

PRICE ELASTICITIES IN SWEDISH FOREIGN TRADE

by Eva Christina Horwitz

CONTENTS

	Page
I INTRODUCTION	171
II TIME SERIES ESTIMATION OF PRICE ELASTICITIES IN INTERNATIONAL TRADE	172
a) The Theoretical Background	172
b) The Least Squares Bias in Single Equation Estimation	175
c) Some Empirical Results	177
III DISAGGREGATED PRICE ELASTICITIES IN SWEDISH FOREIGN TRADE	182
a) The Data	182
b) Import Price Elasticities	184
c) Export Price Elasticities	185
APPENDIX	189
NOTES	194
REFERENCES	195

I INTRODUCTION

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 exercise, 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 exercise. 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 are, however, close to those obtained for Sweden in most studies using single equation methods of estimation. When aggregating over the commodity groups we find a price elasticity of about -1.4 for total Swedish exports, the main impact falling in 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 price elasticity for aggregate imports seems to be just below 1 in this exercise.

II TIME SERIES ESTIMATION OF PRICE ELASTICITIES IN INTERNATIONAL TRADE

a) The Theoretical Background

Empirical work on estimating export and import functions and price elasticities in foreign trade is based on the assumption 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

$$M = f(Y, P_m, P_y) \quad (1)$$

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

The export function can be written analogously as

$$X = f(W, P_s, P_w) \quad (2)$$

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).

An attempt at providing a rationale for an import demand function like (1) is discussed by Armington (1969) in his article "A Theory of Demand for Products Distinguished by Place of Production". Armington makes a distinction between goods and products. Products are characterized by kind as well as by place of production, whereas a good is a group of products from different geographical locations as illustrated in figure 1.

Figure 1 The trade matrix

		Supplying countries			
		1	2	...	m
Goods	1	X_{11}	X_{12}	...	X_{1m}
	2	X_{21}	X_{22}	...	X_{2m}
	.	.			.
	.	.			.
	.	.			.
	n	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.

The demand for a particular product X_{ij} by any particular country C_i 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. Since there are m demands for each product, and since there are mn products, the demand side is comprised of m^2n product demands of which mn are domestic demands and $mn(n-1)$ are export or import demands.

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

Several simplifying assumptions are made to get the extremely simplified import demand function (1).

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 i th market. (Armington (1969), pp. 164-165.) Formally Armington assumes weak separability of the utility function which implies that the demand for product X_{ij} is the outcome of minimizing the cost of purchasing the volume X_i .

Typically all foreign countries are grouped together, and the demand for total imports of the i th good (X_{ij}) is expressed as a function of demand for the i th good, wherever produced (X_i) and the ratios of the average import price (P_{ij}) to the price level in the market (P_i), where j stands for the j th group of countries.

Armington discusses only the theory of consumer choice. However, final consumption goods are less important than intermediate goods in international

trade. For example, only about 25 percent of Swedish imports are classified as consumer goods. The most important class of commodities by value are industrial input goods, about for 40 percent. Fuels add another 10-15 percent. Clearly a model of import behavior must draw on the theory of firm demand for inputs.

It is usually assumed that imports of raw materials and unfinished goods can be explained by a similar equation. (Leamer (1970), p. 12.)

$$M = f(Q, P_m, P_q) \quad (3)$$

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.

A model that attempts to explain trade flows will involve other explanatory variables affecting demand besides prices and income. It is common practice 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.

b) The Least Squares Bias in Single Equation Estimation

Although the questions have been raised long ago, (Orcutt (1950)) only recently (Goldstein and Khan (1977) and Artus and Sosa (1978)) have studies of export- and import price elasticities paid serious attention to the least squares bias and simultaneous equation problem. The "normal" procedure

has been to run OLS regressions of the "demand" equations, assuming that the results will not be too far from a true estimate of the demand price elasticities. (Stern, Francis and Schumacher (1976), p.7.)

Equation (1) and (2) intend to capture the demand relation. But data on prices and quantities, are connected by both a demand and a supply equation. A set of observations on prices and quantities tells us little 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 influence are likely to vary and the price quantity scatter reflects demand as well as supply shifts. In other words, the ordinary least square method will not give unbiased estimates of the parameters, because the explanatory variables are not generally uncorrelated with the error term.

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. This amounts to the assumption of perfect elasticity of supply.

