A complete list of Working Papers
on the last pages

Nr 51, 1981

ON PRICE ELASTICITIES IN FOREIGN TRADE

by

Eva Christina Horwitz

ON PRICE ELASTICITIES IN FOREIGN TRADE

I Abstract

II Time series estimation of price elasticities in international trade

a) The theoretical background

b) Special problems in estimation

c) Some empirical results

III Disaggregated price elasticities in Swedish foreign trade

a) The data

b) Import price elasticities

c) Export price elasticities

I Abstract

The origin of this paper was the need to provide import and export functions for the IUI-model of the Swedish economy used in the 1979 forecasting excercise, later on extended to support the analysis in the KRAN-project. This paper summarizes the results of the estimates of price elasticities in foreign trade in that excercise. It also surveys results for Sweden obtained by others and briefly compares results for other countries.

The final section of this paper presents estimates of Swedish import and export price elasticities at a disaggregated level. The results are exploratory, looking more for the specification sensitivity of estimated coefficients than for any firm results. The results obtained point to a price elasticity of about -1.4 for total Swedish exports the main impact falling on the year after the relative price change. Price elasticities seem to be much lower for exports to the Nordic Countries than for exports to Western Europe and North America, where price elasticities for Swedish goods tend to be around -2. The aggregated price elasticity for imports seems to be just below 1 in this excercise.

The results are close to those obtained for Sweden in most studies using the same methods of estimation. More recent results suggest that estimates of price elasticities can be improved upon. The use of instrumental variables or simultaneous estimation techniques will increase price elasticities. In view of this divergent results the emphasis in this paper is on the theoretical, methodological and econometric problems encountered when estimating price elasticities in international trade.

II Time series estimation of price elasticities in international trade

a) The theoretical background

The theory of international trade is of no assistance in the discussion of price elasticiteis since it is based on the assumption that goods of a particular kind supplied by one country substitute perfectly for the same good produced in another country. The elasticities of substitution between these supplies are infinite,and as a consequence the corresponding price ratios are constant.

Empirical work on estimating export and import functions and price elasticities in foreign trade assumes that goods in international trade can be distinguished from goods produced domestically. The measurement of price elasticities follows the standard approach in consumer theory. It is assumed that the consumer allocates his income among commodities in an effort to achieve maximum satisfaction. Total imports will be the outcome of a process whereby the quantity import goods purchased by any consumer is decided by his income, the price of imports and the price of other consumable commodities.

Aggregate import demand for the economy is expressed as

$$M = f(Y, P_m, Py) \qquad (1)$$

where Y could be nominal GDP of the country for which imports are estimated, P_m the price of imports and Py the price of domestic commodities.

The export function can be written analogously as

$$X = f(W, P_s, P_w) \tag{2}$$

where W and P_w refer to income and prices in the rest of the world and P_s is the domestic export price.

Most empirical work on the determination of income and price elasticities in foreign trade has been done on the basis of (1) and (2).

The theoretical foundation of an import demand function like (1) is discussed in an article by Armington[1] "A Theory of Demand for Products Distinguished by Place of Production". Armington makes a distinction between goods and products. Products are caracterized by place of production, whereas a good is a group of commodities from different geographical locations as illustrated in figure 1.

Figure 1. <u>The trade matrix</u>

	Supplying countries			
Goods	X_{11}	X_{12}	...	X_{1m}
	X_{21}	X_2	...	X_{2m}
	.			.
	.			.
	.			.
	X_{n1}	X_{n2}	...	X_{nm}

Product demand is derived by assuming consumers (in this case consuming nations) maximize utility subject to a budget constraint.

[1] Armington (1969)

The demand for a particular product X_{ij} is

$$X_{ij}=X_{ij}(D,P_{11}P_{12}\dots P_{1m}P_{21}P_{22}\dots P_{2m}\dots P_{n1}P_{n2}\dots P_{nm})$$

where D is an income variable, n the number of products and m the number of countries.

Several simplifying assumptions are made to get the more manageable import demand functions (1) and (2).

In particular we use the fact that products of the same kind are closely associated and assume that demand for any particular product X_{ij} can be written as a function of X_i and the relative product price in the ith market[1].

The the demand for product X_{ij} is the outcome of minimizing the cost of purchasing the volume X_i.

If many countries or areas are identified in the model the equations would be too complicated for practical use.

Typically all foreign countries are grouped together, and the demand for total imports of the ith good (X_{ij}) can then be expressed as a function of demand for the ith product i.e. the ith good, whereever produced (X_i) and the ratios of the average import price (P_{ij}) to the price level in the in the market (P_i).

Armington assumes weak separability of the utility function. Formally this means that the utility function can be expressed as

[1] Armington (1969) pp. 164-165

$$U = U(X_1(X_{11}...X_{1m})...X_n(X_{n1}...X_{nm}))$$

or equivalently that the cost function is

$$C = U \cdot Q(P_1(P_{11}...P_{tm})...P_n(P_{n1}...P_{nm}))$$

A more modern approach to consumer demand theory than that used by Armington would not impose the same restrictions on aggregate demand equations An approach based on the minimizing of the cost or expenditure function would allow a wider choice of demand functions that could be derived from a utility function.

