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Effective protection and trade policy in presence of international fragmentation of production

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Abstract

The concept of effective protection is well known in the theory of international trade. Effective protection is based on the hypothesis that the aim of trade policy is to protect the domestic value added rather than domestic final production, under the assumption that the return to the factors of production is directly related to this value added.

In recent years, the concept of effective protection became increasingly relevant because of the increasing significance of international trade in intermediate inputs and components. Production of many goods occurs nowadays across different national borders, with different phases of production taking place in location many thousands of miles apart. This organization of production gives rise to large international flows of intermediate and semi-finished goods, often crossing the international borders more than once. Within this framework of international fragmentation of production, the nominal level of tariffs and other non-tariff barriers can give a very distorted picture of the effective level of protection granted to an internationally fragmented industry.

The aim of this paper is to assess the relationship between the increased international fragmentation of production and the effective levels of protection.

The evidence produced in the paper shows that this is a non-linear, two-way relationship: on the one hand, in some industries, the effective protection rate in a few years increased substantially because of the increased recourse to international fragmentation of production, and on the other the structure of trade policy deeply affects the incentives to fragment production internationally.

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1. Introduction

The concept of effective protection is well known in the normative theory of international trade. Effective protection is based on the hypothesis that the aim of trade policy is to protect domestic value added rather than domestic production, under the assumption that the return to the domestic factors of production is directly related to this value added.[1] This concept turns out to have a solid empirical foundation. There is ample evidence of the widespread use of effective protection by policy-makers, who clearly understand its implications, and the rate of effective protection has been measured and analyzed in a number of empirical works.[2]

In spite of the fact that the concept appears well-established, the idea of effective protection is not easily introduced in trade models, because it requires that countries trade not only final goods, as it is commonly assumed in most textbook models, but intermediate goods as well. Such an extension has a number of non-trivial implications for the equilibrium of open economies, and it makes more cumbersome to predict trade patterns, the effects of trade and of trade policy. However, in recent years the literature on trade in intermediate goods has advanced, pushed also by the increasing empirical relevance of international trade in intermediate inputs and components generated by the diffusion of international production networks (see for example Jones, 2001; Bond, 2001; Deardorff, 2005).

As it is well documented in many empirical works, there is a growing share of international trade in inputs, parts and components largely related to the fact that production of many goods occurs nowadays across different national borders, with different phases of production taking place in location many thousands of miles apart. This organization of production gives rise to international flows of intermediate and semi-finished goods, often crossing the international borders more than once. Some estimates indicate that the amount of trade related to "global production sharing" amounts to 20-25% of total trade flows (Hummels et al, 2001). Within this framework, the concept of effective protection becomes increasingly relevant. In presence of this international fragmentation of production, the nominal level of tariffs

[1] Early contributions on this issue are found in the works by Balassa (1965), Corden (1971), Ethier (1972), Bhagwati and Srinivasan (1973) among others, which lay the basis of the concept of effective protection and its applications.

[2] It is immediately evident by looking at the structure of tariffs of nearly all countries that policy-makers setting tariff levels apply the concept of effective protection. In fact, tariff levels are systematically higher in final goods than in intermediate goods and raw materials. This phenomenon takes the name of tariff escalation. Some recent examples of tariff escalation are provided in Bacchetta and Bora (2003).

and other non-tariff barriers can give a very distorted picture of the effective level of protection granted to a national economy.

The aim of this paper is to examine the effects of the increased international fragmentation of production on the effective levels of protection accorded to different industries, and to assess how trade policy affects the incentives for firms to engage in international fragmentation of production. This analysis is useful to assess properly the effects of trade policy in a changing international context.

2. Effective protection in presence of international fragmentation of production

2.1 The measure of effective protection

As mentioned, effective protection wants to measure the degree of protection accorded to value added produced domestically, rather than the protection of the entire production process in any give industry. Therefore, effective protection is defined as

$$(V_t - V_W)/V_W$$

where V_t is the value added produced in industry i in presence of trade policies, and V_W is the value added produced in industry i under free trade and world prices.

From this definition, the simplest expression used to compute the degree of effective protection is the following:

$$(V_t - V_W)/V_W = t_A + p_C [(t_A - t_C)/(p_A - p_C)] \qquad [1]$$

where A is the subscript indicating the final good A and C refers to the intermediate components of this good, t is the value of ad valorem tariffs, p are the international prices (supposed exogenous for a small country).

