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Is European Antidumping protection against Central Europe too high ?

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Abstract

In this paper we follow Boltuck (1987) and find that the average level of European antidumping protection against Central-Europe in the period 1985-1990 was 14 to 20% too high. Our simulation results on the Central European antidumping cases show only 'deminimis' injury margins in all cases. Hence, on the basis of these estimates the European Commission would have dismissed all European antidumping complaints against Central-European imports and no antidumping measures would have been imposed. In view of these results we feel that European antidumping legislation and its implementation seriously undermine the credibility of the Association Agreements recently signed between the European Union and the countries of Central-Europe.

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1. Introduction

By signing the Association Agreements (December 1991) with Hungary, Poland, the Czech and Slovak Republic, the European Union (EU) expressed its willingness to move towards free trade with these countries. This political engagement is noteworthy because EU's borders have been kept relatively closed for Central-European imports in the past. However, the Agreements' small print stipulates that the European antidumping mechanism remains in place. This way, the EU keeps the right to impose antidumping measures which are generally regarded as a very selective tool of protection (see for example Tharakan (1991), Messerlin (1991) and Hindley (1993)). The major flaw of the European implementation of the antidumping law is the calculation of injury margins. The European Commission, responsible for the injury investigation, seems to focus on the level of foreign price-undercutting in the European market (Vandenbussche 1995). Price-undercutting is the extent to which the price of a foreign product in the European market is lower than the European price for a similar product. The International Trade Commission, in contrast, makes use of the Boltuck-model (1987) for the calculation of injury. In this model injury is not measured as the price difference between domestic and foreign product in the domestic market but as the reduction in the domestic price resulting from foreign dumping. In our opinion the Boltuck-model is a more economically solid approach because it takes into account how the domestic market reacts to a price reduction of a substitute product. The contribution of this paper lies in simulating the Boltuck-model[2] on European antidumping cases against Central-Europe in the period prior to the Association Agreements (1985-1990). On the basis of that we conclude that the level of price-undercutting used by the European Commission is a poor injury indicator. Despite its convenience as a rule of thumb, we show that it has resulted in European protection that has been far too high. The simulation results suggest that in the period 1985-1990, antidumping measures against Central-Europe were overestimated by 14 to 20%. Moreover our results show that for all antidumping cases in our sample, each individual Central-European country's import market share was so small that it could only have caused 'deminimis' injury to the European industries involved. This normally would have lead the Commission to dismiss all antidumping complaints and no protection would have been taken. If this practice continues, the European antidumping mechanism undermines the future credibility of the Association Agreements.

In section 2 we critically discuss the assumptions underlying the model, then we move on to explain the main steps involved in this approach. For the details of the model we refer the interested reader to appendix A. In section 3 we discuss the data used and the results obtained from the simulations. Section 4 concludes.

[2] The spreadsheet version of the Boltuck-model (1991) is called CADIC which stands for Comparative Analysis of the Domestic Industry and is available from the author upon request.

2. The Model

Among the alternative approaches used by the International Trade Commission (ITC) for calculating material injury in US antidumping investigations, the Boltuck-model (1987) is the most logically valid method because it comes closest to the central question posed by the WTO[3] : do dumped imports *cause* material injury to the domestic industry. Nevertheless some of its assumptions are very stringent. In the next section we will critically discuss the most important ones.

2.A. Discussion of Assumptions

The type of dumping assumed in this model is price-discrimination whereby a lower price is charged in the export market. Price discrimination is a definition of dumping that is too wide in an economic sense but too narrow in a legal sense. Price-discrimination is profit-maximising behaviour without predatory intent on behalf of the foreign exporter and with positive welfare implications for the importing country as a whole. From an economic point of view there is no rational for protection against dumping of that type. One could argue that a competition policy in the exporting country, bringing consumer prices down would be a better type of government intervention in terms of world welfare. From a legal point of view, price-discrimination is by no means the only type of dumping that falls within the scope of the legislation. Therefore, the question remains how the level of injury would differ if dumping would be of a different type than the one assumed by Boltuck (1987). However, if one believes the majority of dumping to be the result of price-discrimination, than the Boltuck-model provides a more transparent and less arbitrary way of calculating injury than in the EU.

Another weakness is that when dumping margins are overestimated, injury margins will also be overestimated. In section 3 we use the spreadsheet version of Boltuck (1991) on a sample of EU's antidumping cases against Central-Europe. One of the variables on the input side, is the observed dumping margin. Several authors have pointed out that especially with respect to non-market economies[4] the dumping margin tends to be overestimated (Tharakan (1991), Messerlin (1989)). As a result, on the output side of the Boltuck-model, the injury margins will also be subject to overesti-

[3]World Trade Organization (WTO)

[4] Hungary, Poland and (former) Czechoslovakia have been deleted from the non-market economy list by EC regulation 517/92 of February 1992. This implies that as of February 1992, the technique of the analogue country no longer applies to these Central-European countries. However in the period we look at 1985-1990 these countries were still on the non-market economy list.

mation.

Further, it is assumed that the import-competing European industry is competitive where firms are price-takers. In many industries involved in antidumping cases this need not necessarily be the case. Political economy studies show that European antidumping cases often involve concentrated industries (see Tharakan and Waelbroeck, 1994). For those industries the Boltuck-model is still useful if one has some idea on how the direction of the injury estimates changes with the degree of imperfect competition in the industry. Or alternatively, if one can show that despite the low number of firms in the domestic industry, the share of the imports in domestic consumption guarantees a competitive domestic market. In that case the distortions of applying the Boltuck-model are relatively limited. Another limitation is the static nature of the analysis. It is assumed that the parameter values provided on the input side do not change over a specific period.

Some of these assumptions are quite stringent. Nevertheless, when the focus of the injury calculation is on prices, the Boltuck-model offers a more economically solid approach than the one favoured by the European Commission.

2.B. The Model

In this section we will briefly outline the main steps in the Boltuck-analysis. A more detailed description can be found in appendix A. The purpose is to determine the extent to which dumped imports change *prices* and *quantities* in the European industry. The Boltuck-model considers both price and output reductions of the domestic industry as injury measures.The model starts by constructing a counterfactual world where the foreign firm is not allowed to price-discriminate between its own market and its export market hence dumping does not occur. The analysis consists of three steps :

1) A calculation of the *price* of the foreign product in both markets when *dumping cannot take place*, which means that the foreign firm cannot price-discriminate and has to charge the same price (P_i) in both markets. This price level is then compared to the *price* charged by the foreign firm in the event of *dumping* (P_u) which is lower. This is shown in graph 1.
2) The reduction in the foreigner's price from P_i to P_u is used to estimate the *change in demand* for the *European like product* (ΔD_d) in the European market.
3) This demand shift (ΔD_d) is then used to estimate *price* (ΔP_d) and *quantity* effects (ΔQ_d) on the European like product which are considered as measures of injury *caused by* dumping.

