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NONELECTRICAL MACHINERY

NONELECTRICAL MACHINERY is by far the largest division of those included in this study, encompassing almost a third of OECD exports in the products covered. Aside from a brief description of the division as a whole, we have chosen seven groups and subgroups for more detailed discussion. These are aircraft engines, other internal combustion engines, agricultural machinery, office machinery, metalworking machine tools, textile and leather machinery, and mechanical handling equipment.

The United States was the leading exporter of nonelectrical machinery, followed by Germany and the United Kingdom, with Japan a comparatively minor factor (Table 12.1). Germany dominated the market in the European OECD countries, which were the destination of almost half of OECD exports in 1963. The United States accounted for more than half of imports into Canada, Japan, and Latin America, and the United Kingdom was the strongest exporter to "other destinations," mainly Africa and Asia. The United Kingdom was not the largest exporter in any of the individual SITC groups. It was second to the United States and far ahead of Germany in power generating and agricultural machinery. Germany was the largest source of exports in metalworking and textile and leather machinery, with a long lead over both the United States and the United Kingdom. The United States accounted for almost a third or more of OECD exports of power generating, agricultural, office, and special industry machinery and was substantially ahead of its nearest rival in each. Japan's share was over 2

Note: SITC 71. *Value of OECD exports in 1963:* $14.2 billion; 31.8 per cent of study total. *Coverage:* Power generating machinery; agricultural machinery; office machines; metalworking machinery; textile and leather machinery; other nonelectrical machinery.

Table 12.1
OECD Exports of Nonelectrical Machinery (SITC 71),
by Origin, Destination, and Commodity Group, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 71	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations and groups	$14,164	100.0	100.0	28.6	17.0	38.8	23.3	2.5
Destination								
U.S.	715	5.0	100.0		16.9	31.2	18.7	7.7
OECD Europe	6,502	45.9	100.0	17.1	14.3	53.3	34.0	0.1
U.K.	568	4.0	100.0	31.5		47.4	28.9	0.1
EEC total	3,739	26.4	100.0	17.4	14.5	53.6	32.1	0.5
Germany	822	5.8	100.0	20.7	16.8	35.3		0.9
Canada	1,044	7.4	100.0	83.0	10.7	3.8	2.3	0.4
Japan	432	3.0	100.0	52.5	8.6	29.9	21.3	
Latin America	1,299	9.2	100.0	50.3	8.9	29.3	15.3	1.8
Other	3,892	27.5	100.0	23.3	28.1	32.2	16.4	6.1
Unaccounted for	280	2.0	100.0	99.6				0.4

(continued)

Table 12.1 (concluded)

	Value of Exports	Per Cent of OECD Exports in 71	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
SITC commodity group								
Power generating machinery (711)	$2,024	14.3	100.0	32.7	23.9	29.3	14.8	2.0
Agricultural machinery (712)	1,398	9.9	100.0	34.5	28.0	23.5	12.7	0.5
Office machinery (714)	1,024	7.2	100.0	35.4	10.8	40.0	16.0	0.8
Metalworking machinery (715)	1,370	9.7	100.0	25.3	12.1	49.3	35.5	1.7
Textile and leather machinery (717)	1,296	9.1	100.0	14.7	17.5	42.9	27.5	9.2
Machines for special industries (718)	2,015	14.2	100.0	35.1	16.5	35.5	24.5	1.8
Machinery, appliances, and machine parts, n.e.s. (719)	5,034	35.5	100.0	25.7	13.8	43.9	26.3	2.3

Source: Appendix A.

per cent only for textile and leather machinery, aside from the miscellaneous category.

Both the United States and the United Kingdom lost ground as exporters of nonelectrical machinery, the former mainly between 1957 and 1961 and the latter in several smaller steps spread throughout the period (Table 12.2). Germany and other EEC countries both increased their shares rapidly during the years before 1961. The Japanese share doubled over the whole period but remained low, at only 3 per cent in 1964.

The outstanding features of the price data for nonelectrical machinery as a group, reported in Table 12.3, are the large price increases, concentrated in the early periods, and the striking similarity of price changes in the different countries. In Table 12.3, for the division as a whole, not a single price declined. There were, however, a few declines in the group and subgroup indexes.

The range of movement in price competitiveness among all the countries in all the years was only eight percentage points, and only three percentage points outside of 1957. The prices for the different countries thus appeared to have kept in step to an extraordinary degree, especially

Table 12.2
OECD Exports of Nonelectrical Machinery, 1953, 1957, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)					
		OECD	U.S.	U.K.	EEC Total	EEC Germany	Japan
		INCLUDING SWITZERLAND AND SPAIN					
1964	$15,736	100.0	29.6	15.3	38.6	22.8	3.1
1963	14,164	100.0	28.6	17.0	38.8	23.3	2.5
1962	13.410	100.0	29.3	16.8	38.2	22.9	2.6
1961	12,088	100.0	28.8	18.0	37.8	23.4	2.6
		EXCLUDING SWITZERLAND AND SPAIN					
1961	11,596	100.0	30.1	18.7	39.4	24.4	2.8
1957	8,264	100.0	39.3	19.0	31.9	21.2	1.5
1953	5,258	100.0	40.5	21.1	29.2	18.4	1.5

Source: Appendix B.

Table 12.3
International Prices, Price Competitiveness, and Price Levels of Nonelectrical Machinery, 1953, 1957, 1961–64

	1953	1957	1961	1962	1963	1964
INTERNATIONAL PRICE INDEXES (1962 = 100)						
U.S.	81	92	99	100	101	102
U.K.	81	92	98	100	100	102
EEC	81	88	97	100	100	102
Germany	80	87	97	100	101	102
INDEXES OF U.S. PRICE COMPETITIVENESS (1962 = 100)						
Relative to						
U.K.	99	99	99	100	100	101
EEC	99	95	98	100	100	100
Germany	99	94	98	100	100	100
INTERNATIONAL PRICE LEVELS (U.S. FOR EACH YEAR = 100)						
U.S.	100	100	100	100	100	100
U.K.	89	90	90	90	90	91
EEC	92	89	91	93	93	92
Germany	92	88	91	93	93	93

Source: International price indexes from Appendix C; price competitiveness indexes, Appendix D; price levels, Appendix E.

in view of the substantial relative price changes in the individual groups that make up the nonelectrical machinery division.

Aircraft Engines and Parts [1]

Trade

Trade in aircraft engines and parts is dominated by the United States and the United Kingdom, which accounted for almost three-quarters of 1963 OECD exports in this group, as can be seen in Table 12.4. Subsidiaries of British and American companies probably accounted for all the trade of the third-ranking exporter, Canada. Most

[1] SITC 711.4. *Value of OECD exports in 1963:* $647.4 million; 1.5 per cent of study total. *Coverage:* Engines exported as spares or for installation in aircraft produced in the importing country. Over $125 million of aircraft engines exported as part of aircraft are not included (see note to Table A.11).

Table 12.4
OECD Exports of Aircraft Engines and Parts (SITC 711.4),
by Origin and Destination, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 711.4	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations	$647.4	100.0	100.0	44.2[a]	27.2[a]	19.5	4.5	1.1
Destination								
U.S.	59.7	9.2	100.0		23.5	8.4	1.7	6.7
OECD Europe	297.9	46.0	100.0	32.2	29.9	33.9	7.7	0.3
U.K.	41.5	6.4	100.0	48.2		43.4	9.6	2.4
EEC total	212.5	32.8	100.0	27.3	36.2	34.8	8.0	b
Germany	57.1	8.8	100.0	12.3	45.5	40.3		
Canada	45.6	7.0	100.0	59.2	39.5			
Japan	26.5	4.1	100.0	86.8	11.3	0.7		
Latin America	23.6	3.6	100.0	63.6	29.7	4.2		
Other	75.8	11.7	100.0	9.2	59.4	23.7	6.6	2.6
Unaccounted for by destination	118.4	18.3	100.0	100.0				

Source: Data underlying Table A.11 and Note to Table A.5.
[a]See Note to Table A.11.
[b]Less than 0.05 per cent.

of the remaining 20 per cent was intra-EEC trade, and only a small part went outside Europe, mainly French exports to Israel and South Africa.

The ultimate destinations of the engines, as parts of aircraft, are more varied than Table 12.4 indicates. The concentration of destinations is partly due to the concentration of the aircraft manufacturing industry in a small number of countries.

The pattern of trade shown in Table 12.4 must be considered a very rough approximation. Since sales of engines for military aircraft are included, some of the data, particularly for the United States, are available only on exports to the world as a whole, and not by destination.

The United States accounted for about half or more of exports to most markets, except for the EEC and the "all other" market consisting mainly of Africa and Asia. The United Kingdom was the main exporter to the EEC, Africa, and Asia, as far as can be seen from this tabulation. However, the $118 million in the U.S. exports not accounted for by destination might, if properly distributed in the table, raise the U.S. share substantially in any of these markets. In addition, the data are beset by an unusual number of errors and inconsistencies, which we attempted to correct in Table 12.4.

Published data do not distinguish military from nonmilitary exports, but the classification of almost all the U.S. exports as special category suggests that military shipments are an important component of the total. The military element in the figures may account for some of the large discrepancy between exports reported by the United States ($286 million) and imports from the United States reported by importers (about $164 million, as shown in the note to Table A.5), although gaps in the country coverage of imports are also significant.

A high proportion of aircraft engine exports seems to be in the form of parts. However, the 3-to-1 ratio of parts to complete engines given in the U.S. data seems surprisingly large. The U.K. figures show parts as one-half of the total, and U.S. production data suggest a similar ratio.[2]

[2] The U.S. export parts total is from *United States Exports of Domestic and Foreign Merchandise; Commodity by Country of Destination,* 1963 Annual, U.S. Dept. of Commerce, Report FT 410, 1964, p. 440, Schedule B No. 79476 (misclassified under SITC 734). The complete engines and parts total is from unpublished revised data of the U.S. Department of Commerce. U.K. exports are from *Accounts Relating to Trade and Navigation of the United Kingdom,* U.K. Board of Trade, December 1964, p. 286. U.S. production data are from *Current Industrial Reports, Complete Aircraft and Aircraft Engines, Summary for 1964,* Series M37G (64–13), U.S. Bureau of the Census, April 1965.