Arminton discusses only the theory of consumer choice. However, goods aimed at final consumption are less important than intermediate goods in international trade. For example, only about 25 % of Swedish imports are classified as consumer goods. The most important class of commodities by value are industrial input goods, - about for 40 %. Fuels add another 10-15 %. Clearly a model of import behaviour must take the theory of firm demand for inputs into account.

It is usually assumed that imports of raw materials and unfinished goods can be explained by a similar equation[1].

$$M = f(Q, P_m, P_q) \qquad (1')$$

where Q is the level of production of the industry, P_m import prices and P_q prices of goods produced in the country. Such an equation can be derived from the cost function of the industry or firm.

---

[1] Leamer 1970 p. 12.

Given a cost function expressed as a function of input prices and the level of output we derive the conditional factor demands.[1]

$$x_i(y,w) = \frac{\partial c(y,w)}{\partial w_i}$$

Here w is the vector of factor prices and y the level of output.

We will not carry the discussion of the theoretical foundation of import and export functions in this paper. It should only be mentioned that a model that attempts to explain trade flows will involve other explanatory variables affecting demand besides prices and income. It is common to include explanatory variables for non-price rationing, waiting time, dummy variables for unusual events, seasonal variables and lagged variables that capture responses through time.

The specification of more refined import equations at a disaggregated level should permit the testing of whether imports are substitutes or complements to domestic goods. In practice the specification is often made more arbitrarily and inclusion of variables is often guided by information obtained from input-output tables as to the uses of the commodity in question.

b) Special problems in estimation

We will now focus on one objection to using the functional forms(1) and (2) to estimate export and import-demand elasticities that arises from a more technical point and is in no way only restricted to import export relations. It concerns the question of simultaneity.

[1] Shephards Lemma, Varian (1978) p. 32.

Whenever we observe data on prices and quantities, these are connected by both a demand and a supply equation. Without more information, a set of observations on prices and quantity tell us nothing about either equation. The equations are not identified. More information will have to be added. If we know something about the relative stability of the supply and demand curves, for example, if other influences on demand remain unchanged over time while those of supply varied, the observations would trace out a price-quantity demand curve. In practice, however, both sets of influences are likely to vary and the price quantity scatter reflects demand as well as supply shifts. In other words, given the import demand function

$$M = f(Y, Pm, Py) \qquad (1)$$

and an export function

$$X = f(W, Ps, Pw) \qquad (2)$$

the ordinary least square method will not give unbiased estimates of the parameters of these two equations, because the explanatory variables are not generally uncorrelated with the error term. A more complete model would involve the supply side as well as demand. Here the omitted variable would be any variable that could help to identify the system.

$$Q^d = \alpha_1 + \alpha_2 P_t + \ldots + \varepsilon_t$$

$$Q^s = \beta_1 + \beta_2 P_t + \ldots + u_t$$

$$Q^d = Q^s$$

Only if prices are truly exogenous - i.e. if import and export prices are given parameters not affected by the actions of agents that decide import and export quantities, will OLS estimates yield unbiased estimates of the price elasticities.

The assumption of exogenous import prices may hold for a small country like Sweden. In the case of export prices the position is harder to defend.

This problem can be solved in at least three ways.

1. Estimation of the reduced form, where by the endogenous variables in the two equations are expressed as functions of the exogenous variables. This of course necessitates the identification of the two curves, i.e., more information about factors influencing supply and demand.
2. The use of instrumental variables whereby we substitute for P_t in the demand equation another variable $\hat{P}_t$ from which correlation with the model error has been purged.
3. Simultaneous estimation of the system of equations.

Although the questions have been raised long ago,[1] only recently[2] have studies of export- and import price elasticities payed serious attention to the simultaneous equation problem, including explicit specifications of the supply functions. The "normal" procedure has been to run OLS regressions of the "demand" equations, assuming that the re-

---

[1] Orcutt (1950).

[2] Goldstein and Khan (1977) and Artus and Sosa (1978).

sults will not be too far off from a true estimate.[1] Sometimes experimentation on the supply side has been undertaken. Since the supply elasticities thus estimated are fairly high for many exporters, the bias in the estimated demand elasticities is assumed to be small.[2]

c) Some empirical results

Surveying the results of empirical studies on price elasticities gives the overall impression that a predominant number of international studies and comparisons are based on the specification in equation (1) and (2).

"Price elasticities in international trade" extensively surveys the results of studies of export and import price elasticities.[3] Table 1, taken from that publication, summarizes the "best" results obtained for several industrialized countries - i.e. results that give the expected sign of price and income variables and an estimate that seems "reasonable".

The results in general point to price elasticities in the range from -0.5 to -2.5. On a disaggregated basis there is a clear tendency for price elasticities to be lower for raw materials and input goods than for finished manufactures and consumer goods.

---

[1] Stern, Francis and Schumacher (1976) p. 7.

[2] Houthakker and Magee (1969).

[3] Estimates obtained in direct connection with general modelbuilding exercises are not included.