In the first step outlined above and illustrated in graph 1, the question is : what would have been the

price of the imports if the foreign firm would set the same price in both its domestic and its export market. In graph 1 this price level is indicated as P_i. This is the price where the foreigner's marginal cost equals marginal revenue in the *integrated* market. Then P_i is compared to the price level in the European market when the foreign firm is allowed to price-discriminate, P_u. Let us denote :

(1) $\Delta P_u = P_u - P_i$

From graph 1 we see that the dumping price P_u from lies below P_i, therefore ΔP_u is negative. A reduction in the price of the foreign product from P_i to P_u will lead to an increase in demand for the dumped foreign imported product (D_u):

$$\overset{+}{D_u}\ (\overset{-}{P_d}, \overset{-}{P_u}) \quad (2)$$

Cheaper imports will result in a lower demand for the European like product (D_d) :

$$\overset{-}{D_d}\ (\overset{-}{P_d}, \overset{-}{P_u}) \quad (3)$$

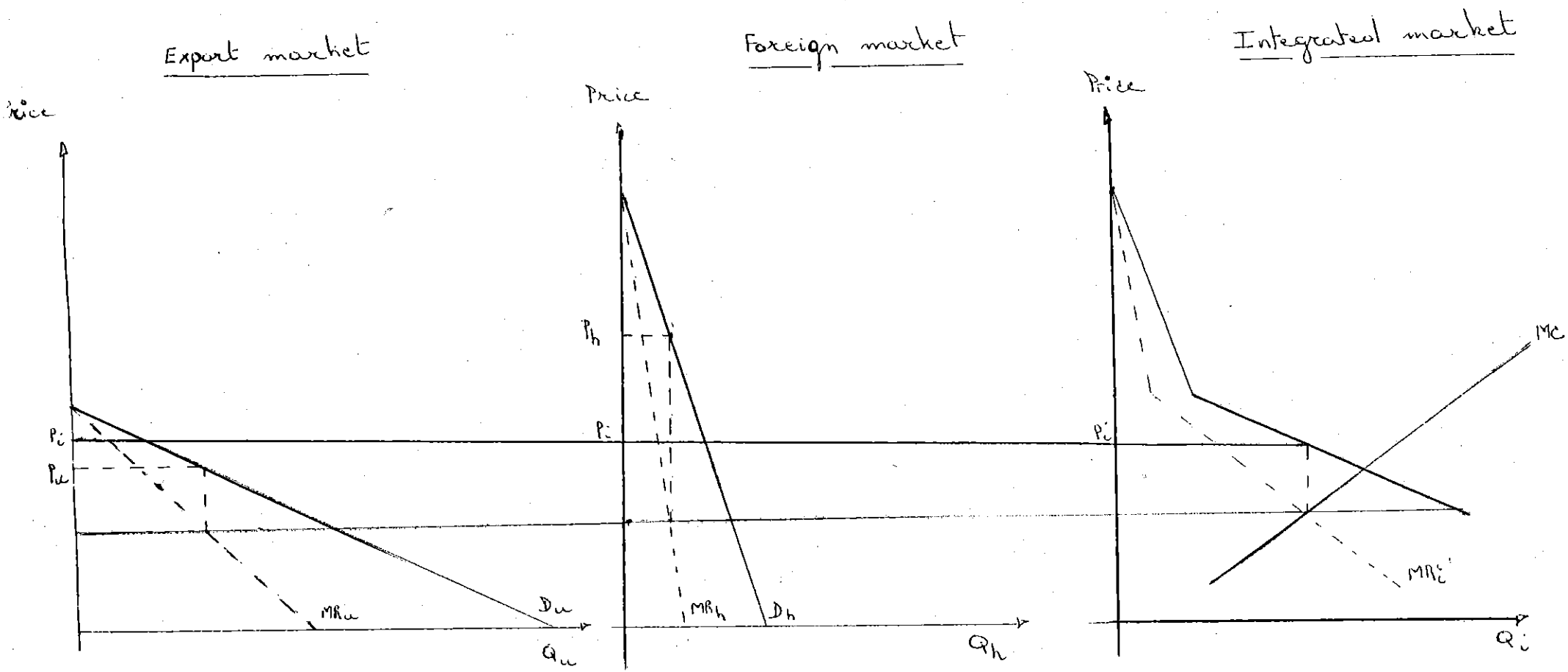
In (3) the *direct* effect of ΔP_u on D_d is given. However there is also an *indirect* effect. ΔP_u will also affect the European price level (P_d). Let us define P_{d1} as the European price when the price of the foreign product is P_i . At a price level P_u, the domestic price level will have changed into P_{d2}. Let us denote :

(4) $\Delta P_d = P_{d2} - P_{d1}$

The expression in (4) shows to what extent a drop in the price of a foreign product lowers the price of the European like product (ΔP_d). This makes much more sense than simply taking the level of foreign price undercutting ($P_{d1} - P_u$) as the European Commission does. (ΔP_d) in expression (4) is only one of the two injury measures of the Boltuck (1987)-model. The other injury measure is the change in the demand for the domestic like product (ΔQ_d) as a consequence of dumping. Taking both *direct* and *indirect* effects into account the quantity effect is the following :

(5) $\Delta Q_d = D_d (P_{d2}, P_u) - D_d (P_{d1}, P_i)$

Graph 1: Dumping as Price-discrimination



Expression (6) and (7) show what ΔP_d and ΔQ_d equal to in the Boltuck-model:

(6) $\Delta P_d = (N_{du} / (E_d - N_d)) \ . ((P_u - P_i)/ P_i)$

(7) $\Delta Q_d = (N_{du} / (E_d - N_d)) \ . ((P_u - P_i)/ P_i) \ . E_d$

where N_{du} : cross-price elasticity of demand between domestic like product and foreign import

E_d : elasticity of supply of domestic like product

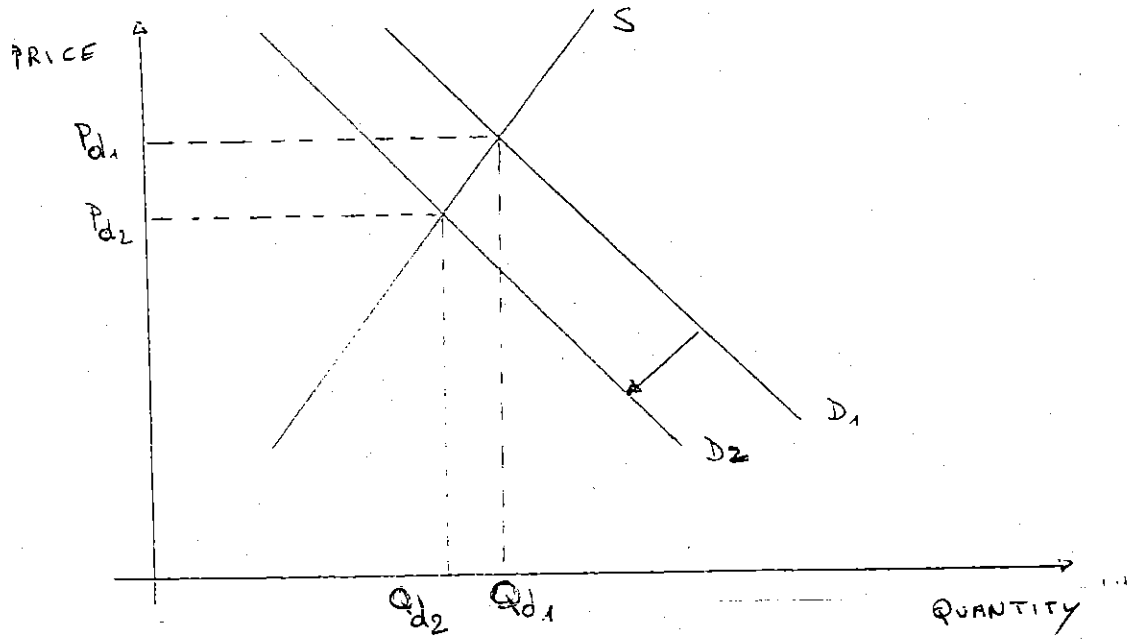
N_d : elasticity of demand for domestic like product

From (6) and (7) we see that a change in the *price* and the *quantity* of the domestic product, depends on the reduction of the foreign import price P_u of the like product as a result of dumping, the substitutability between dumped and like product (N_{du}), the elasticity of supply (E_d) and demand (N_d) of the European like product. ΔP_d gives the percentage change in the *price* of the like product consequent to dumping while ΔQ_d gives the percentage change in the *volume* of the like product consequent to dumping[5].