Alternatively, the effective rate of protection (ERP) can be computed as follows:

$$ERP_A = (t_A - \Sigma_c \varphi_{Ac} t_c)/(1 - \Sigma_c \varphi_{Ac}) \qquad [2]$$

with t_A = nominal tariff on final good A

t_c = nominal tariff on intermediate good C

φ_{Ac} = share of the intermediate input C on the value of good A at international prices

From these expressions, it is evident that if only final goods are traded, the degree of nominal and effective protection is the same. But if countries are involved in international fragmentation of production – where international fragmentation of production (IFP) can be defined as the splitting of production processes into separate parts that can be done in different countries – necessarily there will be trade of intermediate and semi-finished goods, used as inputs into the production process taking place in a specific country. Therefore, in presence of IFP, the measurement of the rate of protection in a given industry must be computed using one of the above expressions.

The presence of international networks of production affects the level of effective protection in spite of the specific organization of such network. There are many forms through which IFP can take place, in any case giving rise to international trade of intermediates between the various production locations, making the concept of effective protection relevant. IFP can take the form of international outsourcing or of processing trade through the markets (in both cases, domestic firms are undertaking arm's length transactions with foreign firms providing intermediate inputs, components and processing or assembling semi-finished goods), or of intra-firm transactions between affiliates of a multinational enterprise (MNE) when a vertical foreign investment takes place. Itagaki (1983) shows that in the case of competitive MNEs the definition of effective rate of protection turns out to be the same as that of the traditional one.[3] Therefore, the EPR can be computed regardless of the organizational form of IFP.

2.2 The effect of increased fragmentation of production on the effective protection rate

From expression [1] and [2] it is possible to see that, with constant nominal tariffs, the effective rate of protection depends of the share of the intermediate inputs on the value of the final good. The higher the weight of intermediate inputs, and therefore the lower the share of domestically produced value added, the higher will be the

[3] In the same paper, Itagaki (1983) also shows that with a vertical MNE, even in a competitive setting the optimal policy is not free trade (zero tariff both on intermediate and final goods) because the host country does not loose any producers' surplus by imposing a tariff on imported intermediate goods. This case reveals how the presence of direct production linkages between firms located in different countries can change the effects of trade policies.

effective protection on that value added. In these expressions these shares are usually taken as given, but in fact it needs not to be so.

If international fragmentation of production is an organizational choice of firms, as it seems quite plausible to assume,[4] the share of imported components and of domestic value added in the total value of a good are not necessarily fixed, and they might change with time and circumstances. In other words, the effective rate of protection depends on the extent of international fragmentation of production and on firms' decision to internalize domestically rather than delocalize abroad phases of production. This means that there are different levels of ERP as there are different ways to organize production internationally.

By definition, expanding the degree of international fragmentation of a production process will increase $\Sigma_c \varphi_{Ac}$ in the expression [2]. With a more intensive use of IFP (i.e. a longer slice of the production chain of a given final good being moved abroad), in [1] we will see a reduction in $(p_A - p_C)$, and in [2] a reduction of the denominator $(1 - \Sigma_c \varphi_{Ac})$. This implies that the share of domestic value added on the good's value is lower, and from the expressions [1] and [2] we see immediately that even keeping constant the tariff levels t_A and t_C, ERP increases. Therefore, there is a positive relationship between the rate of effective protection and fragmentation.

The effects discussed are by no means hypothetical or marginal in a world where the recourse to fragmentation of production is increasing in many industries. The relevance of the effects of IFP on the degree of protection and to what extent this can change even in a short timeframe can be shown through an example taken from an important sector in the EU, the textile and apparel industry. The textile and apparel industry is one of the most affected by IFP because its production technology allows to delocalize phases of production to different locations with ease and with relatively low transportation costs for the intermediate goods. Furthermore, in the EU there has been a fast increase in the use of IFP after the opening of the borders of the Central and Eastern European countries, where labor-intensive production phases could be delocalized to take advantage of the lower production costs.