A higher ratio is more in line with a statement that an aircraft engine consumes roughly one-third of its original purchase price in spare parts each year.[3] Assuming an average life of an engine of about nine years, and all parts purchased from the manufacturer, a ratio of parts to new engines of three to one would be plausible if the level of sales of new engines had remained constant. Any growth in sales, however, implies a lower ratio. We have, therefore, accepted the evidence of the U.K. exports and U.S. production data and weighted parts and complete engines equally in our indexes.

The pattern of trade in engines is probably determined mainly by the trade in aircraft, rather than by engine prices, since aircraft are usually supplied with engines of the same nationality. For example, U.S. imports of British engines have mostly been associated with purchases of British Viscounts and the BAC-111. However, aircraft intended for foreign markets can be fitted with foreign engines when that is commercially desirable. The French Caravelle used Rolls-Royce and American Pratt and Whitney engines and Boeing and Douglas offer versions of their large jets equipped with British, instead of the usual American, engines. An American sales agent for a French-built executive plane was reported to have insisted on the use of U.S.-built engines, and this aircraft was advertised with emphasis on the U.S.-built engine and without reference to the French origin of the airframe.[4]

Piston engines, which were the only ones traded in the early years of the period, were a small fraction of the total compared with jet engines at the end of our period. They were about one-quarter of U.S. exports, but data on OECD imports from all countries indicate that they were only about 15 per cent of total aircraft engine exports.[5]

Price Changes

According to the time-to-time price data summarized in Table 12.5, U.S. prices of aircraft engines and parts rose by almost 30 per cent between 1953 and 1964. Data are not sufficient for the calculation of U.K. prices in 1953, but during 1957–64, when indexes are available for

[3] "Aero-Engines: Rolls-Royce's Exports," *Economist,* March 31, 1962.

[4] "GE Said to be Getting $100 Million Contract for French-Built Jet," *Wall Street Journal,* August 13, 1963; *ibid.,* June 18, 1965.

[5] U.S. exports of piston and jet engines are from unpublished revised tabulation of the U.S. Department of Commerce. From the figure for 711.41 we deducted exports of aircraft engine parts (Schedule B No. 79476). OECD imports are from the *1963 World Trade Annual,* Walker & Company for the United Nations, Vol. IV.

Table 12.5
International Prices, Aircraft Engines and Parts, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
U.S.	85[a]	92[a]	95[a]	100	105	110
U.K.	NA	91	100	100	100	104

Source: Appendix C.
[a]Excluding parts before 1962, as in the U.K. index, 87 in 1953, 94 in 1957, and 99 in 1961.

both countries, U.S. prices rose by 20 per cent and U.K. ones by only 14 per cent.

Prices of parts tended to rise more rapidly than those of complete engines, particularly in the United States. All of the difference between U.S. and U.K. price change over the whole period is due to the rise in parts prices and to the inclusion of parts in the U.S. index for 1962/1961 when the U.K. index excludes them. Taking complete engines alone, we find prices in both countries to have risen only 12 per cent between 1957 and 1964.

The price changes incorporated in these indexes are those on individual engine models from the time they are introduced to the end of their production. Thus no price changes which involved the introduction of new engines enter the indexes at all. If new engines are introduced at a kind of promotional price to the first buyers and then sold to later buyers at prices fully reflecting their quality and production costs, this type of linked index might show rising prices even if there were no changes in the final prices from one engine to another. The past price patterns have, in fact, mostly shown price increases after the initial sales of each engine, but it is possible that these reflected trends in engine price levels rather than adjustments in specific prices.

A U.S. time-to-time index adjusted for quality change can be derived from the 1962 cross-sectional relationship between thrust and price which was calculated for the place-to-place comparisons (appendix to this chapter).[6] If we compare the actual prices paid in 1957 and 1962

[6] It would have been still better to use the superior equation containing both thrust and weight, but information on weight was not available for all the engines in the years other than 1962. The equation used here, not shown in the appendix to this chapter because the weight variable is omitted, is:

$$Y \text{ (price in dollars)} = 1{,}043\, X_1 \text{ (thrust in hundred pounds)} + 47{,}326.$$

with the 1962 equation (derived from order prices for a much larger range of engines), we find that the 1962 actual prices are more than 11 per cent above those calculated from the equation while 1957 prices were only 6 per cent higher. This difference indicates a price rise of 5.2 per cent, slightly below that indicated by the linked index we used. If we exclude from the 1957 data a small engine, far outside the range of sizes included in 1962, and we use a 1962 equation which covers only engines of 10,000 pounds' thrust and over, the measured price increase becomes 5.9 per cent, very close to the result of the linked index. Thus the correlation-based index supports the evidence of the linked index, and the support is the more impressive for the absence from the 1962 index of the engines appearing in the 1957 index.

Price Competitiveness

U.S. price competitiveness in aircraft engines relative to the United Kingdom apparently first rose and then, after 1961, declined (Table 12.6), mainly because U.S. prices rose substantially from 1962 to 1963 while U.K. prices remained stable.

We lack data for the computation of British indexes before 1957 but some information on cost per horsepower of British engines suggests a more rapid rise than in the United States, and therefore an improvement in U.S. competitiveness, between 1953 and 1957. However, the same data show a much greater rise between 1957 and 1960 than our U.K. index and must therefore be viewed skeptically as extrapolators.

It is not clear what effect price measures corrected for quality change, such as were discussed above in connection with the time-to-time

Table 12.6
U.S. Price Competitiveness Relative to the United Kingdom, Aircraft Engines and Parts, 1957, 1961–64
(1962 = 100)

Year	Index	Year	Index
1957	97	1963	95
1961	101	1964	94
1962	100		

Source: Appendix D.

indexes, would have on the index of price competitiveness. The closeness of the U.S. regression-based price index to the linked index and the likelihood that adjustments for power would have been similar for the two countries suggest that the index of price competitiveness would not be strongly affected.

The main basis of the place-to-place index for complete aircraft engines in 1962 was an analysis, described in detail in the appendix to this chapter, of the cross-sectional relation between engine characteristics and price for twenty American and British aircraft engines. A regression equation was derived for price as a function of power (thrust) and weight, and British and U.S. engine prices were compared with the prices calculated from the equation. The U.K.-U.S. place-to-place index for complete engines, calculated by dividing the average U.K. ratio of actual to theoretical prices by the average U.S. ratio, equaled 100. Experimentation with several different forms of the equation did not affect the index significantly, giving results varying only from 99 to 101.

Since the lowest levels of engine power were represented only by U.S. engines and the next level by British ones, it seemed possible that these engines might distort the regression line; the four lowest-powered engines were therefore eliminated from the calculation to produce a regression line confined to the range within which we have both U.S. and British data. Inclusion of all twenty-four engines would have produced a somewhat higher U.K.-U.S. place-to-place index, around 102 or 103.

One rough check on the regression comparison is to match specific British engines with U.S. engines of similar, but not identical, thrust and weight. The method is crude because the results depend on the choice of pairs, which is difficult to standardize. The three pairs most similar in specifications gave U.K.-U.S. ratios ranging from 89 to 103 per cent, with an average of 95 per cent, as compared to the figure of 100 per cent used for the complete engines component of the index in Table 12.7.

The extrapolation of the 1962 place-to-place index for complete engines by time-to-time data gives U.K. price levels for other years ranging from 6 per cent below to 1 per cent above those of the United States.

Prices of engine parts in the United Kingdom were apparently considerably lower than in the United States in 1964—by more than 10 per cent. Our extrapolation by time-to-time indexes indicates a gap in

Table 12.7
U.K. Price Level Relative to the United States, Aircraft Engines and Parts, 1957, 1961–64
(U.S. = 100)

Year	Index	Year	Index
1957	94	1963	92
1961	98	1964	91
1962	97		

Source: Appendix E.

1962 of only about 5 per cent, even then somewhat larger than that for complete engines. The sample is small, however, and is probably biased in favor of the United Kingdom since it consists of those parts which U.S. manufacturers choose to produce in the United Kingdom, possibly a minor and unrepresentative part of their total production.

Taking engines and parts together we find that U.K. prices were below U.S. prices in every year covered, and declined relatively after 1961 to a point almost 10 per cent lower by 1964. It seems likely, however, that the flow of trade in engine parts is determined more by the prices of engines than by those of individual parts, because many parts may be produced only in the factory making the complete engine. In that case, the engine prices should be taken as the appropriate place-to-place index for the group as a whole when the determinants of trade flows are being studied.

Internal Combustion Engines Other Than for Aircraft [7]

Trade

The United States and the United Kingdom were the leading exporters of internal combustion engines, each accounting for a quarter of OECD exports, with Germany following at about a fifth (Table 12.8). In OECD exports as a whole, diesel engines were more important by a considerable margin than all other types combined. In U.S. exports, how-

[7] SITC 711.5. *Value of OECD exports in 1963:* $900 million; 2 per cent of study total. *Coverage:* Gasoline, diesel, and other engines and parts, for automotive, marine, and other purposes, excluding engines exported as parts of vehicles.