Table 1. Summary of Selected Elasticity Results

Imports						Exports				
SITC 0+1	SITC 2+4	SITC 3	SITC 5-9	Total imports	Country	SITC 0+1	SITC 2+4	SITC 3	SITC 5-9	Total exports
-0.80	-0.47	-0.96	-1.84	-1.66	United States	-0.85	-0.86	n.a.	-1.24	-1.41
-0.80	-0.58	-0.52	-2.06	-1.30	Canada	n.a.	n.a.	n.a.	n.a.	-0.79
-0.66	-0.91	-0.57	-1.42	-0.78	Japan	n.a.	n.a.	n.a.	1.77	-1.25
-0.58	-0.80	-1.11	-2.36	-1.08	France	n.a.	n.a.	n.a.	n.a.	-1.31
-0.78	-0.25	-1.17	-2.53	-0.88	W. Germany	n.a.	n.a.	n.a.	n.a.	-1.11
-0.87	-0.25	-0.44	-1.22	-0.65	United Kingdom	n.a.	n.a.	n.a.	-2.00	-0.48
-1.06	-0.22	-1.35	-1.34	-0.83	Belgium-Luxembourg	n.a.	n.a.	n.a.	n.a.	-1.02
-1.52	-0.47	-1.00	-2.61	-1.05	Denmark	n.a.	n.a.	n.a.	n.a.	-1.28
-1.59	-0.93	-0.44	-2.64	-1.37	Ireland	n.a.	n.a.	n.a.	n.a.	-0.86
-0.96	-0.50	-1.16	-1.02	-1.03	Italy	n.a.	n.a.	n.a.	n.a.	-0.93
-0.26	-0.94	-0.01	-0.88	-0.68	Netherlands	n.a.	n.a.	n.a.	n.a.	-0.95
n.a.	-0.27	-n.a.	-0.74	-1.32	Austria	n.a.	n.a.	n.a.	- n.a.	-0.93
-0.09	-0.50	-0.33	-0.99	-0.50	Finland	n.a.	n.a.	n.a.	n.a.	-0.78
-0.58	-1.15	-1.36	-1.65	-1.19	Norway	n.a.	n.a.	n.a.	n.a.	-0.81
-0.47	-0.52	-0.24	-1.05	-0.79	Sweden	n.a.	n.a.	n.a.	n.a.	-1.96
-0.15	-0.17	-2.78	-1.21	-1.22	Switzerland	n.a.	n.a.	n.a.	n.a.	-1.01
-0.73	n.a.	n.a.	n.a.	-0.42	Australia	n.a.	n.a.	n.a.	n.a.	-0.74
-1.12	-0.75	-0.34	-1.23	-1.12	New Zealand	n.a.	n.a.	n.a.	n.a.	-0.70

Source: Stern, Francis and Schumacher (1976), Table 2.2.

Note: "Best" Point Estimates of Long-run Elasticities of Demand for Imports and Exports, by SITC Commodity Group and Country.

Some other studies of price elasticities, (not mentioned in Stern, Francis and Schumacher) based on demand - supply estimation give results close to those obtained by OLS. Others confirms Orcutt's critique that estimates obtained by OLS regressions are biased downwards. A study of US trade by Magee[1] concludes that the simultaneous equation approach appeared superior to OLS for finished manufactures and total exports. The use of instrumental variables to reduce simultaneous equation bias in the estimation of export and import price elasticities of demand for US trade significantly increased a number of the demand elasticities.

The information in table 2 strongly suggests that a simultaneous equation estimate gives substantially higher price elasticity estimates than do the conventional (OLS) approach.

Col. 1 shows export price elasticity estimates based upon a full information maximum likelihood method. These results are compared to estimates for the same countries made by others, and to estimates made by the same authors using the same data, but assuming that regressions of quantity on price trace out the demand curve.

Sweden

Estimates of total export price elasticities for Swedish foreign trade most often point to values in the -1 to -1.5 range. Studies, where supply considerations are taken into account explicity,

---

[1] Magee (1975).

Table 2. <u>Comparison of estimated price elasticities of demand: Total exports</u>

Country	Goldstein-Khan[a]	Houthakker-Magee[b]	Goldstein-Khan[c]
Belgium	-1.57	+0.42	0.05
France	-1.33	-2.27	-1.01
Germany	-0.83	+1.70	-0.52
Italy	-3.29	-0.03	-1.11
Japan	+2.47	-0.80	0.07
Netherlands	-2.73	-0.83	-0.47
United Kingdom	-1.32	-0.44	-0.94
United States	-2.32	-1.51	-2.13

[a] Period = 1955-1970; quarterly data; estimation method = FIML.

[b] Estimates taken from Houthakker and Magee (1969), table 1, p. 113. Period = 1951-1966; annual data; estimation method = OLS.

[c] Period = 1955-1970; quarterly data; estimation method = OLS.

suggest price elasticities above -2.[1] However, these studies also differ in the assumption that the lagged effects of price changes will take longer to work through the system.

Table 3 summarizes the result of some recent studies of import and export price elasticities made for Sweden.

Lindström[2] covers three groups of commodities. Regressions are run to explain Swedish shares of imports to 13 OECD markets by the present and lagged relative price and relative tariffs. Using results obtained for individual markets the aggregated elasticities obtained in Table 3 are a weighted sum of the price elasticities of exports to individual countries. Regressions are run using OLS. No account is taken of any simultaneous equation bias. A variable for relative capacity utilization was tested to give some attention to the supply side. It was excluded from the final estimations.