To observe the effects of IFP on protection, we compute the effective rate of protection of a specific sector within the textile and apparel industry in the early 1990s, when for many countries the process of delocalization of production toward Central-Eastern Europe was still at the beginning, and compute again the protection rate in the mid-1990s, when this delocalization had gained momentum and the recourse to IFP had increased. In both cases we keep fixed the EU tariff rate at its post-Uruguay Round level. In the example we refer to the Italian production of cotton

[4] On the organizational choices of firms with respect to international fragmentation of production, see Helpman (2006). This point will be discussed in the next section.

apparel goods, for which we have data on the extent of use of outward processing trade (a specific form of IFP).[5] We use these data on the relevance of outward processing trade over production as a proxy of the change in the share of intermediate inputs in production, φ_{Ac}. Of course, there could be other imported inputs in the production process, besides the one related to the delocalization of production phases abroad (for example, energy). We focus on the change in inputs coming from processing trade, because this part of the inputs is under the direct control of the firms and it can be considered a choice variable, while we assume that the share of other imported inputs remained constant.

The tariff applied by the EU (and therefore by Italy) on cotton fabrics is 8%, while the tariff applied on apparel goods made of cotton is 12%. As mentioned, here we can see the phenomenon of tariff escalation and this difference between the tariffs tells that the effective rate of protection accorded to the production of cotton apparel goods is higher than the nominal rate of protection.[6] What is less well known is that through the increased use of IFP, this protection rate has increased substantially.

In 1993, the average share of the value added produced abroad by means of outward processing trade in cotton apparel goods and re-imported by Italian firms was 0.1 of the total value added produced in the sector. In 1996 the share had increased to 0.3 (Baldone et al., 2002). Assuming everything else constant, if we plug these numbers in expression [2] we obtain

EPR in cotton apparel production in Italy in 1993 = (0,12-0,1*0,08)/(1-0,1) = 0,1244

EPR in cotton apparel production in Italy in 1996 = (0,12-0,3*0,08)/(1-0,3) = 0,1371

In this example, in three years, considering no change in nominal tariffs, the EPR increased by 10%.

This example (using real data) sheds light on a number of interesting issues. First of all, it confirms that the nominal level of protection is a very poor indication of the true level of protection granted if the industry considered is linked to an international production network. This level of protection might change quite dramatically over time even without any direct policy change, if the organization of production changes. Secondly, the domestic value added in internationally fragmented industry can enjoy a rate of protection that is significantly higher than the nominal

[5] The data used here on the relevance of processing trade (temporary exports of semi-finished goods to be processed and then re-imported) over total domestic production are taken from Baldone et al. (2002), who study in detail the process of international fragmentation of production in the textile and apparel industry in the EU.

[6] Even larger differences in applied tariffs between textile material and garments exist in other sectors of the textile and apparel industry. See Bacchetta and Bora (2003).

one. This means that in internationally fragmented sectors there can be consistent rents, at least in the short run, with questionable effects on the general allocation of resources within a country.

3. The relationship between effective protection and international fragmentation of production choices

An important effect of the presence of IFP is that trade barriers, including tariffs, can affect trade flows more intensely. Eaton and Kortum (2002) illustrate the role of geographic and border barriers in shaping international specialization. This is even more the case with "sub-product specialization" (i.e. specialization in specific production phases). With international fragmentation of production, the same good typically crosses national borders and customs a number of times at different stages of completeness in its production. Therefore, in presence of IFP, trade flows are even more sensible to geography and other barriers. The weight of protection and tariffs increases because of these multiple crossings, and custom duties can be levied many times. The existing empirical evidence shows that IFP is often organized on regional basis, where the effects of geographical proximity and the creation of regional free trade areas sum up. As shown by Yi (2003), the relationship between protection and trade is changed by the presence of IFP, and trade volumes of intermediate inputs respond in a magnified way to a reduction of protection.

Based on the existing theoretical and empirical evidence, the shared view is that freer trade promotes global sourcing and international fragmentation of production, especially in presence of non-perfectly competitive markets (see for example Behrens et al. 2007). It is straightforward to show that this is generally the case, but some conditions should be met.