Table 12.8
OECD Exports of Internal Combustion Engines Other Than for Aircraft (SITC 711.5), by Origin, Destination, and Type of Engine, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 711.5	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations and types of engine	$900	100.0	100.0	25.0	25.0	35.4	20.1	2.4
Destination								
U.S.	48	5.3	100.0		35.4	25.0	16.7	2.1
OECD Europe	351	39.0	100.0	14.0	20.8	49.9	31.3	0.6
U.K.	21	2.3	100.0	28.6		33.3	14.3	a
EEC total	192	21.3	100.0	14.6	21.4	54.2	32.3	0.5
Germany	29	3.2	100.0	10.3	34.5	37.9		a
Canada	82	9.1	100.0	79.3	13.4	3.6	2.4	
Japan	5	0.6	100.0	80.0	NA	20.0	NA	
Latin America	106	11.8	100.0	47.2	13.2	28.3	12.2	1.0
Other	308	34.2	100.0	18.5	35.7	31.8	15.6	5.8

(continued)

Table 12.8 (concluded)

	Value of Exports	Per Cent of OECD Exports in 711.5	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Type of engine[b]	$449	100.0						
Complete engines	252	56.1	100.0	50.0	50.0	NA	NA	NA
Diesel	178	39.6	100.0	35.4	64.6	NA	NA	NA
Automotive	64	14.2	100.0	17.2	82.8	NA	NA	NA
Marine	40	8.9	100.0	50.0	50.0	NA	NA	NA
Other	75	16.7	100.0	44.0	56.0	NA	NA	NA
Other than diesel	70	15.6	100.0	88.6	11.4	NA	NA	NA
Automotive	19	4.2	100.0	84.2	15.8	NA	NA	NA
Marine	19	4.2	100.0	84.2	15.8	NA	NA	NA
Other	33	7.3	100.0	90.9	9.1	NA	NA	NA
Type not specified	4	0.9	100.0		100.0	NA	NA	NA
Engine parts	197	43.9	100.0	49.7	50.3	NA	NA	NA

Source: Appendix A and sources listed there.
[a]Less than 0.05 per cent.
[b]United States and United Kingdom only.

ever, other engines, particularly outboard motors and gasoline engines other than for marine use, were as important as diesel engines, and the United States was by far the major source of these engines. For diesel engines, on the other hand, the United Kingdom was almost twice as large an exporter as the United States, and Germany may also have been more important than the United States.

Among diesel engines, if we can judge by U.S. and U.K. export data, automotive diesels accounted for a little more than one-third and marine diesels for over a fifth. The United Kingdom and United States showed very different specialization, however. The United Kingdom was almost five times as important as the United States in exports of automotive diesels while the two countries were about equally important in marine diesels. In other diesel engines, for which the United Kingdom led the United States, its predominance was large in small diesel engines (under 100 horsepower) but not in very large ones (over 1,000 horsepower) where the United States may even have been more important, although the classification systems of the two countries do not permit an exact comparison.

In the exports of the United States and the United Kingdom, engine parts were almost as important as complete engines. A large share of parts, it will be recalled, also characterized the aircraft engine subgroup.

One feature of the data which may distort the comparisons among the engine industries in the various countries is the omission of engines exported as parts of vehicles. This factor may tend to exaggerate the relative strength of the automobile engine producers in the United States. Since exports are much more important to European than to U.S. automobile producers, engines exported as part of complete vehicles probably account for a much larger share of European than of U.S. engine output.

The major change in the relative importance of the exporting countries was a decline in the U.S. share between 1953 and 1961 (from 35 to 24 per cent), a small part of which was subsequently regained (Table 12.9). The U.K. share rose to 1961 and then declined to slightly under the initial level, and the German share declined by one or two percentage points. The most significant gains were made by two small exporters, France and Italy, which raised their combined share from less than 4 per cent in 1953 to more than 10 per cent in 1961–64.

Table 12.9
OECD Exports of Internal Combustion Engines Other than for Aircraft, 1953, 1957, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)					
		OECD	U.S.	U.K.	EEC Total	EEC Germany	Japan
		INCLUDING JAPAN					
1964	$1,027	100.0	27.0	23.8	34.0	19.9	2.7
1963	900	100.0	25.0	25.0	35.4	20.1	2.4
1962	847	100.0	26.0	24.6	34.9	20.7	2.5
		EXCLUDING JAPAN					
1962	826	100.0	26.6	25.2	35.8	21.1	
1961	783	100.0	24.0	27.7	35.6	21.3	
1957	626	100.0	28.3	24.8	32.3	21.4	
1953	353	100.0	34.6	24.6	29.7	22.1	

Source: Appendix B.

Price Trends and Price Competitiveness

The international price indexes in Table 12.10 indicate that the prices of U.S. and German internal combustion engines fluctuated within a narrow range during the last four years. Our data are not adequate for the publication of price indexes for the United Kingdom or the EEC as a whole, but they do suggest that British price history was roughly similar to that of the United States; the main exceptions are that more of the 1953–61 price rise came before 1957 and that prices rose relatively more in 1964. The U.S. position vis-à-vis Germany improved between 1961 and 1963, but the gains disappeared in 1964. The more limited data available for the United Kingdom suggest little change in U.K.-U.S. price relationships but a sharper rise in U.K. prices in 1964. In the earlier period the data show a sharp fall in U.S. price competitiveness relative to Germany between 1953 and 1957, and then little change to 1961. As can be seen in Table 12.9, the decline in U.S. price competitiveness was accompanied by a sharp decline in the U.S. share of internal combustion engine exports. The improvement in U.S. price competitiveness in 1962 was also matched by a gain in exports, but U.S. exports also gained in 1964, when the price movement appeared

Table 12.10
International Prices and U.S. Price Competitiveness, Internal Combustion Engines Other than for Aircraft, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
	INTERNATIONAL PRICE INDEXES					
U.S.	80	94	100	100	103	104
Germany	85	89	97	100	102	98
	INDEX OF U.S. PRICE COMPETITIVENESS					
Relative to Germany	106	95	97	100	99	94

Source: International price indexes from Appendix C; price competitiveness indexes, Appendix D.

quite unfavorable. Before 1964, at least, these data seem to confirm the high estimates of elasticity of substitution between the United States and Germany found in Chapter 6 for machinery and vehicles at the two-digit level. However, we did not estimate elasticity for the subgroup, since we had so few observations.

Price Levels

Estimates of international price levels for internal combustion engines have several deficiencies. One is that, although we have a large number of observations, they are very unevenly distributed among the various kinds of engines. In particular, there are very few for marine diesels. A major shortcoming is our uncertainty about how best to weight the types and sizes of engines within the group. Weighting is important because there is apparently a greater degree of national specialization within this category than in many others.[8] The United States, for example, has a relative advantage in automotive gasoline engines mass produced in Detroit and elsewhere, particularly those in the 150–400 horsepower range, built for heavy use over long distances. In Europe and in many other markets the nature of the roads and truck loads creates a demand for engines with 50 to 75 horsepower less than

[8] National specialization implies differences in the country-to-country price relatives from one category of product to another. Differences in time-to-time relatives for various categories within each country are likely to be smaller, and the data requirements for such indexes are therefore not as stringent as for price level comparisons.

Table 12.11
Price Levels, Internal Combustion Engines Other than for Aircraft, 1962
(U.S. = 100)

	U.S.	U.K.	EEC	
			Total	Germany
Internal combustion engines and parts	100	90	96	94
Automotive diesel engines	100	70	NA	85
Outboard motors	100	94	100	NA
Parts of internal combustion engines	100	87	95	90

Source: Appendix E.

in the United States. The U.K. industry, which is much more export-oriented than that of the United States, tends to be better at lightweight, compact engines and at marine engines. The Germans tend to do well in industrial engines, particularly where each engine must be custom built. European countries also tend to be cheaper parts suppliers; and parts, as already noted, probably form a substantial fraction of the total trade.

In making our estimates of comparative price levels of internal combustion engines, we incorporated the results of regression analyses of prices of automotive diesel engines and outboard motors, for each of which we had prices of a wide range of models for a number of countries with the prices and specifications of each.[9]

When we combined the direct price comparisons for automotive and other diesel and gasoline engines and for parts with the regression-based indexes we found that for internal combustion engines as a whole U.K. prices in 1962 were 10 per cent and German prices 6 per cent lower than U.S. prices (Table 12.11). Prices in the EEC countries other than Germany were slightly higher than German prices.[10]

The very advantageous U.K. position shown in the price level comparisons is reflected in the trade data for automotive diesel engines

[9] The outboard motor analysis is in the appendix to this chapter; the diesel engine data are from Chapter 5.

[10] Some direct comparisons of automotive diesel engine prices, that is, comparisons between engines of closely matching specifications, show no difference between U.S. and U.K. prices. However, these are on engines outside the range of most U.K. exports and outside the range to which the U.K. regression line was fitted, although they were fairly typical of U.S. engines. If the specifications for these engines are inserted into the U.K. regression equations, the estimated U.K. prices and the U.K.-U.S. price ratios are far below the actual ones. This result indicates that the U.K. regression equation, while it fits the range of observations that produced it, cannot be extrapolated to the U.S. range of engine sizes. Fortunately, the U.K. size range is the one most important in world trade.

given in Table 12.8. U.K. exports were almost five times those of the United States in this subgroup. In outboard motors, on the other hand, for which U.K. prices were much closer to the U.S. level, the United States was by far the leader in exports.

Agricultural Machinery and Implements [11]

Trade

The United States, the United Kingdom, and Germany were the major exporters of agricultural machinery, with the first accounting for over one-third of OECD exports and the last for about one-eighth (Table 12.12). Canada was a smaller but notable exporter. Almost a quarter of total OECD exports represented trade between the United States and Canada. This exchange is facilitated by proximity, similarity of agricultural conditions and techniques, and the absence of U.S. or Canadian tariffs on most of the products in the group. In fact, the North American industry regards Canada and the United States as a single market, and this is often reflected in the organizational structure of the individual firms. Thus a single marketing subdivision may deal with the U.S. and Canadian market, and the location of plants on either side of the border tends to be governed to a large degree by the same kinds of considerations that might determine the choice, say, between Iowa and Illinois.

In 1963 tractors accounted for over half the agricultural machinery and implement exports of the OECD countries as a whole, for over 60 per cent of U.S. exports, and over 80 per cent of U.K. exports. U.S. tractor exports consisted largely of earth-moving tractors, particularly crawler-type, used more in construction than in agriculture, but nevertheless classified here by the SITC.[12] While the United States dominated

[11] SITC 712. *Value of OECD exports in 1963:* $1,398 million; 3.1 per cent of study total. *Coverage:* Tractors, farm and other, except those for tractor-trailers; harvesting, threshing, and sorting machines; cultivating machinery, etc.