In graph 2 we illustrate this graphically. A drop in the foreign firm's export price from P_i to P_u, causes a downward shift of the demand curve for the European like product from D_1 to D_2. As a result of that shift, the domestic price drops from P_{d1} to P_{d2} while domestic output of the European product drop from Q_{d1} to Q_{d2}. The shift in the European demand curve depends on the degree of imperfect substitutability, captured by the cross-price elasticity (N_{du}). By how much the price of the European product will drop also depends on the price-elasticity of the European supply curve (E_d) and the price-elasticity of the European demand curve (N_d). The European Union's practice of simply taking the level of foreign price-undercutting as the injury margin, is overlooking how the market reacts to a price change of a substitute product.

[5]Both *price* and *volume* of the domestic like product are injury criteria stipulated in the WTO-antidumping code. Other injury criteria mentioned in the law such as the evolution of domestic market share, employment, profits, cash flow etc. can be derived from them.

Graph 2: The Model



3. Simulating EU antidumping cases against Central Europe (1985-1990)

In the latter half of the eighties (1985-1990), the European Commission initiated 33 antidumping investigations against Central Europe concerning an import value of more than 113,785 thousand ECU. This is illustrated is tables 1 and 2. Graph 3 gives an overview of the industries involved and the number of cases in each industry. The majority of cases are initiated by the European Chemical industry, followed by the Mechanical Engineering and the Wood and Paper industry.

For the application of the Boltuck-model we limited our sample to cases in the Chemical and the Mechanical engineering sector for the simple reason that the parameters required for the injury calculation were most readily available. This resulted in a sample of 17 antidumping cases for which most of the parameters could be traced.

The fact that that European duty and injury margins often equal the level of foreign price-undercutting, reflects that European officials are worried about the price of the European product. Hence, we will use the reduction in the domestic price (ΔP_d) yielded by the Boltuck-model for comparison with the injury margins determined by the Commission.

Table 1: Cases initiated against imports from Hungary, Poland and Czechoslovakia

	TOTAL	CEM	HU	PO	CZ
1985	60	7	2	3	2
1986	44	5	1	1	3
1987	50	2	1	-	1
1988	74	7	1	3	3
1989	55	11	3	3	5
1990	67	1	-	-	1
TOTAL	350	33	8	10	15

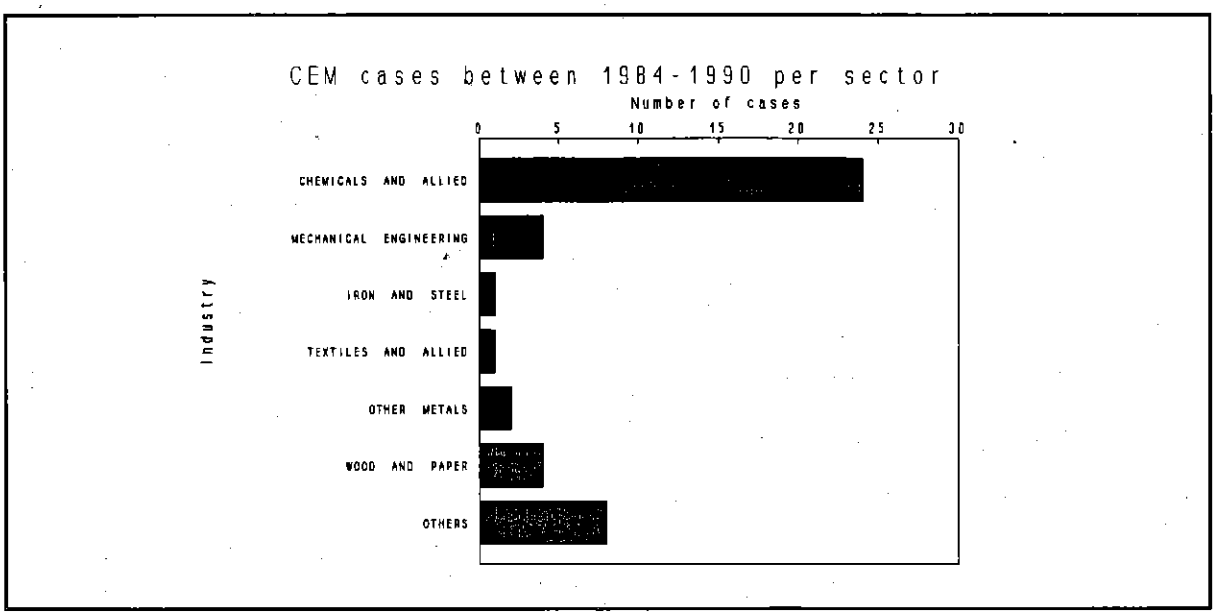
Source : E. Mc GOVERN, The Anti-Dumping Report, Globefield Press,November 1990.

Table 2: Import value in 10^3 ECUS of products from Hungary, Poland and Czechoslovakia (CEM) under investigation.

in 1000 ECUS	TOTAL CEM	HU	PO	CZ
1985	47,173	6,592	24,599	15,982
1986	8,473	740	1,155	6,578
1987	5,019	4,378	-	641
1988	15,291	-	12,840	2,451
1989	37,829	14,085	11,492	12,252
1990	?	-	-	?
	113,785	25,795	50,086	37,904

Source : EUROSTAT : External Trade : 1984-90

Graph 3: EU sectors involved in Antidumping cases against Central Europe (CEM) between 1985-1990



Source: COMMISSION OF EC, Annual reports on the Community's antidumping and antisubsidy activities, 1983-93

3.A The parameters

The spreadsheet version of Boltuck (1991) requires seven parameters on the input side. They are listed below :

M : the observed dumping margin
N_d : demand elasticity for the European like product in the EU
E_d : supply elasticity of the European like product in the EU
E_f : supply elasticity of the fairly traded imports in the EU
a' : the share of the defendant's local sales in its combined export and local foreign sales
V_d : the market share of the European like product in the EU after the dumping
V_u : the market share of the dumped imports[6] in the EU after the dumping

[6] When market shares of individual countries alleged of dumping are cumulated, V_u represents the cumulated market share.

On the basis of these seven parameters, eleven more parameters are calculated by the spreadsheet, mainly cross-price elasticities of demand between the three products in the model : the European like product, the dumped import product and the fairly-traded import product. In appendix B we show how these remaining parameters and the solutions from the Boltuck-model are arrived at from the seven parameters the user of the spreadsheet provides.

3.B.Data search and Sensitivity analysis

In what follows we will briefly discuss how we went about selecting values for the seven parameters listed in section 3.A .