To make the case as simple as possible, assume to have a monopolist selling in its own domestic market a good whose production process entails two stages. In the first production stage, intermediates are supplied at a constant marginal cost c^H or c^F, depending on the country where their production takes place, the home country (H) or abroad (F). Then, intermediates are assembled and distributed in country H at a fixed cost *f*. The monopolist can serve the final demand[7] in H, given by the expression $P = \alpha + \beta Q$, from a local plant, keeping production integrated at home. Otherwise, it may produce intermediates in country F, giving rise to international fragmentation of production, and then ship the intermediates to H at a unit trade cost equal to t_c (which

[7] For now, we rule out competition coming from imports in the domestic market, so that final demand in H corresponds to demand for the monopolist. This assumption will soon be relaxed to introduce the role of effective protection.

corresponds to the tariff imposed by country H on intermediates or components)[8] for assembly and distribution. Monopoly profits from integrated production are given by the following expression:

$$\Pi_{HH} = (P_H - c^H)Q_H - f \quad \text{with} \quad Q_H = (\alpha - c^H)/2\,\beta$$

while profits if production is internationally fragmented are equal to:

$$\Pi_{HF} = (P_{HF} - c^F - t_c)Q_{HF} - f \quad \text{with} \quad Q_{HF} = (\alpha - c^F - t_c)/2\,\beta$$

By comparing the two profit expressions, we can see that international fragmentation of production will take place only if it generates larger profits, and which are the conditions that make this situation more likely to occur. We define $\Delta\Pi = \Pi_{HF} - \Pi_{HH}$ (the extra-profits generated by IFP) and we assume that $Q_{HF} > 0$ only if $\Delta\Pi > 0$. The expression for these extra-profits is

$$\Delta\Pi = \Pi_{HF} - \Pi_{HH} = [t_c^2 - 2(\alpha - c^F)t_c - 2\alpha c^F + 2\alpha c^H + c^{F2} - c^{H2}]/4\,\beta \qquad [3]$$

which is clearly non-linear in *t*. It turns out that the extra profits from IFP increase when t declines (i.e the incentive to fragment production internationally is stronger if trade barriers are lower) if $(\alpha - c^F - t_c) > 0$, which is the same condition that defines $Q_{HF} > 0$. We see that in this very simple setting it is confirmed that trade liberalization promotes IFP.

Assume now that the market of country H is open to imports of final goods also, but it is protected by a tariff t_A on final goods. If country H is small, the domestic price at which the monopolist can sell its good is the (given) international price inclusive of the tariff, $P_I + t_A$. Under these conditions, both the price and the quantity sold by the domestic firm become exogenous (depending on the market absorption and the production capacity of the firm) and profits depend of the unitary margin that the firm can obtain. We can see how the tariff structure and the decision to fragment production abroad affect this profit margin. To better see the effects of IFP, assume also that production takes place now in three stages, with marginal costs c^H or c^F applying to stage one and two (according to where the production stage takes place) and assembly taking place in H again at a fixed cost *f*. The firm can decide whether to delocalize abroad none, one or two phases.

[8] To simplify, here we assume that the only trade barriers are tariffs, but *t* could include any other trade cost.

If production is entirely domestic, the unit profit margin (not considering the fixed cost) of the domestic firm is

$$\pi_{HHH} = P_I + t_A - c^H - c^H$$

If production is partially delocalized abroad, the unit profit margin becomes

$$\pi_{HHF} = P_I + t_A - c^H - c^F - t_c \qquad [4]$$

And if instead production is fully delocalized abroad and we have as much IFP as possible, the unit profit margin expression becomes

$$\pi_{HFF} = P_I + t_A - c^F - t_c - c^F - t_c \qquad [5]$$

From expression [4] and [5], it is immediate to see that the unit profit margin increases with the wedge between tariff on final goods and tariff on intermediates. This is exactly the same idea conveyed by the effective protection rate (see expression [2]). If tariff rates are not uniform across goods, and intermediates are imported, as with IFP, the benefits accruing to an industry depend on the difference between tariffs.

The comparison between expression [4] and [5] allows also to see that if such a wedge between tariff rates exists, i.e. the effective protection rate is higher than the nominal tariff on final goods, the benefits of this protection are maximized when the recourse to IFP is stronger. In this case, we would observe that a higher *effective* protection comes along with more international fragmentation of production. This means that when we consider the entire tariff structure and not simply a single average tariff rate, it is not obvious that lower tariffs promote IFP, as it seemed from expression [3].