[12] The trade patterns reported in the text must be considered in the light of the treatment of tractors in the SITC. SITC 712.5 is the basic classification for tractors designed to haul or push other vehicles, appliances, or loads, but certain types of tractors are classified elsewhere. Road tractors for tractor-trailer combinations are in SITC 732.5; tractors for the short-distance transport or handling of goods or materials (e.g., those with front-end loaders permanently attached) are in SITC 719.3 (mechanical handling equipment); and tractors with permanently attached earth excavating or moving appliances (e.g., bulldozers) are in SITC 718.4 (construction and mining machinery). As can be seen in the notes to Appendix A, there is some disagreement among national statistical offices as to the proper classification of some of these items. In addition, parts for tractors falling within 712.5 are classified in 732.8 (parts for motor vehicles).

Table 12.12
OECD Exports of Agricultural Machinery and Implements (SITC 712), by Origin, Destination, and Commodity Subgroup, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 712	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations and subgroups	$1,398	100.0	100.0	34.5	28.0	23.5	12.7	0.5
Destination								
U.S.	128	9.2	100.0		17.2	2.3	0.8	
OECD Europe	574	41.0	100.0	12.2	31.7	45.8	27.0	
U.K.	33	2.4	100.0	27.3		54.5	27.3	
EEC total	308	22.0	100.0	13.3	28.2	50.6	28.2	
Germany	61	4.4	100.0	16.4	36.1	32.8		
Canada	240	17.2	100.0	90.0	7.1	2.5	0.8	
Japan	10	0.7	100.0	30.0	50.0	20.0	20.0	
Latin America	111	7.9	100.0	59.4	26.1	8.1	1.8	
Other	335	24.0	100.0	38.2	41.2	13.7	4.2	1.8

(continued)

Table 12.12 (concluded)

	Value of Exports	Per Cent of OECD Exports in 712	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
SITC commodity subgroup								
Soil preparation or cultivating machinery (712.1)	$125	8.9	100.0	20.8	16.8	27.2	16.0	3.2
Threshing, harvesting, sorting machinery (712.2)	360	25.8	100.0	18.6	9.4	43.0	25.3	0.3
Dairy machinery (712.3)	41	2.9	100.0	26.8	22.0	24.4	14.6	
Tractors (712.5)	769	55.0	100.0	38.9	41.9	15.3	7.4	0.3
Agricultural machinery and appliances, n.e.s. (712.9)	103	7.4	100.0	77.7	5.8	11.6	2.9	1.9

Source: Appendix A and sources cited there.

the market for large earth movers, the United Kingdom was easily the leader in exporting the lighter, less powerful, usually wheel-type machines which are widely used in agriculture and which are more important in international trade. The strength of the U.K. position may be ascribed to the economies of large-scale production; British production is more concentrated in a few firms than is the case in other major countries, and the British firms concentrate only on two or three models.[13]

Harvesting, threshing, and sorting machines are the second most important subgroup, making up one-fourth of total exports. Germany and Canada are the leaders in the export of combines, which loom large in the subgroup. Combines play an important role in Canadian exports to the United States, reflecting the position in the North American market for the machines produced by a large Canadian-based agricultural equipment manufacturer.

Only in the miscellaneous subgroup (SITC 712.9), which includes poultry equipment and machines for extracting fruit juices, does the United States enjoy a dominant trade position.

Differences in local conditions and techniques create demands for somewhat different designs in different parts of the world. As a result, there tends to be a great deal of local specialization, through small-scale production, to meet local preferences, particularly for smaller products such as plows and harrows. Larger machinery is also affected, as, for example, the need for a combine in North America that will permit wheat farmers to plow straw back under, and for one in Europe that will permit them to harvest it. Again, cheap fuel costs in the United States have made it more economical for U.S. farmers to use tractors powered by gasoline engines, while high fuel prices in other areas have made the initially more expensive diesel engines more advantageous in the long run.

An important element in competition for the larger and more complicated machines such as tractors and combines is the availability of parts; fast parts replacement, especially during critical periods of use,

[13] Cf. *EFTA Bulletin,* European Free Trade Association, July 1962, p. 4. However, the exclusion of parts from SITC 712.5 and the assignment of certain types of tractors to other categories (see previous footnote) tend to enhance the U.K. share of exports in SITC 712.5 and to diminish that of the United States. Parts are more important in U.S. than in U.K. exports; when the 1963 exports of tractors and identifiable tractor parts (parts are not separately distinguished for some tractor categories in the trade statistics) are compared for the two countries, the U.S. total is $462 million and the U.K. total is $388; for 1964 the corresponding figures are $600 million and $377 million. One reason that parts are so important in U.S. exports is that the major U.S. firms are all extensively involved in production overseas.

is essential to the economical operation of such equipment. Thus dealer organization as well as price affects the competitiveness of different makes.

Changes in export shares were comparatively small during the four years for which we have data (Table 12.13). The United States lost somewhat in 1962 but more than regained its initial position by 1964, while the United Kingdom first gained but then lost more in 1964. Germany suffered some loss in its share in both 1962 and 1963 while other EEC countries gained to an extent that more than offset the German losses.

Price Trends and Levels

The two major problems in measuring price differences between times and between places were the lack of comparable models and existence of differential pricing between various markets. (The latter practice in the export trade seems to be a common feature of the agricultural equipment industry abroad and is not unknown in North America.) Our stress upon obtaining from each respondent comparative prices for two or more times or places helped meet both of these problems. In addition, to surmount the difficulty caused by the diversity of models, we used a regression analysis which enabled us to compare tractors of different weight and horsepower specifications over time for the United States and, to a more limited degree, between other countries and the United States. Nevertheless, it would have been desirable, because of the prevalence of differential pricing, to have had a larger sample of prices than we were

Table 12.13
OECD Exports of Agricultural Machinery and Implements, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)					
		OECD	U.S.	U.K.	EEC Total	EEC Germany	Japan
1964	$1,624	100.0	38.2	23.3	23.6	12.9	0.6
1963	1,398	100.0	34.5	28.0	23.6	12.7	0.5
1962	1,185	100.0	33.8	28.4	23.9	13.4	0.5
1961	1,067	100.0	36.6	26.2	22.3	15.7	0.6

Source: Appendix B.

Table 12.14
International Prices, Agricultural Machinery and Implements, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
AGRICULTURAL MACHINERY AND IMPLEMENTS (SITC 712)						
U.S.	83	89	98	100	102	103
U.K.	84	92	98	100	102	102
EEC	84	90	98	100	102	102
Germany	84	91	99	100	101	101
TRACTORS (SITC 712.5)						
U.S.	84	91	98	100	102	102
U.K.	86	95	99	100	101	102
EEC	86	92	98	100	103	104
Germany	88	94	100	100	102	103

Source: Appendix C.

able to gather. We believe, however, that the time-to-time indexes that we were able to put together for the United States and Germany are reliable; the United Kingdom and EEC temporal indexes are more tenuous.

In view of these problems it is somewhat reassuring to find that the indexes for the different countries, each built up from completely independent data,[14] behave in such similar ways. From 1953 to 1964, price increases on agricultural equipment ranged from 17 to 20 per cent, with the largest rise in the United States and the smallest in Germany (Table 12.14). Separate indexes for the important tractor subgroup indicate a slightly smaller increase but an otherwise generally similar timing and pattern of price change.

The same relationships are viewed from a somewhat different standpoint in the indexes of U.S. price competitiveness (Table 12.15). U.S. price competitiveness tended to decline, but only slightly in most cases. The data for tractors hint at some reversal of the U.S. decline in 1964.

The international price indexes and the derived indexes of price competitiveness may be compared with a similar set of indexes based on wholesale prices (Table 12.16). The coverage of these indexes differs

[14] Except, of course, for the overlap between the EEC and Germany.

Table 12.15
U.S. Price Competitiveness, Agricultural Machinery and Implements, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
AGRICULTURAL MACHINERY AND IMPLEMENTS (SITC 712)						
Relative to						
U.K.	102	105	101	100	99	100
EEC	101	102	100	100	100	100
Germany	102	102	101	100	99	99
TRACTORS (SITC 712.5)						
Relative to						
U.K.	102	105	101	100	99	100
EEC	103	102	100	100	101	102
Germany	105	104	102	100	100	101

Source: Appendix D.

Table 12.16
International Price and Price Competitiveness Indexes Based on Wholesale Price Data, Agricultural Machinery and Implements, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
INTERNATIONAL PRICE INDEXES						
U.S.	81	88	99	100	101	103
EEC	86	91	96	100	101	102
Germany	79	85	96	100	100	101
Japan	86	102	101	100	101	99
INDEXES OF U.S. INTERNATIONAL PRICE COMPETITIVENESS						
Relative to						
EEC	105	102	97	100	100	99
Germany	98	96	98	100	99	98
Japan	104	114	103	100	99	96

Source: Appendix F. The EEC index is an average of Germany, weighted three times, and France, weighted once.

widely from one country to another, and they refer, of course, to domestic rather than export transactions. They do not differ radically from the international price indexes, and the U.S. results are virtually identical, but the differences are sometimes large enough to lead to opposite conclusions. The indexes from wholesale prices, for example, show a larger rise in German prices up to 1962 than the international price indexes. As a result, they indicate a small increase in U.S. price competitiveness between 1953 and 1962, while the international prices point to stability or a deterioration in the U.S. price position. They also show a substantial decline in U.S. price competitiveness relative to the EEC while the indexes based on international prices show stability.

Qualifications similar to those mentioned in introducing the time-to-time indexes apply to our estimates of the levels of tractor prices in the different countries. We think it very unlikely, however, that the 1964 relationships below (from Appendix E) are far from the mark:

	SITC 712: Agricultural Machinery & Implements	*SITC 712.5: Tractors*
U.S.	100	100
U.K.	86	78
EEC	90	86

Considering the stability shown by these intercountry price relationships, we may say that over the period of our study the U.K. price level for the group as a whole has been about 15 per cent below that of the United States, and that EEC prices have been about 10 per cent lower than those of the United States. German prices on the average have been a shade below those of other common market countries.