Dumping Margin : M

For each of the 17 antidumping cases we turned to the dumping margins calculated by the EU and reported in the Official Journal. The purpose of this paper is a comparison of injury margins yielded by the Boltuck-model to those arrived at by the European Commission. As we have suggested above, European dumping margins for non-market economies tend to be overestimated. Overestimated dumping margins on the input side will yield overestimated injury margins on the output side of the Boltuck-model (1987). The simulation estimates are therefore likely to be upper limits of the true injury levels. A sensitivity analysis revealed that the dumping margin (M) is positively correlated with the measure of injury (ΔP_d). This is what we expect since the objective of the model is to measure injury *caused* by dumping.

Elasticities :

In order to determine the reduction in the price of the European product (ΔP_d) as a result of a drop in the price of the foreign import product (ΔP_w), the Boltuck-model requires information on three different elasticities. The elasticity of demand (N_d) and supply (E_d) for the European product, and the elasticity of supply for the fairly traded import (E_f). Empirical studies on elasticity estimates of industries are limited in number, especially at the six digit product level which is the level of disaggregation used in the antidumping cases. Ideally one would like information on prices, production and sales at this level of aggregation to calculate the elasticities. At this point in the analysis a trade off imposed itself between the number of cases in the sample on the one hand and the degree of accuracy of the elasticity estimates on the other. We opted for a relatively large sample of cases with a somewhat rough approximation of the necessary elasticities rather than fewer cases but with a greater reliability of the elasticity estimates. The advantage of the former is that it can reveal a general trend of over- or underestimation of injury levels by the European Commission.

Values for the elasticity parameters were derived by using detailed case evidence to adjust available average industry elasticity estimates. From the case reports in the Official Journal we derived detailed information on the specific situation of the Chemical and the Mechanical Engineering sector in the antidumping investigation period. This way we could revise the elasticity average to a more appropriate value for the product involved. In addition, we performed sensitivity analysis to establish the relationship between the elasticity and the injury measure. We used the spreadsheet version of the Boltuck-model to check how a change in the parameter values affected the direction and the magnitude of the injury measure (ΔP_d). This way we could determine a parameter's importance and its upper limits. By that we mean that we took parameter values that yielded relatively high injury margins under the Boltuck approach in order to strengthen our argument that the European Commission has calculated injury margins which were too high.

The elasticity of demand (N_d) depends among others on the availability of substitutes. The majority of the products involved in the Central-European antidumping cases (table 1 column 4), are chemicals. These tend to be homogeneous products with a production process that is relatively standardized. In addition, a sensitivity analysis reveals a negative correlation between the absolute value of the elasticity of demand for the domestic like product (N_d) and the injury margin (ΔP_d).
This suggests that the more elastic the demand for the European product, the less injury is incurred from dumped imports. Hence, for the cases in the Chemical sector, we decided to take a value of -2 for N_d which is smaller that -1 and yet not too elastic such that a reduction in the foreign import price will still yield substantial injury margins.
For the standardized electrical motors belonging to the Mechanical Engineering sector we used a value of -1.3 for N_d. Although European officials' circumscription of the product was that of a 'mass-production good', they also mentioned that the "...ball bearings used in the electric motors coming from Central-Europe are of a lower quality than the ones used in European produced motors...", suggesting that the European motors are of a higher quality than the Central European ones. This vertical product differentiation will make consumers relatively less sensitive to a price change than when products are homogeneous like in the Chemical sector. Therefore we expect the elasticity of demand to be somewhat lower in absolute terms. Nevertheless for a 'mass-production good', price and cost competitiveness are two decisive factors. This implies that the demand for this product in the European market is still elastic and takes a value smaller than -1.

Table 3 : PARAMETER VALUES FOR BOLTUCK SIMULATIONS ON EU ANTIDUMPING CASES

Defendant	Year	Code	Product		Industry	Analogue	DM	V_d	V_e	E_d	N_d	a'
							(a)	(a)	(a),(c)	(f)	(d)	(b),(c)
Czechosl.	1990	29.33.90.10	Methenamine	(1)	Chemicals	Mex	52%	85%	5,30%	1,75	-2	50%
	1990	28.41.60.00	Potas.Perman	(2)	Chemicals	U.S.A.	19,60%	21%	11,40%	1,5	-2	50%
	1987	31.02.15	Urea	(1)	Chemicals	S-Arab.	36%	65%	0,80%	1,46	-2	50%
		31.02.80										50%
	1987	85.01.33	Electric Mot.	(2)	Mech.Engin.	Yugos.	121%	69%	4,60%	1,94	-1,3	14,80%
		.34										
		.36										
	1987	28.38.27	Cop. Sulphate	(2)	Chemicals	Thail.	26%	81,80%	3,40%	1,62	-2	50%
	1986	28.47.60	Potas.Perman.	(1)	Chemicals	U.S.A.	69%	6%	11%	1,5	-2	3,70%
Poland	1990	29.33.90.10	Methenamine	(1)	Chemicals	Mex.	42%	85%	1,40%	1,75	-2	50%
	1987	28.38.27	Cop. Sulphate	(1)	Chemicals	Thail.	44%	82%	4,00%	1,62	-2	50%
	1987	85.01.33	Electric Mot.	(2)	Mech. Engin.	Yugos.	139%	69%	2,40%	1,94	-1,3	1,40%
		.34										
		.36										

Defendant	Year	Code	Product	Measures	Industry	Analogue	DM	V_d	V_a	E_d	N_d	a'
	1986	28.56.10	Silicon Carb.	(1)	Chem.	Norway	9%	52%	0,60%	0,98	-2	1%
	1986	28.20.30	Artif. Corund	(1)	Chem.	Yugos.	12%	69%	2,40%	0,98	-2	23,18%
	1985	28.38.27	Cop. Sulphate	(1)	Chem.	Spain	18%	77%	3,80%	1,17	-2	50%
Hungary	1989	31.02.10.10	Urea	(1)	Chem.	Austria	51%	75%	0,90%	1,49	-2	12,60%
		.99										
	1987	28.38.27	Cop. Sulphate	(2)	Chem.	Thail.	45%	82%	2,13%	1,62	-2	50%
	1987	85.01.33	Electric Mot.	(2)	Mech.Engin.	Yugos.	146%	69%	1,40%	1,94	-1,3	13,10%
		.34										
		.36										
	1986	28.20.30	Artif. Corund	(1)	Chem.	Yugos.	26,40%	69%	1,60%	0,98	-2	50%
	1985	28.38.27	Cop. Sulphate	(1)	Chem.	Spain	19%	77%	0,70%	1,17	-2	50%

Notes: (1) case was decided with a price-undertaking offered by the defendant and accepted by the EU Commission
(2) case was decided with an antidumping duty

Sources: (a) Official Journal of the EU: antidumping Case reports
(b) OECD foreign Trade statistics by country (SITC/Rev2,Rev3)
(c) Eurostat Statistics: External Trade (Nimexe/CN)
(d) Schumacher, Francis and Stern (1976)

The elasticity of supply (E_d) of the European like product depends among others on the capacity utilisation in the EU industry. In Vandenbussche (1995) it became clear that in 38 % of all the Central-European antidumping cases decided upon between 1984-1990, the European industry was suffering from overcapacity at the time of the investigation. This means that in the event of a price increase, production could easily have been expanded in the short run. This seems to justify values for the elasticity of supply parameter (E_d) greater than 1. A sensitivity test revealed that when the elasticity of supply, (E_d) goes up, the injury measure ΔP_d goes down. This means that the more elastic domestic supply, the more insensitive domestic prices are to the dumping of imports. Empirical estimates of elasticity of supply (E_d) are scarce. Estimates of import elasticities (I_d) are far more abundant, which is probably due to the large availability of trade data in comparison to production figures. We used expression (8) (Schumacher, Francis and Stern (1976, p93)), which states a relationship between the two elasticities, to derive values for the elasticity of supply (E_d) .

$$(8) \qquad E_d = \frac{I_d - (C/IMP) \cdot N_d}{(PROD/IMP)}$$

E_d : supply elasticity
I_d : import demand elasticity
C : domestic consumption
PROD : domestic production[7]
IMP : imports
N_d : demand elasticity

This approach yielded values for the elasticity of supply parameter (E_d) ranging between 1 and 2 depending on the sector and product.