4. Preliminary empirical evidence

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Starting from the relationship between effective protection and international fragmentation of production discussed in the previous sections, we want to verify whether there is evidence that the industries with a higher degree of fragmentation are indeed enjoying a higher level of protection, rather than having that the industries where trade liberalization is stronger are the most fragmented. The relationships derived from expression [2] and [3] are apparently clear, but they are quite cumbersome to measure it empirically. In fact, in an empirical test of these relations,

it is difficult to measure directly our variables of interest, and even more to identify the direction of causality.

International fragmentation of production is often measured through the intermediate goods' trade it generates.[9] But IFP can take many forms, and no single dataset can capture them all, and all measures used in the literature are only proxies for this complex phenomenon. Here we use a very specific measure to proxy IFP, that is trade for reasons of processing. Even if data on this type of trade underestimate the extent of IFP, considering only a specific form of fragmentation, they have the advantage of being available for an adequately long time sample at a highly disaggregated level. Therefore we will measure the degree of international fragmentation of production in an industry looking at the extent of use of outward processing trade (OPT).

Some evidence on this measure is provided in Table 1. In the EU (but this is common to most countries), OPT is concentrated in a few sectors. Out of the 97 sectors available in the disaggregation adopted, 90% of this type of trade occurs only in 10 sectors. Even if the ranking changes partially over time, the most affected sectors are the same in 1993 and in 2003. This occurs because the technical feasibility and the economic convenience of IFP are not the same across all industries. Therefore this form of organization of production is exploited especially in some sectors. It is also possible to see that overall the use of this type of trade has increased over time, but the increase did not occur to the same extent in all the sectors involved.

The measurement of the extent of protection is even more problematic. Here it is especially difficult to compute the effective rate of protection because we are assuming that one of the parameters of the ERP expression (φ_{it}) is a variable changing over time.

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Ideally, to test our hypothesis, we should check if an industry is effectively sheltered from foreign competitors and if this increases the profits of producers. Unfortunately, data on producers' surplus are not available and proxies such as profit rates are not very reliable. Therefore, we evaluate the rate of protection indirectly, by looking at the exposure of EU firms to foreign competition in the EU internal market using the EU countries' market share and the penetration of imports. Table 2 reports the EU sectors that should be more exposed to foreign competition: the net importing

[9] Different ways to measure international fragmentation of production make use of input-output tables, data on trade of parts and components, processing trade data, data on intra-firm trade. See for example Feenstra (1998), Feenstra and Hanson (1999), Yi (2001), Egger and Egger (2001), Baldone et al., (2002).

sectors and the sectors where the EU displays the lowest revealed comparative advantage.

As a first check, we look at the correlation between the use of outward processing trade and foreign competition on the EU market. This is done running a regression between the EU members' market share in the EU market and the weight of OPT trade in the different sectors. As an alternative dependent variable, also the value of imports from non-EU countries was used. The regressions were run using sectors' fixed effects and weighted generalized least squares, to take into account the heterogeneity of the sectors. Results reported in Table 3 show a positive correlation between the EU countries' market share and their use of IFP, and a negative correlation between external imports and IFP.

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With respect to the hypothesis under examination, we should understand whether IFP improves the EU firms' position because it grants them more protection or for some other reason. There are in fact alternative explanations for the observed correlation. One of the effects of IFP could be to decrease overall production costs thanks to this form of organization of production, and this could in turn make the EU firms more competitive in terms of prices vis-à-vis extra-EU imports, thereby reinforcing the EU firms position on the internal market.

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5. Conclusions

We have seen that with international fragmentation of production, the effective level of protection might increase substantially. In a world where the international organization of production is changing rapidly, there can be unforeseen changes in effects of the policies adopted. But the analysis of the consequences of such a higher protection in presence of international production networks is not straightforward. When international trade models are extended to include trade in intermediate inputs, many results concerning trade policy might become ambiguous, as shown by a few existing works (see for example Bond, 2001).

In the specific case discussed in this paper, we have seen that if IFP implies more imported inputs, the ERP will increase, or in other words, domestic value added will be more protected in those industries.

It is also ambiguous what happens to the industry's value added. On the one hand, domestic value added is reduced by international fragmentation of production because some value-producing phases are moved abroad; on the other, domestic value

added can be more rewarded thanks to the higher effective protection. Therefore, in a highly fragmented industry, we could see the industry value added increasing or decreasing, according to which of the two effects prevails. This is a point that needs further research and an empirical assessment.