The assumption of totally elastic supply may hold for imports to a small country like Sweden. Estimates of import demand price elasticities on the basis of OLS regressions can be an acceptable

method as far as small countries are concerned. In the case of estimates of export demand the assumption of a perfectly elastic supply curve is harder to defend. We have nevertheless estimated export price elasticities by OLS regressions in this paper. The results can be interpreted as demand price elasticities under the assumption of perfectly elastic supply or as weighted averages of the supply and demand price elasticities.

c) Some Empirical Results

Surveying the results of empirical studies on price elasticities gives the overall impression that most national studies and international comparisons are based on a single equation specification like (1) and (2).

"Price elasticities in international trade" by Stern, Francis and Schumacher (1976) extensively surveys the results of studies of export and import price elasticities.¹ Table 1, taken from that publication, summarizes the "best" results obtained for several industrialized countries - i.e. results that give price and income variable coefficients with the expected sign and of "reasonable" magnitudes.

The results in general give 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.

From a Swedish perspective it is worth noting that export price elasticities seem to be the highest

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.

for Swedish exports. This is a finding that deserves a more extensive analysis than can be presented in this brief survey.²

Estimates of total export price elasticities for Swedish foreign trade in different studies most often point to values in the -1 to -1.5 range. Studies in which supply considerations are taken into account explicitly suggest price elasticities around -2. (Ettlin (1977), Axell (1979), Jansson (1979).) But "two equation" studies also differ in assuming that the lagged effects of price changes will take longer to work through the system.

Table 2 summarizes the result of some recent studies of import and export price elasticities made for Sweden.

Lindström (1980) estimates export price elasticities for Sweden by explaining Swedish shares of imports to 13 OECD markets for three commodity groups - intermediate goods, investment goods and consumer goods - by the present and lagged relative prices and relative tariffs. The aggregation of the 39 elasticities obtained results in an estimate of the total elasticity of -1.4.

Hamilton (1979) 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) classification basis.

Table 2 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	28 commodity groups	5. Textiles and Clothing	-1.7
(Imports)	yearly data		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	1965-74	Manuf.goods	<u>Exports</u>	-2.2
(Exports)	quarterly			
(Imports)	data	Manuf.goods	<u>Imports</u>	-2.2
Horwitz	1973-78	Manuf.goods		-1.6
(Exports)	quarterly data			-2.2
Axell	1965-78	Total		-2.6
(Exports)	quarterly data			
Jansson	1963-77		Engineering	-2.1
(Exports)	yearly data		Chemicals	-1.1

The price elasticity for total exports obtained by Horwitz (1979) is based on a OLS regression of Swedish market shares in total exports of manufactured goods from industrialized countries on Swedish relative export prices for manufactured goods.

Axell (1979) estimates reduced-form 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 (1977) also takes the least squares bias into consideration by estimating two export functions, depending on whether exports can be considered to be constrained from the demand or from the supply side.

Jansson (1979) estimates export price elasticities for two manufacturing sectors, chemicals and engineering, using full information maximum likelihood. Supply elasticities in his estimate are high, which indicates that the bias in estimates obtained by OLS might not be too severe. However the demand elasticities are higher than those obtained by others.

III DISAGGREGATED PRICE ELASTICITIES IN SWEDISH FOREIGN TRADE

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, 1-3 cover agriculture, forestry and mining, and 4-17 cover manufacturing industry proper. We have made an effort to estimate price elasticities on goods following this breakdown, but due to poor data on prices in international trade estimates at such a disaggregated level must be considered extremely tentative.

Data for import relations were obtained from Swedish official statistics used in the Swedish Long Term Surveys. Domestic production as well as imports and exports for each sector were given in constant 1975 prices. Export data has also been collected from international trade statistics. (OECD Trade By Commodities, Series B.) The classification to match trade statistics to production data is shown in Table 3. Collection of more detailed data was not feasible given the number of countries and products involved.

Implicit price indices have been calculated using data for current value imports and exports and the 1975 constant prices series in the above mentioned data base.

The price indices normally used in the estimation of foreign trade price elasticities are the so called unit values, implicit prices obtained from

**Table 3 Classification of trade statistics used
for calculation of export market shares**

Sector	ISIC	SITC Rev
7 Textile and clothing industry	32	61, 65, 83-85
8 Wood, pulp and paper industry	33, 341	24, 25, 63, 64, 82
11 Chemical industry	351, 352, 356	51-59, 26, part of 89, part of 4
14 Basic metal industries	37	67, 68
15 Engineering excl shipyards	38 excl 3841	69, 7 excl 735, part of 81
17 Other manufacturing	39	-

customs statistics, where total value is divided by quantity, and quality differences neglected. The use of this proxy price index may give results very different from those obtained with a proper price index. (Kravis, Lipsey and Pushe (1980).)