For *the supply elasticity of fairly traded imports (E_f)* parameter, The Boltuck- spreadsheet (1991) offers an option. Either a specific value is introduced or the parameter is assumed to equal infinity. An infinitely elastic supply means that whatever the quantity imported by the EU, the unit price will be the same. We used the latter option unless there was evidence which suggested otherwise. A sensitivity test showed that the injury margin (ΔP_d) is relatively insensitive to changes in the value of parameter E_f when the sum of V_d and V_u is high. A high value of $V_d + V_u$ means that there are not much '*fairly traded imports*' (V_f) of the product[8]. In the majority of the Central-European antidumping cases V_f is indeed relatively small. Therefore we set E_f equal to its default value of infinity.

[7]The appropriate figures for consumption, production and imports were found in the antidumping case report.

[8] because $V_d + V_u + V_f = 1$

EU's market share of EU like product and dumped imports : V_d , V_u

The market share of the European like product (V_d) is always revealed in the case reports of the Official Journal. With respect to the market share of the dumped imports (V_u) in the EU, we make a distinction between *individual* and *cumulated* market shares. In Vandenbussche (1995), we disentangled the European injury determination process in two separate steps. In a first step the Commission decides on the *presence* of injury while in a second step the actual injury *margin* is calculated. In the first step the Commission often takes recourse to the practice of cumulating market shares of imports of all the defendants involved in the case. To give an example, suppose an antidumping investigation is initiated against Hungary, Poland and Czechia. Cumulation means that the Commission sums up the individual import market shares of the three defendants involved. Suppose each individual defendant has a market share in the EU of 3 %, the three together represent an import market share of 9%. By taking the cumulated figure, the Commission can argue more convincingly that injury to the domestic EU industry is present. In the second step, the Commission then moves on to calculate an individual injury margin for each defendant separately. It is not difficult to see that cumulation is a bias in favour of protection. If in the first step of the injury determination process, each defendant's market share had been considered separately, it would have been difficult for the Commission to argue that an import market share of 3% is substantial enough to cause injury to a domestic EU industry. However on a cumulated basis the three defendants are far more likely to end up in the second step of the injury process and be subject to antidumping measures. In all the 17 antidumping cases in our sample, the Commission used *cumulation* in the injury process.
The European Commission's preference for cumulation induces us to consider the Boltuck-estimates under two alternative scenarios. We will compare EU injury margins with Boltuck estimates both in the case of *individual* market shares and in the case of *cumulated* market shares. Cumulation implies that the parameter V_u and a' take different values in the simulations. Here we will only discuss V_u, the next paragraph deals with a'. The figures for both the individual and the cumulated market shares (V_u) of the defendants in the EU were obtained from the antidumping case reports in the Official Journal. A sensitivity analysis revealed that the injury estimate (P_d) is very sensitive to this parameter (V_u). The higher the defendant's market share, the more prices for the EU import-competing industry become depressed as a result of a reduction in the price of the foreign like product. Therefore we expect the Boltuck injury margin to be bigger in the case of cumulated market shares than in the case of individual market shares.

The share of the defendant's domestic sales : a'

The original definition of parameter a' is the following :

$a' = (1) / (1 + 2)$

(1) the defendant's sales of the product in its foreign local market
(2) the defendant's sales of the product in the EU

However with respect to Central-European countries, information on local market sales (1) is difficult to get. Therefore we turn to an alternative definition of a' for Central-European countries :[9]

(1) the defendant's exports of the product to the analogue country

In antidumping cases involving Central-European countries an 'analogue country' with market economy is always used to establish the dumping margin. The logic behind the alternative specification of (1) in a' is that by taking the trade of the defendant to the analogue country we have the volume of sales of the defendant's product in the analogue country rather than in its own local market.

Out of the 17 selected antidumping cases we could only calculate a' in 8 cases for the simple reason that in the remaining 9 cases there was no *'export from the defendant country to the analogue country'* (see definition of a') reported in the trade statistics[10].
The low values of a' in those cases where we *do* have information, indicate a high degree of export orientation of the products involved. Because the remaining 9 cases where we *do not* have an estimate of a', are situated in the same industries (Chemicals and Mechanical engineering) and in the same countries, we consider a range for a' between 0 and 50%. A sensitivity analysis shows that the level of injury and the value of a' are positively correlated. Therefore by putting a' equal to its upper limit of 50% we get the highest level of injury possible under the Boltuck-model.

In the scenario whereby we consider cumulated market shares of the imports, parameter a' is likely to change. Here a problem arises. To have an accurate estimate of cumulated a' we need to know 'local sales' for the defending countries with a market economy (see original definition of a'), and the 'exports to the analogue country', for the non-market economy defendants (see alternative definition of a'). Local production figures are far more difficult to obtain than trade figures. From the scenario based on individual market shares, we know that for the Central-European countries involved, the a's are small (below 50%) suggesting a high degree of export orientation. For those cases where all the defendants are Central-European exporters, we set the cumulated value for a'

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[9] We thank Richard Boltuck for suggesting this alternative route

[10] There are three possible reasons for the lack of this information. The first and most simple is that the product concerned is not actually traded between the countries involved, second it is also possible that the goods are first shipped via a different country. In such a case the trade statistics register the country where the goods are last shipped from and not the country of origin of the goods. A third possibility is that it concerns products whose shipments are kept confidential and which do not appear in the trade statistiscs. In an industry with few competitors where the trade flows might reveal information on a competitor's sales, the firms can choose not to publish their export figures.

equal to 50 % which again can be considered as an upper limit[11]. In those cases where some of the defendants are market economies and where we have no indication how export oriented these market economies are with respect to the product involved, we also opted for a cumulated a' of 50%. The motivation for this is that since the export orientation for the Central European defendants is very high (and a' very low), the share of the local sales for the market economies involved would have to be very large in order to get a cumulated a' of over 50% (see definition of a' cumulated in footnote 11).

Table 3 lists all the parameter values of the Central European cases necessary to run the Boltuck-model.