The underlying data indicate substantial variations around these averages for different types of agricultural machinery and equipment. The United Kingdom, for example, is the low-priced source of tractors, but the United States is the low-priced source of preparation and cultivation machinery and of poultry and miscellaneous types of agricultural equipment. Even within the three-digit categories there are differences in the patterns of international specialization. For example, the United Kingdom undersells the United States on agricultural tractors by about 25

per cent but by a much smaller margin on heavy construction-type machines (the latter representing a branch of the industry in which U.S. subsidiaries are active both in the United Kingdom and on the Continent).

Office Machines [15]

Trade

The United States was the largest exporter of office machines in 1963, accounting for more than one-third of OECD exports, while the EEC countries combined accounted for about 40 per cent. More than three-quarters of OECD exports were shipped to other OECD countries, with the United States a large net exporter, Japan almost entirely an importer, and Europe as a whole roughly balancing its trade (Table 12.17).

The United States had a very small share in typewriter exports, but was a major importer and showed a substantial import surplus. Electric typewriters, which were much less important in world trade than portables, accounted for 60 per cent or more of U.S. typewriter exports.

The United States played a large role in exports of calculating and accounting machines (SITC 714.2) and other office machines and parts (SITC 714.9) mainly because of U.S. exports of electronic computers and parts. The former subgroup is composed of two very different components: electronic computers, mainly exported by the United States, and other calculating and accounting machines, in which the United States is much less important. The United States is a small exporter of punched-card and related equipment (SITC 714.3), but a very large factor in exports of the associated parts, which are included in subgroup 714.9.[16]

The role of United States firms in world trade in office machines is understated by the trade figures, since a substantial part of foreign exports is by overseas subsidiaries of U.S. firms. This is particularly the case for subgroups 714.2 and 714.3 (and the associated items in sub-

[15] SITC 714. *Value of OECD exports in 1963:* $1,024 million; 2.3 per cent of study total. *Coverage:* Typewriters; electronic computers and other calculating and accounting machines; punched card and related equipment; other office machines and parts.

[16] The indexes for office machinery as a whole are dominated by electronic computers and punched-card equipment, which are more than 50 per cent of the group total. In addition to the punched-card and related equipment (SITC 714.3) we have estimated that electronic computers account for half of subgroup 714.2 and that parts of electronic computers and punched-card equipment are more than half of subgroup 714.9.

Table 12.17
OECD Exports of Office Machines (SITC 714),
by Origin, Destination, and Commodity Subgroup, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 714	Share in OECD Exports (per cent)						
						EEC			
			OECD	U.S.	U.K.	Total	Germany	Italy	Japan
Total, all destinations	$1,024	100.0	100.0	35.4	10.8	40.0	16.0	11.7	0.8
Destination									
U.S.	96	9.4	100.0		11.4	60.4	20.8	20.8	3.1
OECD Europe	567	55.4	100.0	31.7	9.2	45.8	19.0	11.1	0.2
U.K.	80	7.8	100.0	50.0		37.5	21.2	5.0	2.5
EEC total	350	34.2	100.0	31.7	9.7	44.8	14.8	12.0	0.3
Germany	131	12.8	100.0	32.1	9.2	41.2		11.4	0.3
France	114	11.1	100.0	37.7	9.6	40.4	20.2	17.5	0.3
Italy	40	3.9	100.0	27.5	10.0	47.5	27.5		
Canada	69	6.7	100.0	85.5	4.3	7.2	2.9	4.3	0.4
Japan	93	9.1	100.0	71.0	5.4	14.0	6.4	3.2	
Latin America	71	6.9	100.0	35.7	7.5	41.6	11.8	24.4	1.6
Other	127	12.4	100.0	25.2	26.8	34.6	15.7	11.0	2.4
SITC commodity subgroup									
Typewriters, etc. (714.1)	141	13.8	100.0	12.0	7.8	66.0	31.2	17.7	2.8
Calculating machines (714.2)	460	44.9	100.0	46.1	8.7	32.4	11.7	16.5	0.4
Statistical machines (714.3)	162	15.8	100.0	8.6	17.3	52.5	20.4	6.2	0.6
Office machines, n.e.s. (714.9)	260	25.4	100.0	45.8	12.3	31.9	12.7	3.5	0.4

Source: Appendix A and sources cited there.

group 714.9): It has been estimated that the leading U.S. producer of electronic computers and punched-card equipment sells more in the main European markets (outside of the United Kingdom) than all its U.S. and foreign competitors combined, and that the great majority of these sales consist of European-produced machines.[17] A substantial share of the rest of the European market is supplied by subsidiaries of other American firms.

The importance of U.S. firms in foreign production is less overwhelming in the other office machinery items. However, United States-owned firms produce, in European countries, items in all the other subgroups of office machines. In some cases they have transferred to their European plants their entire production of certain items, particularly portable typewriters and adding machines, including products for the U.S. market. A large part of U.S. typewriter imports, including virtually all from the Netherlands, is produced in United States-owned foreign plants.[18]

The U.S. share of OECD office machinery exports fell sharply between 1953 and 1957 and then changed little, increasing slightly after 1962 (Table 12.18). The U.K. share declined by about 60 per cent between 1953 and 1961, and then remained fairly stable. The EEC gained until 1962, mainly at the expense of the United States and the United Kingdom, but the gains of the United States and Japan after 1962 were matched by EEC losses.

International Price Indexes

From the measures of international price movements in Table 12.19 it is clear that office machine prices have behaved very differently from most prices since 1953. In the United States and the United Kingdom they were at almost the same level in 1964 as in 1953, and in Germany and the EEC countries they were considerably lower.

Our indexes since 1962 show a general decline in prices for all countries, partly attributable to the incorporation of cost data. Prices paid

[17] "Automation Abroad," *Wall Street Journal,* November 26, 1963; "Problems of Financing, Costs, and Competition Plaguing Europe's Computer Industry," *New York Times,* April 12, 1964; "European Computer Demand Widening US Firms' Horizons," *Journal of Commerce,* July 6, 1964; *Export Market Guide to Italy: Electronic Computers and Peripheral Equipment,* Bureau of International Commerce, U.S. Dept. of Commerce, 1965.

[18] "Burroughs Corp. to Close Plant in Mid-Detroit," *Wall Street Journal,* December 27, 1963; "Typewriters: The Status Symbol," *Economist,* October 8, 1960; *Typewriters, Report on Escape-Clause Investigation No. 7-84,* U.S. Tariff Commission, May 1960.

Table 12.18
OECD Exports of Office Machines, 1953, 1957, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)						
		OECD	U.S.	U.K.	EEC Total	EEC Germany	EEC Italy	Japan
1964	$1,153	100.0	37.6	9.8	38.6	17.1	9.9	1.3
1963	1,024	100.0	35.4	10.8	40.0[a]	16.0	11.7	0.8
1962	971	100.0	33.3	9.6	42.7	17.0	12.0	0.5
1961	896	100.0	34.6	9.2	40.1	16.2	11.5	2.8
1957[b]	391	100.0	35.3	13.6	39.1	17.4	10.5	0.3
1953[b]	205	100.0	44.9	15.1	28.8	12.7	7.3	0.5

Source: Appendix B.

[a]Of which France, 7.6 per cent.

[b]Excluding Spain ($2 million in 1961) and Switzerland ($23 million in 1961).

by ultimate purchasers for these products tended to remain constant during 1962–1964. The use of these prices instead of cost data would therefore have tended to reduce or possibly eliminate the decline in U.S. and European prices shown in the last two years, but it would not have affected the movement of the indexes of price competitiveness presented below.

Our price indexes in this group take little or no account of the enormous improvements in quality that have taken place with the introduction of new computers. The price declines we show reflect mainly gains in the efficiency with which old machines were produced. Therefore, these

Table 12.19
International Prices, Office Machines, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
U.S.	92	100	103	100	96	92
U.K.	90	96	100	100	93	89
EEC	107	98	100	100	94	89
Germany	106	97	100	100	94	89

Source: Appendix C.

Table 12.20
U.S. International Prices, Office Machines: NBER Index vs. Indexes from Wholesale Price and from Unit Value Data, 1953, 1957, 1961–64

	1957/1953	1961/1957	1962/1961	1963/1962	1964/1963
NBER international price index	109	103	97	96	96
Index derived from wholesale prices	112	102	99	101	100
Index derived from export unit values	106	124	106	91	108

Source: International price indexes: unlinked indexes underlying Table 12.19. Index derived from wholesale prices: Appendix F. Index derived from export unit values: Appendix G.

price indexes must be biased upward by a large margin. We did not have the data necessary for the type of regression analysis performed elsewhere in this study, but the dimensions of the upward bias are suggested by a comparison with regression-based indexes for U.S. domestic sales of computers, which show a decline of over 50 per cent in computer prices between 1961 and 1964 when our indexes report a decline of a little less than 15 per cent.[19]

In Table 12.20 our U.S. international price indexes for office machines are compared with indexes derived from BLS wholesale price series and from those U.S. export unit values of office machines that are used by the Department of Commerce in its export unit value index. These latter indexes, as year-to-year price changes, appear in the second and third lines of Table 12.20. There were not enough wholesale price series for the other countries to permit the construction of similar price indexes.

There are several large differences between the NBER indexes and the export unit value indexes. The NBER data show no upward price trend while the export unit values indicate a price rise of over 30 per cent and, in addition, fluctuate much more sharply. The unit value data cover a narrower list of products but nevertheless include a much wider range of price changes in some years than the NBER indexes. In 1961/1957,

[19] Gregory C. Chow, "Technological Change and the Demand for Computers," *American Economic Review*, December 1967.

for example, the export unit value changes in the three series covered ranged from −32 per cent to +36 per cent. Since the export unit values are averages for many transactions one would expect them to have, if the groups were homogeneous, a narrower range of price changes in any one year and greater stability over time than the individual transaction prices used in the NBER indexes.

The indexes derived from wholesale price data are in every year as close as or closer than the unit value indexes to the NBER indexes, particularly in 1961/1957 and 1962/1961, when there were large differences between the two trade indexes. One reason for the superiority of the wholesale price data is their wider coverage.