Appendix - Variables definitions and sources

The data reported in the tables and used in the regressions are taken from Eurostat, Comext database, which collects total trade of the EU members states among themselves and with non-EU members, and distinguished between different types of trade, including trade for reason of processing.

Outward processing trade (OPT) refers to trade flows recorded under statistical procedures 3 and 7 as defined by Comext (goods temporarily exported to be processed and then re-imported in the EU territory).

EU market share in the EU market is measured as the ratio between EU members exports toward the EU internal market and total EU imports (from EU members and from non-EU countries;

the ***value of extra-EU imports*** is the value in Euro of total EU imports from non-EU countries;

the ***share of re-imports*** is the ratio between EU re-imports from non-EU countries (recorded as outward processing trade under statistical procedure codes 3 and 7) and EU total imports from non-EU countries in each sector;

EU relative prices are measures as the ratio between average unit values of EU exports toward the EU internal market and average unit values of EU imports from non-EU members in each sector.

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Table 1
International fragmentation of production in the EU

Sectors with higher values of re-imports								Sectors with higher share of re-imports on total imports			
1993				**2003**							
		Re-imports				Re-imports		**1993**		**2003**	
Description	*CN code*	Mill. Euro	% of total re-imports	*Description*	*CN code*	Mill. Euro	% of total re-imports		%		%
Apparel	62	3498.52	0.35	Autovehicles	87	4286.85	0.28	Apparel	0.2154	Apparel	0.1088
Electrical machin.	85	2253.97	0.22	Apparel	62	3160.30	0.20	Footwear	0.0763	Autovehicles	0.0750
Machinery	84	1101.92	0.11	Aircraft	88	1664.35	0.11	Knitted apparel	0.0563	Textile fibres	0.0612
Knitted apparel	61	570.64	0.06	Machinery	84	1423.69	0.09	Electrical machin.	0.0462	Aircraft	0.0572
Aircraft	88	489.15	0.05	Electrical machin.	85	1271.12	0.08	Other metals	0.0451	Footwear	0.0477
Footwear	64	377.34	0.04	Knitted apparel	61	759.21	0.05	Railway	0.0415	Other edibles	0.0424
Precision tools	90	285.21	0.03	Footwear	64	514.34	0.03	Other textiles	0.0410	Cereal preparations	0.0386
Autovehicles	87	199.83	0.02	Precision tools	90	413.49	0.03	Aircraft	0.0362	Knitted apparel	0.0356
Furniture	94	185.12	0.02	Organic chem.	29	221.07	0.01	Furniture	0.0345	Railway	0.0351
Other textiles	63	81.93	0.01	Jewellery	71	215.23	0.01	Meat preparations	0.0291	Other textiles	0.0261
Total of the above		9043.63	0.90	Total of the above		13929.65	0.90				

Source: our calculations from Eurostat, Comext database
Sectors are defined according to the Combined Nomenclature used by Eurostat at the two-digit level (97 sectors)

Table 2

Sectors with the lowest revealed comparative advantage for the EU
(measured as normalized balance (X - M)/(X + M))