Hamilton[3] estimates import price elasticities for 28 commodities. Changes in the share of imports in total domestic purchases i.e. imports/production less exports are explained by relative prices, i.e. Swedish import price and the domestic price. This study exploits the availability of Swedish production statistics on a SITC, (i.e., trade-statistics) basis, in addition to the standard (ISIC)

---

[1] Ettlin (1977), Axell (1979), Jansson (1979)

[2] Lindström (1980)

[3] Hamilton (1979)

Table 3. Summary of Price Elasticities for Sweden

	Period	Level of disaggregation	Price elasticities	
Lindström	1963-74	3 classes	1. Intermediate goods	-1.3
(Exports)	yearly data	13 countries	2. Investment goods	..
			3. Consumer goods	-2.2
			Total	-1.4
Hamilton	1960-75 yearly data	28 commodity groups	5. Textiles and Clothing	-1.7
(Imports)			6. Manufactures...	-1.5
			3. Iron and Steel	-2.0
			2. Glass	-0.8
			4. Chemicals	-0
			1. Food	-0.7
			Total	-1.7
Ettlin (Exports)	1965-74 quarterly	Manuf.goods	Exports	-2.2
(Imports)	data	Manuf.goods	Imports	-2.2
Horwitz (Exports)	1973-78 quarterly data	Manuf.goods		-1.6 -2.2
Axell (Exports)	1965-78 quarterly data	Total		-2.6
Jansson (Exports)	1963-77 yearly data		Engineering Chemicals	-2.1 -1.1

classification basis. An import price index and a production price index have been calculated using this database, a great advantage over studies where import prices and domestic prices must be obtained from different sources, one a unit value index from the customs statistics and the other a producer price index. Regression results were obtained by OLS.

The price elasticity for total exports obtained by Horwitz[1] is based on a OLS regression of Swedish market shares in total exports of manufactured goods from industrialized countries explained by Swedish export prices for manufactured goods relative to that of other industrialized countries combined.

Axell[2] obtains reduced form estimates of demand and supply price elasticities of total exports from Sweden. His results, together with those of Ettlin and Jansson, support the idea that demand price elasticities are significantly higher when the supply side is taken into account explicitly.

Ettlin[3] makes use of two export functions, depending on whether exports can be considered to be constrained from the demand or from the supply side, in a quarterly model of the Swedish economy.

Jansson[4] has estimated export price elasticities for two manufacturing sectors, chemicals and

---

[1] Horwitz (1979)

[2] Axell (1979)

[3] Ettlin (1977)

[4] Jansson (1979)

engineering, using simultaneous equation and a full information maximum likelihood procedured. The results point to supply elasticities that are very high thus indicating that the bias in estimates obtained by OLS might not be too severe. However, the demand elasticities are higher than results obtained by others.

III Price elasticities in foreign trade of a multisector model for Sweden

a) The Data

In the model, for which estimates of import and export price elasticities were a required input, productive activity is broken down into 17 sectors. Number 1-3 covering agriculture, forestry and mining, 4-17 covering manufacturing industry proper. We have made an effort to estimate price elasticities on goods following to this breakdown, but due to the scarcity of information on prices and quantities in international trade estimates at such a disaggregated level must be considered extremely tentative.

Data, used to estimate import relations, were obtained from the data base used in the Swedish Long Term Surveys. Domestic production as well as imports and exports for each sector are given in constant 1975 prices. In order to calculate export market shares data has been collected from international trade statistics.[1] The classification, to obtain trade statistics corresponding to production data is extremely rough, as shown in Table 4. A more detailed collection of data was not feasible given the number of countries and products involved.

In order to obtain price indices, data for current value imports and exports have been collected, and implicit price indices for exports and imports for each sector have been calculated.

---

[1] OECD Trade by Commodities. Series B.

Table 4. Classification used for calculation of export market shares

Sector		ISIC	SITC[1]
7	Textile and clothing industry	32	61, 65, 83-85
8	Wood, pulp and paper industry	33, 341	24, 25, 63, 64, 82
(10 (	Rubber products) industry)	355	62
11	Chemical industry	351, 352, 356	51-59, 26, part of 89, part of 4
(12 (	Petroleum and coal) industry)	353, 354	11
(13 (	Non-metallic mineral) product)	36	66, part of 81
14	Basic metal industries	37	67, 68
15	Engineering excl shipyards	38 excl 3841	69, 7 excl 735, part of 81
(16	Shipyards)	3841	735
17	Other manufacturing	39	-

[1] Rough classification to illustrate export pattern and export market shares for the commodity groups concerned.

Note: Crude oil is not included in sector 3 but classified in sector 12 in the export share analysis.

The price indices used are so called unit values, i.e. implicit prices obtained from custums statistics whereby total value is divided by quantity with little regard paid to quality differences etc. The use of this proxy price index could affect the results as compared to a proper price index.[1]

In this paper the export price index is even one step further removed from the desired price index. Due to the lack of data for the commodity groups corresponding to those used in the model, the relative price for exports is obtained by comparison of a Swedish export price and an international price index at a higher level of aggregations. As a consequence export functions were only run for 5 commodity groups for which an international price thus defined, could be relatively easily obtained.