3.C. Results

Antidumping measures in the European Union are targeted at eliminating the lower of the dumping or injury margin. Case evidence has demonstrated that when the case is decided with a duty, usually the injury margin is the smaller of the two (Vandenbussche 1995). Hence antidumping duties often equal the extent of price-undercutting. When an EU antidumping case is decided by acceptance of a price-undertaking however, the level of injury is not revealed by the European Commission. A price-undertaking is a voluntary price increase offered by the defendant to eliminate the injury to the

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[11]Consider the following example: a case where three countries are alleged of dumping : Hungary, Poland and Czechoslovakia. Each of the **individual** a' lies between 0 and 50% :

$$0 \leq a'_{HU} = HUS/(HUS + EU_{HU}) \leq 50\% ;$$

$$0 \leq a'_{PO} = POS/(POS + EU_{PO}) \leq 50\% ;$$

$$0 \leq a'_{CZ} = CZS/(CZS + EU_{CZ}) \leq 50\% ;$$

The definition of the cumulated a' is than:

$$a'_{CU} = (HUS + POS + CZS)/(HUS + EU_{HU} + POS + EU_{PO} + CZS + EU_{CZ})$$

One can show that the **cumulated** value for a' also has to lie between 0 and 50 % :

$$0 \leq a'_{CU} \leq 50\%$$

with HUS = Hungarian sales in Hungary and EU_{HU} = Hungarian exports to the EU
POS = Polish sales in Poland and EU_{PO} = Polish exports to the EU
CZS = Czechosl. sales in Czechosl. and EU_{CZ} = Czechosl. exports to the EU

EU industry. The extent of the price-undertaking offered is confidential. In analogy with the duty cases we believe it is reasonable to assume that the Commission acts according to the same principles. Hence in table 4 we set the European injury margins in the price-undertakings cases equal to the level of foreign price-undercutting. Whenever the percentages reported in the column 'European injury margins' in table 4 are smaller than the dumping margins (see table 3) these percentages represent ad valorem tariffs to be paid on top of the import price in the EU in the case of an antidumping duty. Or in the case of a price-undertaking, they represent the increase in the foreign exporter's price to the EU. In our sample there are three cases where the European injury margin (table 4) is higher than the dumping margin (table 3). Potassium permanganate against Czechoslovakia, silicon carbide and artificial corundum against Poland. In those cases antidumping measures equalled the dumping margin. In all the remaining cases in our sample, antidumping measures were aimed at injury margins.

The general results from table 4 can be summarized as follows. For *individual* market shares, Boltuck injury levels (ΔP_d) always appear to be much lower than the ones reported by the European Commission. The average European injury margin is 20.6% while the average Boltuck injury margin is only 1.15 %. An injury margin of around 1 % is normally regarded by the Commission as a 'deminimis' injury level which would have lead to dismiss all claims for antidumping protection against Central-European exporters. Except perhaps for the case involving Methenamine from Czechoslovakia, where the individual Boltuck injury margin equals 6%. However, this relatively high injury figure for Methenamine may be explained by the failure of the Boltuck-model to take into account the imperfect nature of the European industry for Methenamine (see below). In sum, on the basis of individual Boltuck injury levels, the majority if not all the antidumping cases in our sample would have been stopped without further recourse. However, from the course of history we know that the average level of antidumping protection[12] for the products involved was 19.9%. This result seems to suggest that European consumers of these products on average paid 20% too much. The Boltuck results cast doubt on the argument that antidumping protection was necessary to guarantee the continued survival of the complaining European industries. Instead it may have jeopardized the competitiveness of industries further down the production chain using the products in our sample as inputs. On the basis of *cumulated* market shares, simulated injury margins are higher than on the basis of individual market shares but remain far below the Commission's. The average cumulated Boltuck injury margin is 6.5 %, which is still 14.1 % lower than the average Commission's injury margin.

[12]In calculating the average level of antidumping protection for the 17 cases in our sample we considered for each case the lower of dumping and injury margin. For the three cases in our sample where European injury margins outweighed the dumping margins, the dumping margin had to be used for the calculation of the average level of protection.

Table 4 : A COMPARISON OF EU INJURY LEVELS AND CADIC INJURY LEVELS[13]

Defendant	Year	Product	EU Injury Margin	Individual Market Share	Cumulated Market Share			
			(a)	CADIC ΔP_d	V_a (cumulated)	number of defendants	a' (cum)	CADIC ΔP_d
Czechoslov.	1990	Methenamine	22 %	6 %	12 %	4	50 %	11,50 %
	1990	Potas.Perman	25 %	0,70 %	11,40 %	1	50 %	1,30 %
	1987	Urea	19,5 %	0,20 %	20 %	8	50 %	5,20 %
	1987	Electric Mot.	35 %	2,80 %	20 %	7	50 %	10,7 %
	1987	Copper Sulph.	5%	1,4%	16%	4	50 %	5,8%
	1986	Potas.Perman	21 %	0,2 %	77 %	3	50 %	?
Poland	1990	Methenamine	10%	1,4 %	12 %	4	50 %	9 %
	1987	Copper Sulp.	25 %	3,2 %	16 %	4	50 %	9,7 %

[13]Sources: (a) Official Journal of the EU: antidumping Case reports

? : data not plausible with price discrimination : no results are given by CADIC

Defendant	Year	Product	EU injury margin	CADIC (ind) ΔP_d	V_u cumulated	Number of defendants	a' (cum)	CADIC (cum) ΔP_d
	1987	Electric Mot.	35 %	0 %	20 %	7	50 %	11,8 %
	1986	Silicon Carbi-de	16 %	0 %	40 %	5	50 %	2,40 %
	1986	Artif Corund	13 to 20 %	0,10 %	7 %	3	50 %	0,90 %
	1985	Cop. Sulphate	18 %	0,90 %	11%	3	50 %	2,60 %
HU	1989	Urea	17 %	0,10 %	11,50 %	6	50 %	6,30 %
	1987	Cop. Sulphate	19 %	1,80 %	16 %	4	50 %	10 %
	1987	Electric Mot.	35 %	0,20 %	20 %	7	50 %	12.2 %
	1986	Artif. Corund	18,50 %	0,40 %	7 %	3	50 %	1,80 %
	1985	Cop. Sulphate	18 %	0,20 %	11 %	3	50 %	2,70 %

Under cumulated Boltuck, only three cases would definitely be dismissed because of 'deminimis injury'. It involves Potassium permanganate from Czechoslovakia with an injury margin of 1.3 %, the 1985 Copper sulphate case against Poland with an injury margin of 0.9% and the Artificial corundum case against Hungary with an injury margin of 1.8 %. In all the other cases the Boltuck injury margins would probably lead to the imposition of antidumping measures. The average level of antidumping protection in the case of cumulated market shares under Boltuck is equal to the average injury margin of 6.5 %. The reason for this is that all the Boltuck injury margins lie below the dumping margins. Therefore the injury margins also reflect the height of the antidumping measure.

The overall conclusion is that the European injury margins in our sample are seriously overestimated. They result in an average level of antidumping protection which is 20 % too high compared to Boltuck (1987) injury estimates on the basis of *individual* market shares and 14 % too high compared to Boltuck (1987) injury estimates on the basis of *cumulated* market shares. This shows among others, that no matter how convenient the level of foreign price-undercutting may be as a rule of thumb, to use it for the calculation of injury margins results in injury and duty levels which are far too high. The simulated injury margins on the basis of the Boltuck-model (1991) are derived under the implicit assumption of a competitive European industry where firms are price-takers. The objection could be raised that the low values of the simulated injury margins might be due to the failure to take into account the imperfect nature of the European industries involved. From a theoretical point of view it is difficult to predict how the Boltuck-injury estimates would change under imperfect competition. This will depend on the specific type of oligopoly prevailing in the industry concerned. The number of firms in the industry, the presence of price or quantity competition, horizontal or a vertical product differentiation are all factors that will determine to what extent the European price will get depressed as a result of foreign dumping. However, from an empirical point of view the oligopolistic power of the European industries concerned is diluted by import competition. This can be seen by calculating the share of imports in the EU consumption. In table 5 we have listed this share for all the antidumping cases in our sample. In the cases for which this share is relatively large, the market structure problem is not too serious because the high import penetration guarantees the competitiveness of the European market. The last column in table 5 shows that only in 2 cases, this share is smaller than 20 %. In 4 cases, the imports constitute between 20 and 30 % of European consumption. The majority of cases, 6 in total, have a share lying between 30 and 50 %. In 4 cases this ratio is over a 100 % which suggests that imports exceed European consumption[14]. In cases where imports constitute less than 20 % of European consumption it is not correct to conjecture that the level of competition is sufficiently high to justify the use of the Boltuck-model. The European market for Methenamine is in this position. In all the other cases, the share of imports in consumption is sufficiently high to rely on the Boltuck-estimates.