1993			2003		
Description	*CN code*		*Description*	*CN code*	
Wickerwork	46	-0.8658	Wickerwork	46	-0.8904
Cellulose	47	-0.8555	Ores	26	-0.8311
Ores	26	-0.8491	Feather articles	67	-0.8124
Feather articles	67	-0.7963	Seeds	12	-0.7293
Other vegetal prod	14	-0.7562	Umbrellas	66	-0.7150
Seeds	12	-0.7227	Other vegetal pr	14	-0.7128
Tin	80	-0.7137	Fish	3	-0.6913
Coffee and spices	9	-0.7081	Fuels	27	-0.6843
Wood	44	-0.6989	Fruit	8	-0.6541
Fish	3	-0.6884	Tin	80	-0.6492
Fruit	8	-0.6445	Knitted apparel	61	-0.5845
Fuels	27	-0.6115	Meat preparatior	16	-0.5763
Umbrellas	66	-0.5782	Coffee and spice	9	-0.5754
Resid. food ind.	23	-0.5281	Toys	95	-0.5415
Toys	95	-0.5192	Resid. food ind.	23	-0.5206
Other animal prods	5	-0.4975	Nickel	75	-0.5121
Knitted apparel	61	-0.4709	Cellulose	47	-0.4982
Nickel	75	-0.4223	Apparel	62	-0.4915
Apparel	62	-0.4152	Lead	78	-0.4844
Clocks	91	-0.4128	Hats	65	-0.4663
Hats	65	-0.3839	Other textiles	63	-0.4187
Vegetables	7	-0.3839	Clocks	91	-0.3914
Lead	78	-0.3708	Other animal pro	5	-0.3739
Musical articles	92	-0.3422	Wood	44	-0.3161
Copper	74	-0.3288	Fertilizers	31	-0.3154
Leather goods	42	-0.3134	Footwear	64	-0.2808
Paper	48	-0.3095	Raw minerals	25	-0.2719
Other metals	81	-0.2819	Cocoa	18	-0.2585
Other textiles	63	-0.2514	Other metals	81	-0.2526
Raw minerals	25	-0.2322	Musical articles	92	-0.2338
Meat preparations	16	-0.2232	Leather goods	42	-0.2181
Fertilizers	31	-0.1877	Vegetables	7	-0.2036
Carpets	57	-0.1723	Veget. preparati	20	-0.1946
Jewellery	71	-0.1671	Others	99	-0.1744
Tobacco	24	-0.1381	Copper	74	-0.1728
Veget. preparation	20	-0.1348	Aluminium	76	-0.1722
Cotton	52	-0.1321	Zinc	79	-0.1527
Aluminium	76	-0.1004	Jewellery	71	-0.1464
Electrical machin.	85	-0.0623	Furniture	94	-0.1360
Animals	1	-0.0599	Explosives	36	-0.1098

Net importing sectors in the EU
(sectors sorted by value of imports in 2003)
EU imports from extra-EU (Mill. Euro)

		1993	2003	imports' growth
Description	*CN code*			%
Fuels	27	64548.1	146241.0	126.56
Electrical machin.	85	48805.5	121253.3	148.44
Jewellery	71	20950.4	30391.6	45.06
Apparel	62	16242.3	29052.4	78.87
Knitted apparel	61	10144.0	21319.9	110.17
Wood	44	10696.4	13221.4	23.61
Toys	95	6112.1	10895.4	78.26
Aluminium	76	4436.8	10866.9	144.93
Footwear	64	4948.1	10771.8	117.69
Fish	3	5225.8	9948.7	90.38
Rubber	40	4048.7	9496.5	134.56
Fruit	8	5532.6	9375.1	69.45
Ores	26	4667.3	7809.5	67.32
Inorganic chem	28	3181.2	6087.8	91.37
Seeds	12	4020.1	5985.6	48.89
Leather goods	42	3500.2	5893.1	68.36
Resid. food ind.	23	4614.8	5783.7	25.33
Other textiles	63	1999.8	5092.3	154.64
Copper	74	4427.1	5000.5	12.95
Cellulose	47	3698.5	4145.1	12.07
Clocks	91	2861.8	3912.8	36.73
Cocoa	18	1388.8	3443.3	147.93
Coffee and spices	9	3111.4	3435.2	10.41
Cotton	52	3199.9	3391.0	5.97
Veget. preparatior	20	1915.6	3354.1	75.09
Raw minerals	25	2170.2	3351.0	54.41
Nickel	75	1050.8	3081.8	193.29
Meat preparations	16	1837.5	3066.6	66.89
Vegetables	7	2457.2	2677.9	8.98
Fertilizers	31	1200.9	2163.8	80.18
Other metals	81	626.6	1544.4	146.46
Carpets	57	1466.0	1159.8	-20.89
Other animal prod	5	694.2	818.1	17.85
Musical articles	92	616.3	778.9	26.37
Hats	65	330.5	691.1	109.07
Feather articles	67	393.4	461.8	17.39
Wickerwork	46	252.1	430.7	70.86
Explosives	36	171.8	341.0	98.53
Lead	78	169.3	331.2	95.66
Umbrellas	66	224.9	324.4	44.25
Tin	80	227.6	295.8	29.94
Silk	50	349.0	284.2	-18.57
Other vegetal pro	14	92.7	110.4	19.16
TOTAL		487428.4	992676.0	103.66

Source: our calculations from Eurostat, Comext database
Sectors are defined according to the Combined Nomenclature used by Eurostat at the two-digit level (97 sectors)