The ultimate choice of variables to include in each export and import function are limited by the use made of the model at the expense of having the best possible equation in each case. High accuracy would require inputs - forecasts for other explanatory variables - that are not realistic to make in connection with this modelling excercise.

b) Import price elasticities

Imports to Sweden were tested in three ways for each sector explaining the import share of total supply by the relative price between imports and Swedish producer prices.

---

[1] Kravis, Lipsey and Bushe (1980)

Estimates of import price elasticities in the present paper are based on the equation

$$\frac{M}{Y} = f(P_y/P_m)$$

where Y stands for domestic supply i.e. total production plus imports less exports, P_m the price of imports and P_y the domestic price. The price coefficient is expected to be positive since an increase in the relative price i.e. domestic price relative to the foreign price increases the level of imports.

The three equations tested are the import share explained by relative prices the same year and the two previous years; import shares explained by relative prices and a trend; import shares explained by lagged relative prices over time (Koych-lag). A summary of the results are found in Table 5 where the price coefficient in col.1 and 2 is the sum of the first and second year.

The results are rather robust against changes in the specification i.e. whether price elasticities are obtained using a 2 year lagged effect of relative price changes, or a trend for the import share, or a declining weight pattern for the influence of relative prices.

The results reported in the appendix suggest, however, that better estimates of import demand could be obtained using a more elaborate specification than equation (1). It is also evident that the level of aggregation is not well suited for the purpose of estimating import equations.

Table 5. Summary of import price elasticities using three specifications of the import function

	2yearlag	2yearlag and trend	Koycklag
Sector 5 Food industry	-	0.3	1.2
Sector 6 Beverages	1.8	1.8	1.1
Sector 7 Textile	5.8	2.1	6.2
Sector 8 Wood, pulp, paper	1.7	-	2.2
Sector 9 Printing	0.8	0.9	1.9
Sector 10 Rubber products	2.6[1]	1.4	-
Sector 11 Chemicals	-	0.3	-
Sector 12 Petroleum	-	-	-
Sector 13 Non metallic minerals	-	0.3	-
Sector 14 Basic minerals	1.1	0.4	2.1
Sector 15 Engineering (excl. shipyards)	-	0.9[2]	0.5
Sector 17 Other manufact.	2.3	0.5	1.4

[1] Only one year lag included

[2] Only first year effect

c) Export price elasticities

The export market share regressions were performed using a somewhat different approach. Five sectors, in which exports constitute a substantial part of total production and for which a relative price seemed relevant in explaining export performance were included. The 1963-1977 development of market shares of Swedish exports in total OECD-imports[1] for these sectors are given in Figure 2. A more detailed analysis of export shares in current prices by market and commodity groups is found in Horwitz (1979).[2]

Swedish relative prices in the current and previous year were used to explain the Swedish market share of imports to three markets, the Nordic market, Western Europe excluding the Nordic countries and North America.

$$\frac{X}{W} = f\left(\frac{P_s}{P_w}\right)$$

The results in Table 6, point to a price elasticity of about -1.4 for total Swedish exports, the main impact falling on the year after the relative price change. This result holds for the total of the sectors included as well as for the most important sector - the engineering sector.[3]