The wholesale price indexes do show some upward trend over the eleven years as a whole, but much less than the unit value indexes. One explanation for the differences in trends is that neither the unit value nor the wholesale price indexes include subgroup 714.3, electronic computers in subgroup 714.2, or the corresponding parts in subgroup 714.9, whereas the NBER indexes do. These items, particularly electronic computers, were responsible for the downward movement in the NBER price indexes in the later years. The NBER indexes for subgroups 714.1 and 714.2 other than electronic computers were all within two percentage points of the corresponding BLS indexes, except in the 1957/1953 segment when their rise was substantially less than that shown by the BLS.

Price Competitiveness

Relative to the United Kingdom, American price competitiveness barely changed during these years (Table 12.21). The relationship between the U.S. and British international price levels in 1964 was almost the same as in 1953. Germany and the EEC countries as a group gained substantially on the United States, the bulk of the improvement taking place between 1953 and 1957, with little or no change in price competitiveness after that.[20]

The data underlying both the time-to-time and place-to-place comparisons used in the indexes of price competitiveness for office machines

[20] It should be noted that the indexes prior to 1962 are seriously weak because they do not cover electronic computers, punched-card equipment, and the corresponding parts of machines in SITC 714.9. However, the evidence for later years does not suggest that changes in price competitiveness in these groups of commodities were very different from those in other subgroups of office machines, given the price measurement methods we are using. See, however, the discussion of international price measures, above.

Table 12.21
U.S. Price Competitiveness, Office Machines, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
Relative to						
U.K.	98	97	97	100	98	97
EEC	118	98	97	100	98	97
Germany	116	98	97	100	98	97

Note: Changes in price competitiveness can also be inferred from place-to-place data. The results of this calculation, although based on fewer and less reliable observations than the time-to-time calculations, are similar, as can be seen below:

	1953	1957	1961	1962	1963	1964
Relative to						
U.K.	102	100	99	100	98	98
EEC	NA	100	98	100	98	96
Germany	NA	100	98	100	98	96

Source: Appendix D.

differ from those in most of the other commodity groups in one major respect: the use of cost data in place of prices. Cost data were employed particularly in subgroups 714.2 and 714.3, but to some degree also in subgroups 714.1 and 714.9. Costs were used instead of prices in several cases in which sales were made through international companies which filled orders from production by subsidiaries in various countries but did not give the purchaser the option of selecting the source. It was felt that in such cases the international company could be regarded, for the purpose of measuring international price competitiveness, as the purchaser of the products rather than the seller, since it had no nationality as a manufacturer but determined, by its own "purchase" decisions, where the product was to be produced. These purchase decisions were undoubtedly influenced by many nonprice factors, notably the relative lengths of order books, but the cost of production in each country of manufacture may be taken as the closest measure of the price element in the international company's decisions.

Price Levels

As can be seen from the first section of Table 12.22 European prices were slightly lower than U.S. prices from 1957 on, except in 1962,

Table 12.22
Price Levels, Office Machines, 1953, 1957, 1961–64
(U.S. for each year = 100)

	1953	1957	1961	1962	1963	1964
U.S.	100	100	100	100	100	100
U.K.	98	97	97	100	97	97
EEC	117	98	97	99	98	96
Germany	115	96	96	99	97	96

Note: Independent, and probably less reliable, measures of international price levels are provided by the actual place-to-place comparisons for all years, rather than by extrapolation from the best year using the price competitiveness index, as described in Appendix E. The place-to-place data, based in some cases on a smaller number of observations, ranging from 7 to 36, are as follows:

	1953	1957	1961	1962	1963	1964
U.K.	102	100	99	100	97	98
EEC	NA	100	98	100	98	96
Germany	NA	100	98	100	98	95

Source: Appendix E.

when they were at almost the same level. At the beginning of our period, however, EEC prices, including German prices, were substantially higher than American ones.

The closeness of price levels shown in Table 12.22 conceals much larger differences among subgroup price levels. The United States was at a considerable competitive disadvantage in typewriters (SITC 714.1) and in calculating and accounting machines. Less technological change has taken place in these groups than in electronic computers (included in SITC 714.2) or in punched-card machines (included in SITC 714.3). The growth of world trade in typewriters and calculating and accounting machines has also been smaller, to judge by the more than tenfold growth of U.S. electronic computer exports between 1958 and 1964.

Our indexes for electronic computers show a competitive advantage for the United States, and those for punched-card machines suggest about equal prices in the United States and Europe. Even where the indexes are based mainly on cost data, new and old models of machines must be distinguished. After production of a model had continued for several years in both Europe and the United States, European costs

were slightly lower than U.S. costs for components of electronic computer systems and 10 to 20 per cent lower for punched-card equipment. The advantage calculated for the United States was derived from the high cost in the early stages of European production for each model and the assumption of the same high initial level of European costs during the period before European production began, when the United States was the only source for a model. The level of the price differential in this calculation depended to a large degree on the lag between initial U.S. and initial European production for each model of a machine, and on the length of the period during which the model was produced. A long lag and a high rate of obsolescence (a short commercial life for each model) tend to raise the calculated ratio of foreign to U.S. costs.

Even within typewriters there were considerable differences among types of machines. The indexes are dominated by portables, which are estimated to have accounted for about two-thirds of world trade in typewriters in 1963. The unfavorable U.S. competitive position in these machines is confirmed by the fact that several typewriter producers that operate in both the United States and Europe have concentrated their production of portables in Europe. However, the United States remained an important exporter of electric typewriters, in which the competitive position was more advantageous. Costs and prices of electric typewriters were generally about as high in Europe as in the United States or higher, while EEC costs and prices for nonelectric standard and portable typewriters were 10 to 20 per cent below the U.S. level. Even this differential may be underestimated because we lack cost data from manufacturers who completely switched their production away from the United States.

Prices and the Pattern of Trade

Since price levels and price changes are not the only forces determining the direction of trade and changes in it, one could not hope to find very high simple correlations between prices and trade movements, but good correlations would be an indication that we have had some success in our price measurement.

For each pair of countries, we ranked five subgroups of office machines in the order of the price ratios, from highest to lowest, and compared this ranking with that of the export value and export-import ratios. For example, in the first section of Table 12.23, where we compare the

Table 12.23
Relation of Price Ratios to Export Shares and Export-Import Ratios, 1963

SITC Number[b]	Rank[a] of Price Ratio	Export Value Ratio	Export-Import Ratio Based on Export Data[c]	Import Data[d]
U.K./U.S.				
714.2B	1	5	5	5
714.3	2	1	2	3
714.9	3	4	4	4
714.1	4	2	1	1
714.2A	5	3	3	2
EEC/U.S.				
714.2B	1	5	5	5
714.9	2	4	4	4
714.3	3	2	3	3
714.2A	4	3	2	2
714.1	5	1	1	1

Note: Price ratios are from subgroup indexes underlying Table 12.22. Export values, except for separation of 714.2 into 714.2A and 714.2B, are from Appendix A and the sources underlying it. U.S. exports for 714.2B are from *U.S. Export Statistics,* 1963 Annual, U.S. Bureau of the Census, Report FT 410, June 1964. Estimates of U.K. exports are from *Accounts Relating to the Trade and Navigation of the United Kingdom,* HMSO, December 1964. Those for other European countries are derived very roughly from *Market Information on Electronic Products in West Germany,* U.S. Dept. of Commerce, Overseas Business Reports, OBR 64-120, October 1964, and *Export Market Guide to Italy, Electronic Computers and Peripheral Equipment,* U.S. Dept. of Commerce, Bureau of International Commerce, 1965.

Import values from export data are OECD exports to the United States, the United Kingdom, and the EEC, from the same sources as the export values, except for 714.2B, which is roughly estimated from the sources mentioned above.

Import values from import data are total imports of the United States, the United Kingdom, and the EEC countries, from *Trade by Commodities,* OECD Statistical Bulletin, Series C, 1963, Vol. II, *Imports,* and for electronic computers, rough estimates based on the sources previously mentioned.

[a]High to low.

[b]The subgroups are 714.1, typewriters and check-writing machines; 714.2A, calculating, accounting machines other than electronic computers; 714.2B, electronic computers, 714.3, statistical machines; 714.9, office machines, n.e.s.

[c]For each country, exports as reported by that country and imports as the sum of other countries' reported exports to that country.

[d]For each country, exports and imports as reported by that country.

United Kingdom and the United States, we show in the first column that U.K. prices are highest relative to U.S. prices in electronic computers, and lowest in calculating and accounting machines other than electronic computers. In the second column we show the ranks of the export value ratios: the ratios of U.K. exports to U.S. exports for the five subgroups. As we might expect, the value ratio is lowest in subgroup 714.2B, for which the price ratio is highest. Similar sets of comparisons are made for the EEC vs. the United States.

All these comparisons of prices and trade values are subject to two serious drawbacks. One is the heterogeneity of the SITC trade groups, even on a four-digit level. In these comparisons, for example, it was necessary to break subgroup 714.2 down between electronic computers (714.2B) and other calculating and accounting machines (714.2A) because the price movements of the two items differed greatly. However, the division of the export and import values could be done only very crudely for lack of comparable data.

Even where the export classes do not combine such different commodities they suffer from inconsistencies among the trade classifications of the various countries, which produce spurious relationships among the export values. For example, the high ratio of U.K. to U.S. exports in subgroup 714.3 is at least partly due to the fact that the U.S. combines all electronic computers into one class, which is placed in subgroup 714.2, while the U.K. distinguishes those operating with punched-cards and puts them into subgroup 714.3 (see notes to Appendix A). There are probably similar difficulties with the EEC data.

There seems to be little relationship between price and export value ratios for the United Kingdom relative to the United States. In the comparison between the United States and the EEC countries, however, the relationship is inverse, as we would expect if the "product" substitution elasticities are greater than 1, as indicated in Chapter 6. The U.S. price advantage in electronic computers and related parts appears to be reflected in high shares of exports in subgroups 714.2B and 714.9, and the lower degree of U.S. price competitiveness in typewriters is reflected in comparatively low export ratios. In both the U.K. and the EEC comparisons, particularly the former, the U.S. export share for subgroup 714.3 is surprisingly low. To some extent, as has been mentioned, this apparently low U.S. share may be the result of differences in classification systems.

