be always protected, as shown in Table 2. This result is an intuitive outcome of the model where consumers are not organized and the intermediate industry (that can potentially be organized) has no interest in reducing domestic prices of the final goods.

The results suggests that asymmetric GATT/WTO disciplines, whereby export taxes are unrestricted and export subsidies are limited, can lead to cross-sectoral distribution of income in the economies with organized interests. According to the model, organized exporters of the final good will be in a more favourable position that the organized exporters of the intermediate inputs. Intermediate goods producers will have no instrument to impact the domestic price of their goods, while final goods producers can still obtain protection by lobbying for a lower price of inputs through taxes imposed by the government on the export of intermediates. This reasoning is valid for a small economy case, while for a large economy export taxes can be potentially applied to any industry due to ToT gains.
4. Empirical approach

4.1. Estimated equation

I will only look at regression for intermediates because practically all sectors are intermediate to something else (as GTAP social accounting matrices confirms), and GKO assume this as well.

As in Goldberg Maggi (1997) I will move the elasticity measure to the left, so that the measurement error in elasticities does not bias the results, but it may reduce the precision of the estimates.

The estimated equation than takes the following form:

\begin{align*}
(20.a) \quad T_{iY}\varepsilon_{iY} &= \beta_1 F_{iY} + \beta_2 N_{iY} + \varepsilon_{iY} \\
(20.b) \quad F_{iY} &= \frac{\Sigma_{iZ}(Q^*_Z P_{iY})}{X_{iY} a_i} \\
(20.c) \quad N_{iY} &= I_{iY} \frac{Q_{iY} P_{iY}}{X_{iY} a_i} \\
(20.f) \quad I_{iY(Z)} &= \begin{cases} 1 & \text{if industry } Y(Z) \text{ is organized} \\ 0 & \text{otherwise} \end{cases}
\end{align*}

Where subscript i denotes country, Y stands for intermediate sector, Z to the final sector related to Y through the supply chain. All sectors are assumed to be both intermediate and final.

\( T_{iY} \) is an export policy on sector Y expressed as a difference between world price and domestic price, hence a negative value indicates export restriction and a positive number indicated subsidy. \( P_{iY} \) is a domestic prices of good Y in country i. \( \varepsilon_{iY} \) is price elasticity of export supply of intermediates. \( Q_{iY} \) is domestic production of sector Y in country i, \( X_{iY} \) is i’s export of Y, \( Q^*_Z \) is the value of Y used in production of Z, and \( a_i \) is the weight i’s government attaches to social welfare. \( I_{iY(Z)} \) is dummy variable taking the value of 1 if industry Y(Z) is organized.

Thus, \( \frac{Q_{iY}}{X_{iY}} \) is an inverse measure of export orientation of an industry s, \( \frac{\Sigma_{iZ}(Q^*_Z X_{iY})}{X_{iY} a_i} \) is a measure of dependency of final sector or sectors Z on the domestic supply of intermediates Y. \( \frac{1}{a_i} \) can be seen as a measure of corruption, even though not all lobbying activities are illegal.
I directly observe all variables, so the objective of the paper is two-fold. First, I check if the model fits the data by examining if the sign of the coefficients corresponds to the predictions of the model ($\beta_1$ is expected to be positive and $\beta_2$ negative).

Second, I will successively introduce further variables, e.g. import restrictions and environmental indicators, in the estimation to test whether the empirical model generate better fit. This will not be consistent with the theoretical model but can shed light on the aspects of export policy formulation that are not captured by the political economy argument (Protection for Sale).

In addition I can estimate either welfare mindness of the government or degree of political organisation of the sectors and check whether the estimated results fits the observable data. Furthermore, I can run results country-by-country and sector-by-sector to check if the results hold. If they don’t that would mean that in that country or sector export policy is determined through other channels (e.g. revenue generation or environment).
5. Data

Data on exports, production and the share of domestic inputs in production are derived from social accounting matrices of the GTAP9 for two base years 2007 and 2011. GTAP contains 44 traded commodity sectors and 115 individual countries. Export taxes (subsidies) are calculated as a difference between world price and market prices, also using the GTAP9 data.

The main innovation is in the construction of the data on lobbying. I consider that a sector is organized if in the 4 years preceding the base year (e.g. between 2003-2006 for the base year 2007) a country was a complainant in at least one WTO Dispute Settlement case for at least one HS 6-digit product. The underlying data is from Bown (2014) "WTO Dispute Database", The World Bank.

Export supply elasticities are from Broda, Limao and Weinstein (2008) and are available at country level only for a singly year 2004 (labelled elblw2008). Prices for 2007 and 20011 are approximated by using trade unit values (TUV) from CEPII database, available at HS 6-digit level and aggregated to GTAP sector level using simple averages.