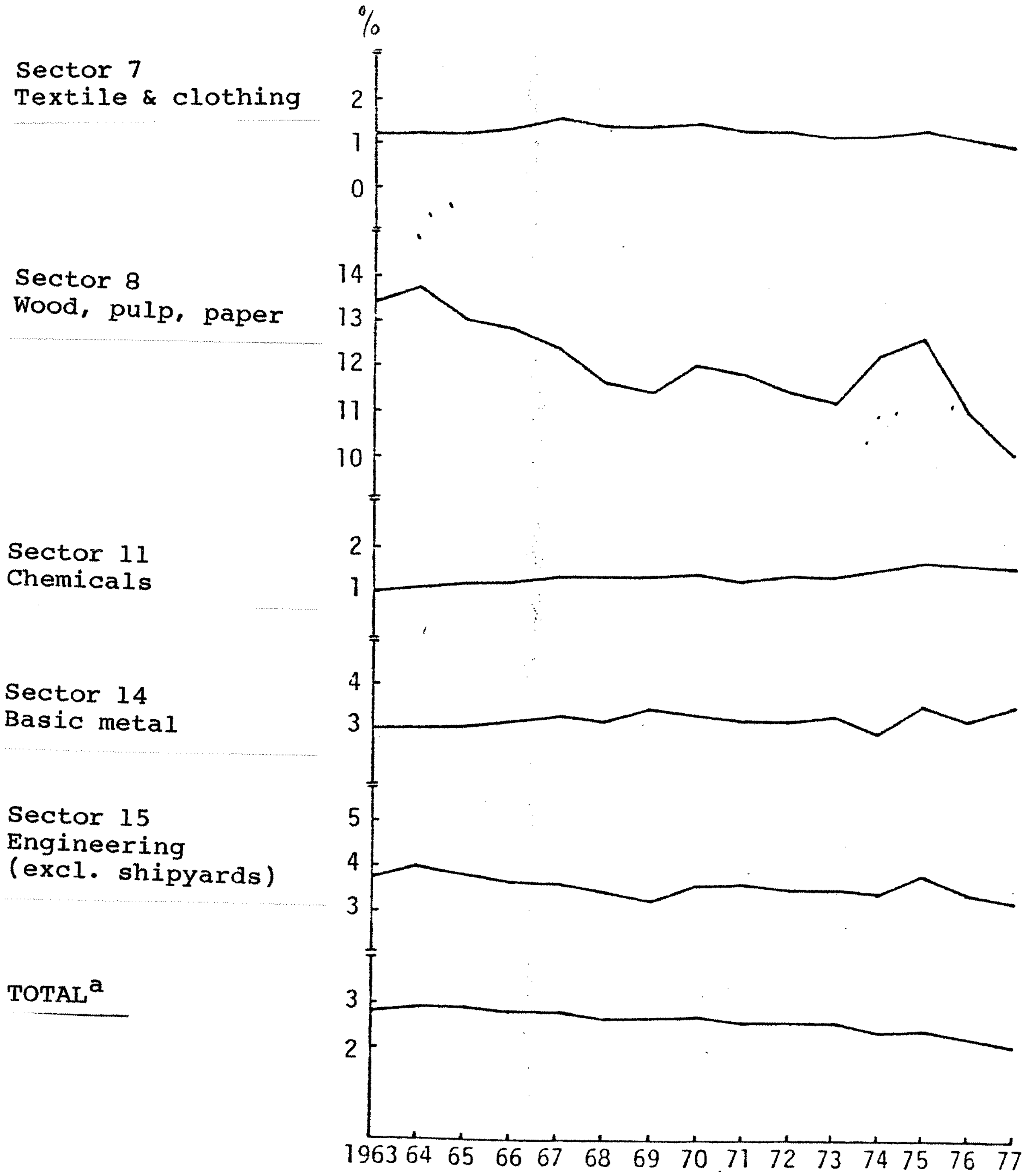
---

[1] Sum of 14 OECD-countries

[2] Horwitz, EC (1979)

[3] Results using a similar approach by Lindsträm (1980) gave no significant result for investment goods, the price elasticity of which was assumed to be -1.0

Figure 2. The Swedish market share in OECD[a] imports



a) The sum of 14 countries.

Price elasticities seem to be much lower for exports to the Nordic countries than for exports to Western Europe and North America where price elasticities tend to be around -2. More detailed results giving commodity and market breakdowns are found in the appendix.

Table 6. Export price elasticities
For detailed results, see appendix

	Nordic Countries	Western Europa	North America	Total
Sector 7 Textile & clothing	-3.7	-1.9	0.8	-
Sector 8 Wood, pulp, paper	-1.3	-2.5	-5.3	-
Sector 11 Chemicals	1.0		-4.1	-
Sector 14 Basic metal	0.6	0.1	-0.5	-
Sector 15 Engineering (excl. shipyards)	-0.5	-1.0	-2.4	-1.4
TOTAL[a]	-0.2	-1.8	-1.8	-1.4

[a] Estimate for total export.

APPENDIX

SWEDISH IMPORTS

$$\log \frac{M}{Y} = C + \beta_1 \log\left(\frac{P_y}{P_m}\right)_t + \beta_2 \log\left(\frac{P_y}{P_m}\right)_{t-1} + \beta_3 \log\left(\frac{P_y}{P_m}\right)_{t-2}$$

(Standard error in brackets)

	C	β_1	β_2	β_3	SEE	R^2
Sector 3	-0.203	0.014	-0.060	-0.058	0.04	0.35
		(0.05)	(0.06)	(0.057)		
Sector 4	-2.43	0.169	-0.07	-0.006	0.07	-0.09
		(0.014)	(0.17)	(0.144)		
Sector 5	-1.32	-0.166	0.133	-0.100	0.05	-0.20
		(0.21)	(0.26)	(0.21)		
Sector 6	-1.55	1.119	-0.543	1.265	0.04	0.83
		(0.25)	(0.40)	(0.29)		
Sector 7	-0.66	2.611	0.92	2.32	0.05	0.96
		(0.40	(0.49)	(0.40)		
Sector 8	-2.385	3.09	-2.62	1.186	0.14	0.65
		(1.35)	(2.37)	(1.55)		
Sector 9	-2.96	0.006	0.362	0.433	0.04	0.98
		(0.30)	(0.39)	(0.32)		
Sector 10	-1.05	2.206	0.382	-1.44	0.18	0.40
Sector 11	-0.77	-0.137	-0.065	0.052	0.03	-0.06
		(0.11)	(0.14)	(0.14)		
Sector 12	-0.30	-0.117	0.036	-0.161	0.11	-0.18
		(0.27)	(0.33)	(0.27)		
Sector 13	-1.84	4.103	-5.708	-0.732	0.14	0.48
		(1.46)	(2.09)	(1.30)		
Sector 14	-1.08	0.454	0.659	-0.332	0.09	0.14
		(0.48)	(0.56)	(0.49)		
Sector 15	-0.99	-0.084	1.516	-3.198	0.05	0.74
		(0.77)	(1.12)	(0.69)		
Sector 16	-0.76	1.625	-0.327	-0.139	0.50	0.10
		(0.93)	(1.04)	(0.97)		
Sector 17	-0.38	0.439	0.980	0.918	0.14	0.21
		[illegible]	[illegible]	[illegible]		