In a sense, export values or shares provide only a partial test of the price relationships, because the influence of prices should appear on the import as well as the export side of the trade account. It is partly to catch the influence on imports that we have included in the indexes domestic prices for commodities that a country does not export. For the second set of comparisons in Table 12.23 we therefore ranked ratios of exports to imports, by subgroup, for each country.

The comparison of EEC-U.S. export-import ratios with price ratios shows a perfect negative relationship. The U.K.-U.S. comparison, like that for the export ratios, shows little relationship. In particular, the U.K. trade ratio for SITC 714.3 is surprisingly high, given the price relationship. It may be that classification inconsistencies are again involved, since the import data are derived from other countries' exports while the export data follow the U.K. classification system.

To escape this classification problem a second set of export-import ratios was computed in which the import values were taken from each country's reported imports rather than from partners' exports. The advantage in this method was that the numerator and denominator for each country's ratios come from the same statistical system. However, even this method does not insure the comparability of export and import data, since some countries' export classifications differ substantially from their own import classifications.

This modification of the import data produces slightly better results in the U.K.-U.S. comparison. There is at least a tendency toward a negative relationship between price ratios and export-import ratios, although it is not a perfect one. The EEC-U.S. comparison remains perfectly negative, as it was using the earlier set of import data.

To summarize, we have some evidence for the idea that higher price levels for office machines do tend to be associated with lower levels of exports or, particularly, with lower ratios of exports to imports. The trade data thus do confirm, although somewhat weakly, the results of our price measurements.

It would be of great interest to relate changes in the movement of trade over ten years or more to changes in the price competitiveness of individual countries, but the possibilities for such comparisons are very limited in the office machines group. One difficulty is that changes in price competitiveness, as shown in these indexes, have been very small:

Only in two indexes for group 714 as a whole, both for 1953–57, were there changes of more than three percentage points. More price changes are to be found in the subgroup indexes, but there are no corresponding trade data available to compare them with, except for 1962 and 1963.

Most of the changes in price competitiveness shown in Table 12.21 are too small, especially in view of the probable margins of error surrounding the figures, to warrant any expectation of matching changes in trade flows. However, the one major change in price competitiveness, the substantial improvement for Germany and the EEC as a whole relative to the United Kingdom and the United States between 1953 and 1957, was accompanied by substantial changes in export shares. The German share of OECD exports rose from 13 to 17 per cent and the EEC share from 29 to 39 per cent, while the U.S. share declined from 45 to 35 per cent.

Summary

America tends to be a high-cost producer of business machines compared to Europe once the production of a particular machine is established in Europe and volume output achieved. The U.S. advantage lies in the continual introduction of new machines with superior capabilities and in the economies of mass production, which owing to the size of the American market, enable a firm to obtain large volume on a new machine quickly. Once a machine is developed and the U.S. market for it established, a market is fostered in Europe and other foreign areas through exports, licensing, and finally production abroad. In the initial stages foreign production may be 10 or 20 per cent more costly than U.S. production, but once the learning period is over and an optimum volume can be achieved European costs may be lower than those of the United States by 10 or 20 per cent. If a subsidiary of a U.S. firm is involved, the transition from high- to low-cost production may take place in as short a period as two or three years.

Taking old and new types of machines in the proportions in which they entered international trade, we found that U.S. international prices for office machines were usually slightly above U.K. and EEC prices. U.S. price competitiveness did not change significantly relative to the United Kingdom after 1953, or relative to the EEC countries after 1957, but the EEC countries gained substantially between 1953 and 1957. The

U.S. price position was most favorable in the technologically advanced lines—particularly electronic computers—and in electric typewriters, and weakest in portable and standard typewriters and in calculating and accounting machines. Data on the direction of trade show a pattern of competitive strength and weakness that tends to confirm the price indexes. Changes in trade flows support the finding of substantial gains in competitiveness by the EEC countries before 1957 but do not seem to have been closely related to the much smaller fluctuations in price competitiveness since then.

Both wholesale prices and unit values appear to give unsatisfactory measures of international price changes for office machines, mainly because the coverage of both sets of underlying data is inadequate and because individual unit value series display erratic movements. These probably do not correspond to any actual price changes but may represent shifts in composition within the export classes.

Metalworking Machine Tools [21]

Trade

More than half of OECD exports of metalworking machine tools were by the countries of the EEC, with Germany by far the leader in EEC and in the world as a whole (Table 12.24). The United States followed Germany in importance, but far behind, and the United Kingdom was the third ranking exporter, at about a third of the German level. In fact, the United States and the United Kingdom together exported less than Germany. As will be seen later, however, 1963 was a particularly poor year for U.S. machine tool exports and a particularly good one for German exports. The German lead was not usually as large as that shown here.

Total trade in machine tools can be broken down by type of machine, a separation which is desirable because the group contains a wide variety of products of different uses and degrees of technical sophistication. The leading position of Germany runs through the whole list, at least in the detail we have available. The German lead over the United States

[21] SITC 715.1. *Value of OECD exports in 1963:* $1,016 million; 2.3 per cent of study total. *Coverage:* Metal-cutting machine tools; presses and other metal-forming machine tools.

varied from a very wide one in lathes and milling machines (exports about three times as great as those of the United States) to less than 50 per cent for metal-forming machines. The United States, in turn, was consistently ahead of the United Kingdom, except in lathes and milling machines.

Much of international specialization seems to take place along different lines, dividing each group of machines according to the complexity or precision of the machine or the degree to which it is automatically controlled.

It is this specialization that explains the degree of cross-exporting (that is, trade in a product in both directions between a pair of countries) even within machine tool categories. Switzerland is reported to specialize in complex high-performance machine tools and to import its standard tools from Germany, while the United Kingdom concentrates on standard machine tools, exported mainly to the Commonwealth and to less industrialized countries. Germany sells both standard and specialized tools, and the United States concentrates mainly on numerically controlled tools and other sophisticated products such as those used for automobile production. The United States lead in numerical control has been attributed to military research, particularly in aircraft, largely financed from U.S. Air Force funds. Even when these machines are produced abroad they frequently use control systems built by U.S. electrical and electronic equipment firms and their foreign subsidiaries.[22]

Another basis for trade among the developed countries is differences in delivery time. Reports during the last few years about the rise of imports into the United States have stressed the effect of lengthening U.S. delivery delays relative to both Japan and European countries, particularly when full order books in one country coincide with recession in another.[23]

A recent study of 1956–62 U.K. export orders for machine tools found that waiting time for delivery of U.K. and German machine tools

[22] "Whose Revolution in Machine Tools?" *Economist,* November 26, 1960; "Machine Tools," *EFTA Bulletin,* March 1962; "The Numbers Game," *Economist,* July 2, 1966; "Consumersville USSR," *ibid.,* February 4, 1967; *Outlook for Numerical Control of Machine Tools,* BLS Bull. 1437, 1965, pp. 9–10.

[23] "More Machine Tools from Overseas Flow into U.S. Markets," *Wall Street Journal,* May 25, 1965; "Japan Pushes Tool Sales Drive," *Journal of Commerce,* January 13, 1966; "Tool Imports Rising as Delivery Slows," *ibid.,* February 23, 1966; "Big Hike in Machine Tool Exports for '66 Forecast," *ibid.,* March 28, 1966; "Tool Imports from Japan Up," *New York Times,* April 3, 1966; "U.S. Tool Order Backlog Opens Door to Imports," *Journal of Commerce,* April 29, 1966; "Foreign Machine-Tool Makers Profit from Domestic Shortage," *New York Times,* June 5, 1966.

Table 12.24
OECD Exports of Metalworking Machine Tools (SITC 715.1),
by Origin, Destination, and Type of Tool, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 715.1	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations	$1,016.1	100.0	100.0	21.0	12.4	51.2	36.2	1.7
Destination								
U.S.	34.6	3.4	100.0		17.3	39.3	28.9	2.9
OECD Europe	560.2	55.1	100.0	17.5	8.2	59.6	44.0	3.9
U.K.	67.9	6.7	100.0	30.0		51.2	39.8	0.9
EEC total	329.6	32.4	100.0	18.6	9.1	56.6	41.1	0.4
Germany	53.2	5.2	100.0	26.7	9.0	26.1		0.2
Canada	40.1	3.9	100.0	71.3	13.5	10.5	7.5	1.2
Japan	64.0	6.3	100.0	40.3	2.8	41.9	36.1	
Latin America	71.5	7.0	100.0	34.7	5.9	49.0	29.0	1.5
Other	245.6	24.2	100.0	14.5	25.6	43.4	26.5	4.9

(continued)

Table 12.24 (concluded)

	Value of Exports	Per Cent of OECD Exports in 715.1	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
All types of machine[a]	1,015.8	100.0						
Metal cutting	716.5	70.5	100.0	18.5	12.2	54.3	38.2	1.7
Boring machines	70.2	6.9	100.0	16.2	15.7	49.8	31.6	3.7
Drilling machines	38.4	3.8	100.0	16.4	13.0	54.9	29.2	2.6
Gear-cutting machines	49.6	4.9	100.0	28.8	7.0	49.2	46.0	0.8
Grinding machines	155.6	15.3	100.0	21.4	11.0	49.9	35.0	1.0
Lathes	194.1	19.1	100.0	13.4	16.1	55.8	39.0	1.8
Milling machines	90.0	8.9	100.0	12.7	12.7	60.2	38.2	1.7
Planers, broaching & miscellaneous cutting	118.7	11.7	100.0	25.1	6.7	57.6	44.6	1.2
Metal forming	299.3	29.5	100.0	25.3	11.8	55.1	43.1	1.1
Hydraulic pneumatic presses	43.0	4.2	100.0	20.0	19.5	56.0	41.6	1.4
Mechanical presses	73.8	7.3	100.0	28.6	9.5	56.9	41.6	0.8
Forming, except presses	182.5	18.0	100.0	25.2	10.8	55.1	44.0	1.0

Source: Appendix A and sources cited there.

[a]For explanation of differences between totals by destination and type of machine, see General Note to Appendix A.