[14] One possible explanation for this is the difficulty that arises when trying to match production and trade figures.

Table 5: share of imports in European consumption for the products involved in the Central European antidumping cases

Defendant	Year	Product	EU production (a) in tonnes	Extra EU imports (b) in tonnes	Extra EU exports (c) in tonnes	share of imports in EU consumption (b)/(b+a-c)
Czechosl.	1990	Methenam.	27,500	3,956	1,272	13 %
	1990	Pot.perm.	402	2,657	837	119 %
	1987	Urea	4,313,000	1,370,064	921,867	29 %
	1987	Electr.mot.	20,700 (*)	40,957	25,906	114 %
	1987	Cop.sulph.	50,287	11,162	10,059	22 %
	1986	Pot.perm.	696	2,657	1,778	169 %
Poland	1990	Methenam.	27,500	3,956	1,272	13 %
	1987	Cop.sulph.	50,287	11,162	10,059	22 %
	1987	Electr.mot.	20,700 (*)	40,957	25,906	114 %
	1986	Silic.carb.	100,000	59,921	40,236	50 %
	1986	Art.corund	121,193	72,845	46,380	49 %
	1985	Cop.sulph.	34,000	16,656	9,047	40 %
Hungary	1989	Urea	4,564,529	1,370,064	1,434,355	30 %
	1987	Cop.sulph.	50,287	11,162	10,059	22 %
	1987	Electr.mot.	20,700 (*)	40,957	25,906	114 %
	1986	Art.corund	121,193	72,845	46,380	49 %
	1985	Cop.sulph.	34,000	16,656	9,047	40 %

Sources: (a) Official Journal case report

(b) en (c) EUROSTAT External Trade Statistics

Notes : (*) This figure is the equivalent of the 'number of motors', the unit measure used in the case.

4.Conclusion

In this paper we find that the European Commission has overestimated injury margins in 17 antidumping cases against Central Europe in the period 1985-1990. This conclusion was arrived at by comparing the European Commission's injury margins with those obtained on the basis of an alternative approach. For this purpose we turned to the Boltuck-model which is often used by the International Trade Commisssion in the US for the calculation of injury in dumping cases. In calculating injury margins, the European Commission seems to focus on the level of foreign price undercutting. The Boltuck-approach defines injury as the reduction in the domestic price resulting from cheaper imports. From an economic point of view the Boltuck-model is preferable because it takes into account how the market reacts to the price change of a substitute product. One of the critical assumptions underlying this approach is that the European industry is competitive. Although the import-competing European industries in our sample are relatively concentrated, the share of imports in domestic consumption was high enough to guarantee competitive European markets and to rely on the injury estimates. Our injury calculations show that on the basis of individual market shares, the average overestimation by the Euroepan Commission is 20 %, while on the basis of cumulated market shares, the average overestimation is 14%. The European Commission's own estimates in those cases were all derived using cumulation. Therefore, it seems appropriate to consider 14% as the most likely figure of overestimation. By law, antidumping measures have to offset the lower of dumping or injury margin. In the large majority of the Central European cases in our sample, the injury margins are the lower of the two. This means that the injury margins determine the level of antidumping protection. The fact that European Commission seems to have overestimated injury margins suggests that this resulted in an overestimation of the level of protection in those cases. By keeping the European antidumping mechanism in place, the European Union can continue denying acces on legal grounds to Central-European imports. In our opinion, the way towards a more liberal and unrefrained trade order with the new Associated Members of Central-Europe lies elsewhere. A first-best solution would be to dismiss the antidumping mechanism between the signing parties of the Association Agreements and to install the EU's competition policy as guardian of fair practices as it is now the case between member states. A second best solution would be to change the method of injury margins calculation from the arbitrary rule of thumbs which are being used today to more economically solid methods.

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APPENDIX A: THE BOLTUCK - MODEL

1. List of symbols:

D_h	:	demand for the dumped product in foreign market (= country of origin)
D_u	:	demand for the dumped product in European market
D_f	:	demand for fairly-traded imports in EU
D_d	:	demand for like product in EU
C	:	average (marginal) cost of production
S_d	:	supply of like product
S_f	:	supply of fairly-traded imports
a	:	the ratio of the foreign exporter's local sales over the sum of his local sales and exports to the EU (fractional) when exporter sets one single price
P_i	:	Single price of the integrated market for the dumped product
N_i	:	Elasticity of demand for the dumped product in the integrated market
a'	:	the ratio of the foreign exporter's local sales over the sum of his local sales and exports to the EU (fractional) in the case of separated markets.
V_d	:	EU market share of EU like product (fractional)
V_u	:	EU market share of dumped imports (fractional)
N_I	:	Elasticity of demand for aggregate import I
N_A	:	Elasticity of demand for aggregate import A
N_d	:	Elasticity of demand for EU like product
N_u	:	Elasticity of demand for dumped import
N_u'	:	Augmented elasticity of demand for dumped import
N_f	:	Elasticity of demand for fairly-traded import in the EU
N_h	:	Exporter's home market elasticity of demand for dumped product in his local market
N_{du}	:	cross-price elasticity of demand between like productand dumped import price
N_{ud}	:	cross-price elasticity of demand between dumped import and like product price
N_{fd}	:	cross-price elasticity of demand between fairly-traded import and like product price
N_{df}	:	cross-price elasticity of demand between like-product and fairly-traded import price

N_{fu} : cross-price elasticity of demand between fairly-traded import and dumped import price

N_{uf} : cross-price elasticity of demand between the dumped import and the fairly-traded import

E_d : Elasticity of supply of like product in EU

E_f : Elasticity of supply of fairly-traded import in EU

M : dumping margin

2. The Economic Model

A. DUMPING

The dumping exporter selects a price in its local foreign market, P_h , and a price in its export (EU) market, P_u , so as to maximise its profits (Π^F) under constant marginal costs given by c:

$$\Pi^F = (P_h \cdot D_h + P_u \cdot D_u) - [C \cdot (D_h + D_u)] \quad (1)$$

In the foreign market, demand depends only on the price of the exporter's product, whereas in the EU market demand for the dumped product depends on the price of the dumped product P_u , the price of the EU like product P_d and the price of a fairly-traded product P_f available in the EU market. All three products are imperfect substitutes ;

$$D_h = D_h(P_h) \quad (2a)$$

$$D_u = D_u(P_u, P_d, P_f) \quad (2b)$$

Profits (1) are maximised if the partial derivatives with respect to, the exporter's choice variables P_h and P_u both equal zero. For D_h this is relatively simple since it depends only on one variable. However in order to calculate the influence of the change in P_u on D_u we have to take the total derivative because P_u , P_d and P_f are not independent. A change in P_u will also effect P_d and P_f .
This first-order conditions for maximising (1) are :

$$P_h = \frac{C}{(1 + \frac{1}{N_h})} \quad (3a)$$

$$P_u = \frac{C}{(1 + \frac{1}{N_u'})} \quad (3b)$$

with N_u' equal to :

$$N_u' = N_u + N_{ud} \cdot \frac{d\ln P_d}{d\ln P_u} + N_{uf} \cdot \frac{d\ln P_f}{d\ln P_u} \tag{4}$$