Table 3
Correlation between the use of IFP and the strenght of foreign competition in the EU internal market

All sectors considered

Dependent Variable: EU market share in the EU market
Method: Pooled Least Squares
Sample: 1993 2002
Number of cross-sections used: 97
Total panel (balanced) observations: 970

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	0.4830	0.1255	3.8475
Fixed Effects included			
R-squared	0.9718		
Adjust. R-squared	0.9687		
S.E. of regress.	0.0360		

White Heteroskedasticity-Consistent Standard Errors & Covariance

Dependent Variable: value of extra-EU imports
Method: GLS (Cross Section Weights)
Sample: 1993 2003
Number of cross-sections used: 97
Total panel (balanced) observations: 1067

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	-735771.5	23389.88	-31.45683
Fixed Effects included			
R-squared	0.8896		
Adjust. R-squared	0.8785		
S.E. of regression	6731362		

White Heteroskedasticity-Consistent Standard Errors & Covariance

Net importing sectors only

Dependent Variable: EU market share in the EU market
Method: Pooled Least Squares
Sample: 1993 2002
Number of cross-sections used: 47
Total panel (balanced) observations: 470

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	0.5575	0.1188	4.6931
Fixed Effects included			
R-squared	0.9524		
Adjust. R-squared	0.9472		
S.E. of regress.	0.0392		

White Heteroskedasticity-Consistent Standard Errors & Covariance

Dependent Variable: value of extra-EU imports
Method: GLS (Cross Section Weights)
Sample: 1993 2003
Number of cross-sections used: 47
Total panel (balanced) observations: 517

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	-4422215	53084.51	-83.3052
Fixed Effects included			
R-squared	0.8877		
Adjust. R-squared	0.8765		
S.E. of regression	7632385		

White Heteroskedasticity-Consistent Standard Errors & Covariance

Table 4
Relationship between the use of IFP and the position in the EU internal market

All sectors considered

Dependent Variable: EU market share in the EU market
Method: Pooled Least Squares
Sample: 1993 2002
Number of cross-sections used: 97
Total panel (balanced) observations: 970

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	0.7353	0.1830	4.0170
EU relative prices	0.0084	0.0036	2.3421
(EU rel.pr)*(share re-imp	-0.1502	0.0807	-1.8605

Fixed Effects included

R-squared	0.9722
Adjust. R-squared	0.9690
S.E. of regress.	0.0358

White Heteroskedasticity-Consistent Standard Errors & Covariance

Dependent Variable: value of extra-EU imports
Method: GLS (Cross Section Weights)
Sample: 1993 2002
Number of cross-sections used: 97
Total panel (balanced) observations: 970

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	-325508.1	67680.59	-4.8095
EU relative prices	-29144.14	144.4347	-201.7808
(EU rel.pr)*(share re-imp	356060.3	51626.73	6.8968

Fixed Effects included

R-squared	0.9185
Adjust. R-squared	0.9093
S.E. of regression	6659188

White Heteroskedasticity-Consistent Standard Errors & Covariance

Net importing sectors only

Dependent Variable: EU market share in the EU market
Method: Pooled Least Squares
Sample: 1993 2002
Number of cross-sections used: 47
Total panel (balanced) observations: 470

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	1.0843	0.2653	4.0867
EU relative prices	0.0143	0.0076	1.8724
(EU rel.pr)*(share re-imp	-0.2911	0.1105	-2.6339

Fixed Effects included

R-squared	0.9531
Adjust. R-squared	0.9476
S.E. of regress.	0.0391

White Heteroskedasticity-Consistent Standard Errors & Covariance

Dependent Variable: value of extra-EU imports
Method: GLS (Cross Section Weights)
Sample: 1993 2002
Number of cross-sections used: 47
Total panel (balanced) observations: 470

Variable	Coefficient	Std. Error	t-Statistic
Share of re-imports	-5168433	147517.3	-35.0361
EU relative prices	-27606.98	512.0458	-53.9151
(EU rel.pr)*(share re-imp	609232.4	120142.1	5.0709

Fixed Effects included

R-squared	0.9238
Adjust. R-squared	0.9149
S.E. of regression	7511232

White Heteroskedasticity-Consistent Standard Errors & Covariance