Due to the lack of data on prices for the commodity groups corresponding to those used in the model, export functions were only run for 5 commodity groups for which an international price thus defined, could be relatively easily obtained. And even in those instances the relative price for exports is obtained by comparison of a Swedish export price and an international price index at a somewhat higher level of aggregation.

b) Import Price Elasticities

Equations for imports to Sweden for each sector were expressed as the import share of total supply as a function of the relative price between import prices and Swedish producer prices.

The regression run was

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

where M and Y are expressed in volume and 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 index.

The price coefficient is expected to be positive in this formulation since an increase in the relative price (i.e., in domestic prices relative to the foreign prices) increases the level of imports.

Three equations were estimated: 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 the relative price and the lagged import share (Koycklag). A summary of the results are found in Table 5, where the price coefficients in col. 1 and 2 refer to the sums of the first and second years.

The results are rather robust against changes in the specification of the lag-structure. 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 present level of aggregation is not well suited to the task of estimating import equations.

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 1963-77 pattern of market shares of Swedish exports in total OECD-imports (Sum of 14 OECD-countries) for those 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 EC (1979).

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. The equation tested was

$$\frac{X}{W} = f\left(\frac{P_S}{P_W}\right)$$

where X and W are expressed in volume.

The results in table 5 point to a price elasticity of about -1.4 for total Swedish exports, the main impact falling in 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

**Table 4 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 ^a	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 ^b	0.5
Sector 17 Other manufact.	2.3	0.5	1.4

^a Only one year lag included

^b Only first year effect

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.