SWEDISH IMPORTS

$$\log \frac{M}{Y} = C + \beta_1 \log\left(\frac{P_y}{P_m}\right)_t + \beta_2 \log\left(\frac{P_y}{P_m}\right)_{t-1} + \beta_3 \log\left(\frac{P_y}{P_m}\right)_{t-2} + \text{trend}$$

(Standard error in brackets)

	C	β_1	β_2	β_3	trend	SEE	R^2
Sector 3	-0.204	0.002 (0.06)	-0.069 (0.07)	-0.068 (0.06)	-0.002	0.04	0.30
Sector 4	-2.35	-0.036 (0.16)	-0.040 (0.149)	-0.198 (0.159)	0.012 (0.01)	0.06	0.15
Sector 5	-1.288	-0.016 (0.13)	0.146 (0.16)	0.167 (0.15)	0.009 (0.002)	0.03	0.54
Sector 6	-1.547	1.101 (0.27)	-0.526 (0.43)	1.240 (0.34)	0.001 (0.003)	0.04	0.32
Sector 7	-0.547	1.019 (0.35)	0.363 (0.27)	0.718 (0.35)	0.037 (0.006)	0.03	0.99
Sector 8	-2.28	0.724 (0.61)	-1.686 (0.93)	1.024 (0.602)	0.050 (0.006)	0.05	0.95
Sector 9	-2.96	0.086 (0.307)	0.362 (0.40)	0.433 (0.32)	0.041 (0.01)	0.04	0.98
Sector 10	-0.72	0.332 (0.31)	0.691 (0.59)	0.383 (0.55)	0.042 (0.004)	0.05	0.94
Sector 11	-0.76	0.005 (0.157)	0.076 (0.17)	0.189 (0.17)	0.005 (0.003)	0.03	0.00
Sector 12	-0.49	-0.044 (0.09)	0.053 (0.11)	0.112 (0.09)	-0.024 (0.002)	0.04	0.87
Sector 13	-1.59	0.704 (0.72)	0.305 (0.13)	-0.756 (0.51)	0.038	0.05	0.92
Sector 14	-0.97	-0.007 (0.22)	0.413 (0.25)	0.020 (0.21)	0.018 (0.002)	0.04	0.84
Sector 15	-0.87	0.887 (0.44)	-0.315 (0.69)	-0.422 (0.64)	0.019 (0.003)	0.03	0.93
Sector 16	-0.83	0.853 (1.04)	-1.088 (1.129)	-0.883 (1.07)	-0.883 (0.07)	0.48	0.18
Sector 17	-0.36	0.391 (0.225)	0.154 (0.37)	-0.027 (0.37)	0.041 (0.005)	0.06	0.38

SWEDISH IMPORTS

$$\log \frac{M}{Y} = C + \beta_1 \log \frac{P_Y}{P_m} + \beta_2 \log \frac{M}{Y}_{(t-1)}$$

(Standard error in brackets)

	C	β_1	β_2	SEE	$\bar{R}^2$
Sector 3	-0.17	-0.05 (0.30)	0.236 (0.30)	0.04	0.20
Sector 4	-1.87	0.065 (0.14)	0.230 (0.36)	0.07	-0.01
Sector 5	-0.164	0.145 (0.11)	0.884 (0.21)	0.03	0.56
Sector 6	-1.23	0.882 (0.33)	0.203 (0.18)	0.06	0.41
Sector 7	-0.022	0.647 (0.30)	0.895 (0.06)	0.03	0.98
Sector 8	-0.15	0.198 (0.37)	0.911 (0.21)	0.08	0.87
Sector 9	-0.82	0.545 (0.22)	0.717 (0.11)	0.05	0.97
Sector 10	0.108	-0.03 (0.25)	1.054 (0.09)	0.04	0.96
Sector 11	-0.54	-0.085 (0.09)	0.294 (0.28)	0.02	0.05
Sector 12	-0.005	0.048 (0.07)	1.075 (0.12)	0.04	0.85
Sector 13	0.16	-0.164 (0.35)	1.065 (0.09)	0.05	0.92
Sector 14	-0.23	0.515 (0.21)	0.751 (0.15)	0.04	0.75
Sector 15	-0.04	0.031 (0.36)	0.934 (0.13)	0.05	0.77
Sector 16	-0.67	0.995 (0.74)	0.151 (0.29)	0.50	0.13
Sector 17	-0.04	0.147 (0.225)	0.898 (0.119)	0.06	0.84

SWEDISH EXPORTS

$$\log \frac{X}{W} = C + \alpha_1 \log\left(\frac{P_s}{P_w}\right)_t + \alpha_2 \log\left(\frac{P_s}{P_w}\right)_{t-1}$$

(Standard error in brackets)