$\frac{d\ln P_d}{d\ln P_u}$ can be evaluated in terms of basic elasticity parameters by differentiating the equilibrium condition for the EU like product market. This equilibrium condition is :

$$D_d(P_u, P_d, P_f) = S_d(P_d) \tag{5}$$

$\frac{d\ln P_f}{d\ln P_u}$ can also be evaluated in terms of basic elasticity parameters by differentiating the equilibrium condition for the market for the fairly-traded import. The equilibrium condition is[15]:

$$D_f(P_d, P_u, P_f) = S_f(P_{fd}) \tag{6}$$

Logarithmically differentiating (5) and (6) w.r.t. P_u and solving the resulting linear equations simultaneously yields :

$$\frac{d\ln P_d}{d\ln P_u} = \frac{[N_{du}(E_f - N_f) - N_{fu} \cdot N_{df}]}{[(E_d - N_d) \cdot (E_f - N_f) - N_{fd} \cdot N_{df}]} \tag{5'}$$

$$\frac{d\ln P_f}{d\ln P_u} = \frac{[N_{fu}(E_d - N_d) + N_{du} \cdot N_{fd}]}{[(E_d - N_d) \cdot (E_f - N_f) - N_{fd} \cdot N_{df}]} \tag{6'}$$

So in order to calculate P_u , we have to put (5') and (6') into (4) and then (4) into (3b). This gives us P_u in terms of elasticities and cross-elasticities.

B. INTEGRATED MARKET

What price would the exporter have charged had it been forced to select a single price for both markets? The exporter would select its price based on the amount of market power it enjoys in the now integrated market :

$$P_i = \frac{c}{(1 + \frac{1}{N})} \tag{7}$$

What is N_i in terms of basic parameters? Therefore we have to turn to total demand which is given by :

$$D_i = D_h(P_i) + D_u(P_i, P_d, P_f) \tag{8}$$

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[15] Condition (5) assumes that the market for the EU like product is competitive.

Logarithmically differentiating (8) w.r.t. P_i yields,

$$N_i = a \cdot N_h + (1 - a) \cdot N_u' \tag{9}$$

where N_u' is given by (4) and a is given by:

$$a = \frac{D_h}{(D_h + D_u)} \tag{10}$$

So in order to write P_i in terms of elasticities and cross-elasticities we put (4) into (9) and then (9) into (7).

3. Solutions given by the CADIC - spreadsheet

A. EFFECT OF DUMPING ON THE PRICE OF DUMPED IMPORTS

The percentage change in the price of the dumped import consequent to dumping is :

$$d\ln P_u = \frac{(P_u - P_i)}{P_i} \tag{11}$$

B. EFFECT OF DUMPING ON THE CONDITION OF THE EU INDUSTRY

The percentage change in the price of the EU like product as a result of dumping is :

$$d\ln P_d = \frac{d\ln P_d}{d\ln P_u} \cdot d\ln P_u \tag{12}$$

The percentage change in the volume of the EU like product consequent to dumping is :

$$d\ln Q_d = d\ln P_d \cdot E_d \tag{13}$$

Note : if $E_f = +\infty$, then (5') simplifies to :

$$\frac{d\ln P_d}{d\ln P_u} = \frac{N_{du}}{(E_d - N_d)}$$

and $$\frac{d\ln P_f}{d\ln P_u} = 0$$

APPENDIX B : HOW TO ARRIVE AT SOLUTIONS FROM PARAMETERS PROVIDED IN CADIC? [16]

The parameters we provided are :

$M, V_d, V_u, N_d, E_d, E_f, a'$

The parameters that are derived from them are :

$N_{df}, N_{du}, N_{fd}, N_{ud}, N_{uf}, N_{fu}, N_f, N_u, N_h, a, P_i$

The following separable utility function is assumed :

$$U = U\{A[I(Q_f, Q_u), Q_d], Q_0\} \quad (1)$$

where Q_0 comprises all goods outside of the subject product category $A[.]$ is a linear homogeneous aggregation function and so is $I(.)$. N_A is the elasticity of the aggregate good A, and N_I is the elasticity of demand for the aggregate good I.

If the user does not provide N_A specifically, then the spreadsheet sets $N_A = 0 . N_I$ can be arrived at by solving :

$$N_d = -\frac{(1-V_d)}{V_d} \cdot (N_A - N_I) + N_A \quad (2)$$

N_{du} and N_{df} are obtained from :

$$N_{df} = \frac{(1-V_d-V_u)}{V_d} \cdot (N_A - N_I) \quad (3)$$

$$N_{du} = \frac{V_u}{V_d} \cdot (N_A - N_I) \quad (4)$$

N_{fd} and N_{ud} equal : (via Slutsky Symmetry)

$$N_{fd} = (N_A - N_I) \quad (5)$$

$$N_{ud} = (N_A - N_I) \quad (6)$$

Via the MURRAY and BALDWIN-assumption ('any two cross-price elasticities of demand for product within a product category, w.r.t. the same price of another product within the category are equal'). This implies that:

$$N_{uf} = N_{df} \quad (7)$$

$$N_{fu} = N_{du} \quad (8)$$

The own-price elasticities of demand N_f and N_u equal the following :

[16] Own calculations.

$$N_f = -\frac{(V_d + V_u)}{V_d} \cdot (N_A - N_I) + N_A \quad (9)$$

$$N_u = -\frac{(1 - V_u)}{V_d} \cdot (N_A - N_I) + N_A \quad (10)$$

The demand elasticity N_h can only be solved by making use of M

$$N_h = \frac{[N_u' \times (1 + M)]}{(1 - N_u' \times M)} \quad (11)$$

The parameters a and P_i , which cannot be observed, can only be found simultaneously since a depends on P_i and P_i depends on a :

$$a = \frac{D_h(P_i)}{[D_h(P_i) + D_u(P_i)]} \quad (12)$$

$$P_i = \frac{c}{1 + \frac{1}{[a \cdot N_h + (1-a) \cdot N_u']}} \quad (13)$$

We know that a must vary between 0 and 1, and P_i lies between P_u and P_h . The CADIC spreadsheet looks for values of P_i and a that satisfy (simultaneously) both equations, by means of an iterative process.
When all the above took place the solutions can be calculated

$$d\ln P_u = \frac{P_u - P_i}{P_i}$$

with

$$P_u = \frac{c}{(1 + \frac{1}{N_u'})}$$

$$P_i = \frac{c}{(1 + \frac{1}{N_i})}$$

$$N_i = a \cdot N_h + (1-a) N_u'$$

$$N_u' = a\ function\ of\ N_u, N_{ud}, N_{uf}, N_{du}, E_f, N_f, N_{fu}, N_{df}, E_d, N_d, N_{fd}, E_d, N_d$$

$$d\ln P_d = \frac{d\ln P_d}{d\ln P_u} \cdot d\ln P_u$$

with

$$\frac{d\ln P_d}{d\ln P_u} = a\ function\ of\ N_{du}, E_f, N_f, N_{fu}, N_{df}, E_d, N_d, E_f, N_g, N_{fd}, N_{df}$$

$$d\ln Q_d = d\ln P_d \cdot E_d$$

LIJST VAN RECENTE SESO-RAPPORTEN

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