Measure of welfare mindness of the government is approximated by using the invers of the Corruption Perception Index (CPI) of the Transparency International available yearly for most countries (labelled inv_cpi). Alternatively, the estimate of alpha from Gawande, Krishna, Olarreaga (2012) is used (labelled gko_a).

<table>
<thead>
<tr>
<th>Table 3 Summary statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>output</td>
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<td>year</td>
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<td>inv_cpi</td>
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<td>gko_a</td>
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<td>elblw2008</td>
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6. Results

All five specifications are estimated using OLS, with different fixed effects. All specifications show expected sign of the coefficients. This confirms that export policy can be explained by “Protection for Sale” channel. The overall fit of the model is however low, suggesting that other, more important motives are at play.

Table 4 Regression results

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1) Tax</th>
<th>(2) Tax</th>
<th>(3) Tax</th>
<th>(4) Tax</th>
<th>(5) Tax</th>
</tr>
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<tr>
<td>F</td>
<td>0.03***</td>
<td>0.03***</td>
<td>0.03**</td>
<td>0.02***</td>
<td>0.03**</td>
</tr>
<tr>
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<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>N</td>
<td>-0.01***</td>
<td>-0.01***</td>
<td>-0.02**</td>
<td>-0.01***</td>
<td>-0.01*</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Constant</td>
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<td>1,865***</td>
<td>-5.886</td>
<td>-3.926</td>
<td>-2.573</td>
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<tr>
<td></td>
<td>(619.1)</td>
<td>(0.352)</td>
<td>(208.5)</td>
<td>(143.3)</td>
<td>(408.4)</td>
</tr>
<tr>
<td>Observations</td>
<td>939</td>
<td>939</td>
<td>939</td>
<td>939</td>
<td>939</td>
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<tr>
<td>R-squared</td>
<td>0.002</td>
<td>0.001</td>
<td>0.061</td>
<td>0.113</td>
<td>0.168</td>
</tr>
<tr>
<td>Controls</td>
<td>year FE</td>
<td>year and country FE</td>
<td>year and sector FE</td>
<td>year, sector and country FE</td>
<td></td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
7. Robustness check

As a robustness check I re-run the regressions using alpha (measure of welfare mindness) from GKO. All results remain the same in term of sign, with 10-fold increase in magnitude.
8. Conclusions and future research

An increasing application of export taxes called for a theory explaining the endogenous determination of trade policy and sectoral patterns of protection in the presence of intermediate goods and lobbying. The derived model shows that downstream industry producing final goods is always protected (through an export subsidy or an import tariff) because no organized group is interested in lobbying for lower domestic prices of the final goods. As in PFS, protection is a decreasing function of the weight government attribute to the aggregate welfare, export and the price elasticity of export supply. In addition, this model shows that final goods producers are in political rivalry with producers of intermediates and thus the equilibrium policy depends on the relative sizes of each industry and the cross elasticity of the supply of intermediates.

The equilibrium policy for the upstream industry producing intermediate goods from primary factors depends on the organisation of the industry and the net effect of the lobbying competition whereby producers of intermediates lobby for higher domestic prices for their goods while producers of final goods seek cheap inputs. The intermediates’ sector is subject to an export tax (an import subsidy if imported) if the owners of sector-specific factors are not organized. When both sectors are organized, the upstream industry receives an export subsidy (an import tariff) if they produce intermediate goods above the level required by the downstream industry as inputs, and an import subsidy otherwise. Supply chain matters, and not every organized industry receives protection.

The empirical results confirms that export policy can be explained by “Protection for Sale” channel. The overall fit of the model is however low, suggesting that other, more important motives are at play. As next step, the additional variables can be sequentially added to the model to identify influential factors behind export policy formulation. These variables include import tariff and non-tariff barriers, employment, unionisation, market concentration, share of output used as intermediate good, numbers of sectors consuming production as intermediates, current account deficit, environment, terms of trade, imports of intermediates, WTO membership, WTO binding on export taxes, market structure, vertical specialisation, food security, food prices and riots, investment attraction, budgetary shortfalls, international primary commodity prices, elections, countries natural endowments, GDP per capita (to control for WTO restriction on subsidies) and other aspects suggested in the literature as determinants of export restrictions.

Bibliography


## Annex

**Table 5 Definition of staple food items**

<table>
<thead>
<tr>
<th>Food group</th>
<th>HS 2-digit code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live farm animals</td>
<td>01</td>
</tr>
<tr>
<td>Meats</td>
<td>02</td>
</tr>
<tr>
<td>Fish and shellfish</td>
<td>03</td>
</tr>
<tr>
<td>Dairy and eggs</td>
<td>04</td>
</tr>
<tr>
<td>Vegetables</td>
<td>07</td>
</tr>
<tr>
<td>Fruits and nuts</td>
<td>08</td>
</tr>
<tr>
<td>Cereals</td>
<td>10</td>
</tr>
<tr>
<td>Vegetable oils and oilseeds</td>
<td>12</td>
</tr>
</tbody>
</table>