	C	α_1	α_2	SEE	$\bar{R}^2$	DW
Nordic Countries						
Total exports	3.8	0.39 (0.4)	-0.59 (0.7)	0.07	-0.9	0.50
Sector 7	3.7	-1.69 (1.3)	-1.97 (1.4)	0.12	0	0.76
Sector 8	9.4	-0.53 (0.3)	-0.68 (0.4)	0.12	0.31	0.74
Sector 11	-1.99	1.25 (1.1)	-0.27 (0.2)	0.11	0.31	0.91
Sector 14	0.16	-0.86 (0.5)	1.46 (0.9)	0.15	0	0.91
Sector 15	5.27	0.42 (0.7)	-0.92 (1.4)	0.06	0.25	1.00
Western Europe						
Total exports	9.68	-0.89 (-1.7)	-0.91 (1.7)	0.05	0.90	0.89
Sector 7	8.5	-0.49 (0.7)	-1.45 (1.9)	0.07	0.82	1.58
Sector 8	14.25	-0.92 (2.1)	-1.56 (3.3)	0.04	0.95	1.51
Sector 14	0.73	-0.24	0.34	0.076	-0.14	2.19
Sector 15	5.46	0.16 (0.3)	-1.12 (1.7)	0.059	0.60	1.47
North America						
Total exports	8.68	0.18 (0.2)	-2.00 (1.9)	0.097	0.68	0.94
Sector 7	-8.5	3.3 (1.5)	-2.55 (1.1)	0.20	0.08	1.1
Sector 8	24.2	-5.3 (1.6)	0.03 (0)	0.30	0.65	0.84

	C	α_1	α_2	SEE	$\bar{R}^2$	DW
Sector 11	-2.7	-2.3 (0.9)	-1.8 (0.8)	0.22	0.05	1.23
Sector 14	3.18	0.61 (0.4)	-1.14 (0.7)	0.14	-0.05	1.49
Sector 15	11.4	0.04 (0.03)	-2.40 (1.9)	0.11	0.72	0.88
<u>Aggregate estimates</u>						
Sector 15	7.6	0.06 (0.7)	-1.4 (1.7)	0.07	0.68	1.04
TOTAL	7.9	-0.27 (0.6)	-1.13 (2.2)	0.045	0.86	1.17

REFERENCES

Armington, Paul S. A Theory of Demand for Products Distinguished by Place of Production. IMF Staff Paper (March 1969).

Artus Jacques R and Susana C Sosa. "Relative Price Effects on Export Performance: The Case of Electrical Machinery. IMF Staff Papers. March 1978.

Axell, Bo., 1979. "Inflation och resursutnyttjande" (Inflation and Capacity Utilization) in Utrikeshandel, inflation och arbetsmarknad (Foreign Trade, Inflation and the Labor Market). Special Studies for the IUI Medium Term Survey 1979. Vol.1 1979.

Ettlin, Franz. Arbetskostnader, priser och exportandelar. Skandinaviska Enskilda Bankens kvartalsskrift No. 1-2, 1977.

Ettlin, Franz. Några viktiga ekvationer i STEP 1 modellen på kvartalsbasis 1976 (Some important equations in the STEP 1 quarterly model). (Mimeograph).

Goldstein, Morris, Khan Moshin S. The Supply and Demand for Exports: A Simultaneous Approach. The Review of Economics and Statistics. May 1978.

Hamilton, Carl. Import Penetration and Import Price Elasticities with Special Reference to Dynamic LDC Export Commodities. The Case of Sweden 1960-1975. Institute for International Economic Studies, Seminar paper No. 116, February 1979.

Horwitz, E.C., 1979. Världshandeln, marknadsandelar och svenska kostnader (World Trade, Swedish Market Shares and Relative Costs) in Utrikeshandel, inflation och arbetsmarknad (Foreign Trade, Inflation and the Labor Market) Special Studies for the IUI Medium Term Survey 1979, Vol. 1 1979.

Houthakker, HS and Magee, Stephen P. Income and Price Elasticities in World Trade. The Review of Economics and Statistics. May 1969.

Janson, Leif. Sammanfattning av estimerade exportfunktioner fär verkstads- och kemiindustri. (Summary of estimates of export functions for the engineering and chemical industries). IUI 1979. (Mimeograph).

Kravis, I.B., Lipsey, R.E., Bushe, D.M. "Prices and Market Share in International Machinery Trade", National Bureau of Economic Research. Working Paper No. 521. July 1980.

Leamer, Edward E. and Stern, Robert. Quantitiative International Economics. Allyn and Bacon, Boston (1970).

Lindsträm, Lennart. "Export by Demand Groups" in Swedish Exports Prospects up to 1983 by Nils Gottfries and Lennart Lindsträm. National Institute of Economic Research. Occasional Paper 12. Stockholm 1980.

Orcutt, G.H. "Measurement of Price Elasticities in International Trade." Review of Economics and Statistics (May 1950).

Magee, S.P. "Price, Incomes, and Foreign Trade" in International Trade and Finance; Frontiers for Research. Ed by Peter B. Kenen, Cambridge University Press (1975).

Richardson, J.D. "Some Issues in the Structural Determination of International Price Responsiveness" in Quantitative studies of international economic relations .Ed by Herbert Glejser, North Holland, Amsterdam (1976)

Stern, R.M.J., Francis and Schumacher. Price elasticities in international trade. Trade Policy Research Center, Macmillan, London (1976).