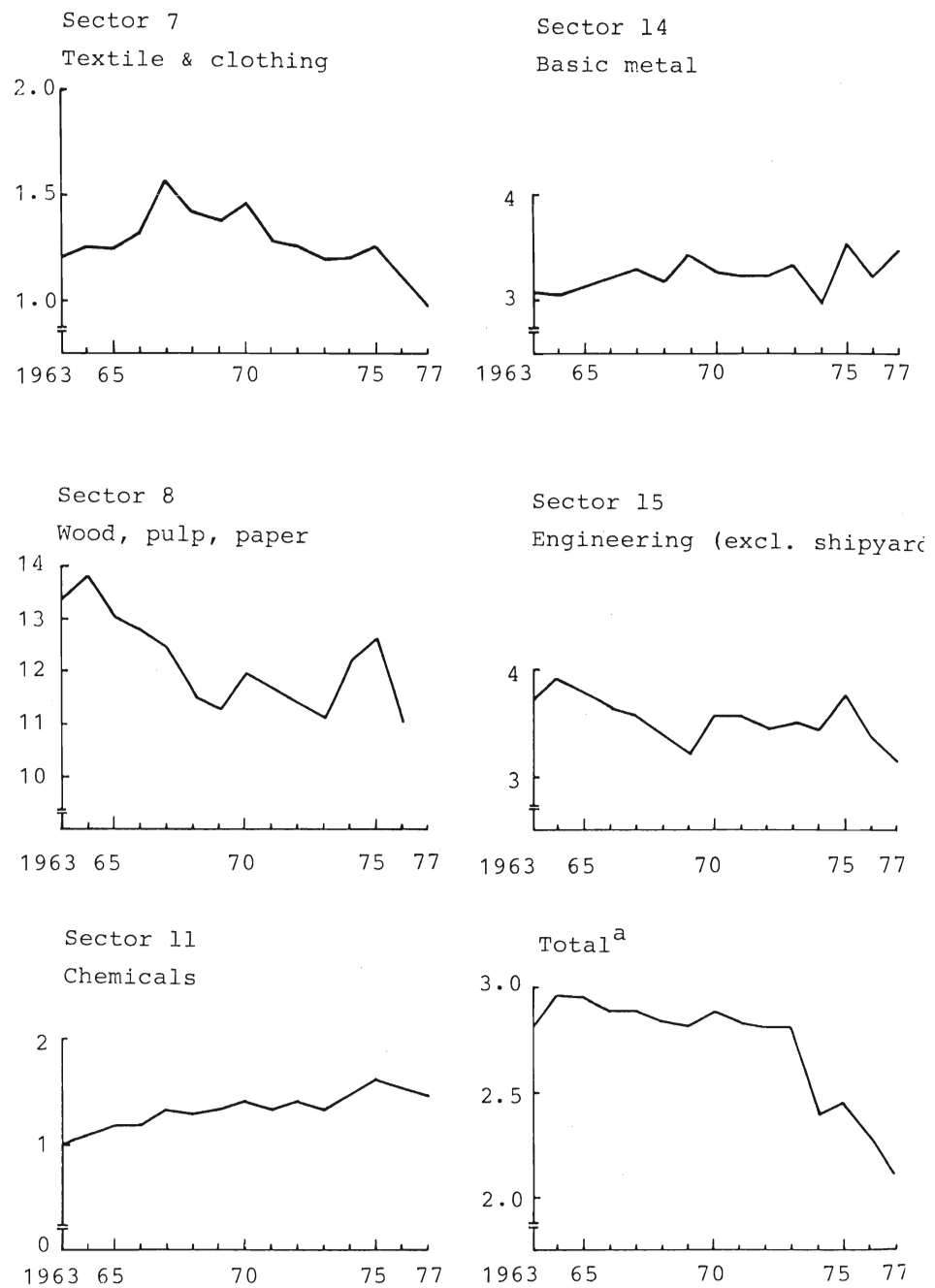
Table 5 Export price elasticities

For detailed results see Appendix

	Nordic Countries	Western Europe	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.

Figure 2 The Swedish market share in OECD^a imports



^a The sum of imports to 14 countries.

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 (0.05)	-0.060 (0.06)	-0.058 (0.057)	0.04	0.35
Sector	4	-2.43	0.169 (0.014)	-0.07 (0.17)	-0.006 (0.144)	0.07	-0.09
Sector	5	-1.32	-0.166 (0.21)	0.133 (0.26)	-0.100 (0.21)	0.05	-0.20
Sector	6	-1.55	1.119 (0.25)	-0.543 (0.40)	1.265 (0.29)	0.04	0.83
Sector	7	-0.66	2.611 (0.40)	0.92 (0.49)	2.32 (0.40)	0.05	0.96
Sector	8	-2.385	3.09 (1.35)	-2.62 (2.37)	1.186 (1.55)	0.14	0.65
Sector	9	-2.96	0.006 (0.30)	0.362 (0.39)	0.433 (0.32)	0.04	0.98
Sector	10	-1.05	2.206	0.382	-1.44	0.18	0.40
Sector	11	-0.77	-0.137 (0.11)	-0.065 (0.14)	0.052 (0.14)	0.03	-0.06
Sector	12	-0.30	-0.117 (0.27)	0.036 (0.33)	-0.161 (0.27)	0.11	-0.18
Sector	13	-1.84	4.103 (1.46)	-5.708 (2.09)	-0.732 (1.30)	0.14	0.48
Sector	14	-1.08	0.454 (0.48)	0.659 (0.56)	-0.332 (0.49)	0.09	0.14
Sector	15	-0.99	-0.084 (0.77)	1.516 (1.12)	-3.198 (0.69)	0.05	0.74
Sector	16	-0.76	1.625 (0.93)	-0.327 (1.04)	-0.139 (0.97)	0.50	0.10
Sector	17	-0.38	0.439 (0.52)	0.980 (0.89)	0.918 (0.92)	0.14	0.21

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

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

(Standard error in brackets)

		C	β_1	β_2	SEE	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	R ⁻²	DW
<u>Nordic Countries</u>						
<u>Total exports</u>	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
<u>Western Europe</u>						
<u>Total exports</u>	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
<u>North America</u>						
<u>Total exports</u>	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	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

NOTES

¹ Estimates obtained in direct connection with general model building exercises are not included.

² Similar results are obtained by Horwitz (1982) OLS estimates of demand price elasticities for export of manufactured goods from 11 industrialized countries. The results rest heavily on the assumption of perfect elasticity of supply. When supply elasticities are allowed to be less than infinite, Swedish export demand price elasticities are more compatible with those of other countries.

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

REFERENCES

- Armington, Paul S. A theory of Demand for Products Distinguished by Place of Production. IMF Staff Paper (March 1969).
- Artur Jacques R. and Susanna 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.
- Horwitz, E.C., 1982. Price Elasticities in Swedish Foreign Trade. IUI Working Paper 1982.
- Howthakker, 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 för verkstads- och kemiindustri. (Summary of estimates of export functions for the engineering and chemical industries). IUI 1979. (Mimeograph).
- Kravis I.B., Lipsey R.F., 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. Quantitative International Economics. Allyn and Bacon, Boston (1970).
- Lindström, Lennart. "Export by Demand Groups" in Swedish Exports Prospects up to 1983 by Nils Gottfries and Lennart Lindström. 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. Keenan, Cambridge University Press (1975).

Richardson, J.D. "Some Issues in the Structural determination of international price responsibleness" in Quantitative studies of international economic relations. Ed by Herbert Glejser, North Holland, Amsterdam (1976)

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