Table 12.25
OECD Exports of Metalworking Machine Tools, 1953, 1957, 1961–64
(dollars in millions)

	Value of OECD Exports[a]	Share in OECD Exports (per cent)						
					EEC			
		OECD	U.S.	U.K.	Total	Germany	Switzerland	Japan
1964	$1,093.0	100.0	26.6	11.8	45.9	31.7	8.6	2.2
1963	1,016.1	100.0	21.0	12.4	51.2	36.2	8.6	1.7
1962	1,060.3	100.0	28.7	10.0	47.4	33.0	8.1	1.1
1962	1,059.8[b]	100.0	28.7	10.0	47.4	33.0	8.2	1.0[b]
1961	942.1[b]	100.0	28.2	9.4	47.3	33.6	8.4	1.7[b]
1961	920.9[c]	100.0	28.9	9.7	48.4	34.4	8.6[c]	1.7[c]
1957	518.4[c]	100.0	28.7	15.2	39.9	30.2	11.2[c]	0.8[c]
1953	404.6[d]	100.0	39.3	16.1	40.2	26.1	NA	NA

Source: Appendix B and sources cited there.
[a]Excluding Ireland.
[b]Data for Japan from Business and Defense Services Administration, U.S. Department of Commerce.
[c]Data for Japan and Switzerland from BDSA.
[d]Excluding Japan and Switzerland.

had a significant effect on the amount of foreign ordering of U.K. machine tools. U.S. waiting times, which were always lower than those in either the United Kingdom or Germany, were not significantly related, perhaps because the United States and the United Kingdom were offering different types of tools, or possibly because the differences between the United States and the other countries remained large even when U.S. waiting times rose.[24]

The main changes in shares of export trade (Table 12.25) were the large losses by the United States and the United Kingdom between 1953 and 1961—from 39 to 29 per cent for the former and from 16 to 10 per cent for the latter—and the rise in the German share from 26 to 34 per cent. Since 1961 however, there have been no clear trends. In 1963 every major exporter gained at the expense of the United States, but almost all the loss was recovered the next year.

[24] M. D. Steuer, R. J. Ball, and J. R. Eaton, "The Effect of Waiting Times on Foreign Orders for Machine Tools," *Economica*, November 1966.

Table 12.26
International Prices, Metalworking Machine Tools, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
METALWORKING MACHINE TOOLS, TOTAL						
U.S.	81	90	98	100	101	105
U.K.	75	85	95	100	101	107
EEC	71	82	98	100	100	103
Germany	75	85	98	100	103	107
METAL-CUTTING MACHINE TOOLS						
U.S.	81	89	97	100	101	105
U.K.	74	84	94	100	101	106
EEC	72	81	98	100	97	102
Germany	77	86	98	100	102	106
METAL-FORMING MACHINE TOOLS						
U.S.	NA	NA	101	100	100	105
EEC	NA	NA	97	100	106	102
Germany	NA	NA	98	100	106	108

Source: Appendix C.

Price Trends

Prices of metalworking machine tools rose throughout the period in all the countries covered by our international price indexes (Table 12.26).[25]

[25] The very rapid rise in the official German export price series before 1961 (see notes to Table C.4) seemed suspect to us. Our index, derived from data other than the official export price series, rises much more slowly until 1962 and is much closer to the U.S. international price index, as can be seen in the Note to Table C.4, where separate indexes are calculated from reports by buyers and reports by sellers. Buyers reported smaller price increases than sellers in four out of five periods in the United States, Germany, and the EEC countries as a whole, and in three out of five periods in the United Kingdom. The earlier data were less reliable and compiled from fewer observations; the large discrepancies may, therefore, arise from errors or sampling variation. The U.K. indexes do not show large differences over the period as a whole, but the United States and German data diverge substantially, by 15 and 25 per cent, respectively, over the decade.

The apparent long-term upward bias of sellers' reports relative to those of buyers agrees with the findings of Stigler and Kindahl for standard commodities (George J. Stigler and James K. Kindahl, *The Behavior of Industrial Prices*, New York, NBER, 1970).

The evidence is not conclusive, but it suggests that sellers may tend to report list prices and buyers to report transaction prices. We make this judgment because it is

For some countries and groups it is possible to compare our international price indexes with the corresponding domestic, mainly wholesale, price indexes. The main differences are at the two ends of the period. The international price indexes rose more rapidly in 1964 in both the United States and Germany. In the first period, 1953–57, the international indexes rose less than wholesale prices in the United States and more than wholesale prices in Germany. The result of these two differences was that the international price movements for the two countries were much more alike in these years than the wholesale ones. This greater similarity among international price indexes is a fairly general phenomenon, as is pointed out in Chapter 8.

All the price indexes shown here, and those for the United States in particular, probably tend to overstate the extent of price increases because they do not take account of productivity changes involved in important technological developments, especially the introduction of numerically controlled machine tools. There are no comprehensive data on the productivity of these machines, but some reports suggest that, for companies whose work permits their use, the substitution of these tools for the older ones produces large savings in total cost. The rapid rate of increase in the number of numerically controlled tools also suggests that they are relatively cheaper than types previously available. Of all those shipped between 1954 and 1963 almost two-thirds were shipped in the last two years of the period.[26]

Price Competitiveness

In metalworking machine tools the price competitiveness of the United States relative to the United Kingdom and the EEC countries increased substantially from 1953 to 1962 or 1963 (Table 12.27). The U.S. gains were larger in metal-forming than in metal-cutting machine tools. In both groups the gains were greater relative to the EEC countries than to the United Kingdom in the earlier years, but at the end of the period the EEC countries improved their price competitiveness relative to both the United Kingdom and the United States. The reversal in the movement of U.S. price competitiveness relative to the EEC appeared earlier in metal-cutting tools than in the metal-forming group.

buyers' prices that move more in conformity with the nonquantitative reports on the state of the trade, a pattern that would fit the hypothesis that buyers are more willing than sellers to reveal unannounced discounts or premiums.

[26] *Outlook for Numerical Control of Machine Tools*, BLS Bull. 1437, 1965, pp. 15, 29–31.

Table 12.27
U.S. Price Competitiveness, Metalworking Machine Tools, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
METALWORKING MACHINE TOOLS, TOTAL						
Relative to						
U.K.	90	94	96	100	101	102
EEC	87	90	100	100	99	98
Germany	92	94	100	100	103	101
METAL-CUTTING MACHINE TOOLS						
Relative to						
U.K.	92	95	96	100	100	102
EEC	89	90	102	100	96	97
Germany	95	96	102	100	101	101
METAL-FORMING MACHINE TOOLS						
Relative to						
U.K.	87	91	93	100	105	104
EEC	83	91	96	100	106	97
Germany	87	89	97	100	106	103

Source: Appendix D.

The movement of U.S. price competitiveness in these products stands in strong contrast to that in most other groups in this study. The typical pattern has been a decline in U.S. price competitiveness until some date in the early 1960s and then an improvement in 1964. Metalworking machine tools show the reverse movement, at least relative to the EEC countries: a large improvement followed by a small decline in the last year or two.[27]

The movements of the indexes of U.S. price competitiveness fail to explain the shifts in export shares shown in Table 12.25, particularly the

[27] Our index computations in this subgroup took account of the possibility that the differences between buyers' and sellers' price reports might represent bias in one or both types of data and that it was therefore logical to compute indexes of price competitiveness separately from the two sources. If that had not been done, the index relative to Germany would have shown a large rise in the indexes of U.S. price competitiveness, reflecting the heavier weight given to the fast-rising sellers' prices in the German index compared to the American.

large gain by Germany from 1953 to 1957. In fact, the changes in U.S. and German exports are the opposite of those one would expect from the price movements in almost every year. The comparisons with the United Kingdom do not show any consistent relationship in either direction between our measures of price competitiveness and exports.

One caution should be kept in mind in any comparisons of trade with price movements. There may be a considerable time lag between orders of machine tools, to which the prices apply, and the corresponding deliveries, which are reflected in the trade statistics. These lags may vary over time and among countries. The waiting times estimated in the previously cited study of machine tool orders ranged from eight to twelve months for the United Kingdom, two to nine months for the United States, and nine to 11 months for West Germany.[28] However, some data on actual waiting times, gathered in connection with the place-to-place comparisons discussed below, showed average waiting time of only about four months for the United States, the European countries, and Japan in the early 1960s.

Price Levels

The estimated price levels shown in Table 12.28 must be considered rough approximations even though the number of observations is not unusually small. In 1962, the year on which the price level comparisons are based, there were approximately fifty individual comparisons between the United States and the United Kingdom and more between the United States and EEC countries, but fewer for Germany. However, that number of observations is not sufficient because there is, as we point out below, a great deal of heterogeneity among the various types of machine tools and even within the usual categories.

The United Kingdom and the EEC countries appeared to have offered lower prices on machine tools than the United States throughout the whole period covered by the study, and the U.K. and EEC price levels were generally similar.

In 1964, the price differential was about 20 per cent in favor of European countries on metal-cutting tools, and there was little or no differential on metal-forming tools. For metalworking tools as a whole the United Kingdom and the EEC countries offered prices 10 to 15 per cent below those of the United States from 1962 through 1964.

[28] Steuer, Ball, and Eaton, *op. cit.*

Table 12.28
Price Levels, Metalworking Machine Tools, 1953, 1957, 1961–64
(U.S. for each year = 100)

	1953	1957	1961	1962	1963	1964
METALWORKING MACHINE TOOLS, TOTAL						
U.S.	100	100	100	100	100	100
U.K.	77	80	81	85	86	87
EEC	75	78	86	86	85	84
Germany	80	82	87	87	89	88
METAL-CUTTING MACHINE TOOLS						
U.S.	100	100	100	100	100	100
U.K.	73	76	77	80	80	81
EEC	72	73	82	80	78	78
Germany	76	78	82	81	82	81
METAL-FORMING MACHINE TOOLS						
U.S.	100	100	100	100	100	100
U.K.	84	88	90	97	101	100
EEC	82	90	96	99	105	97
Germany	88	90	99	101	108	104

Source: Appendix E.

Since Germany is the world's leading machine tool exporter (Table 12.24), it is not surprising that its price level is below that of the United States. However, the U.K. export performance does not square with its apparently low price level. Furthermore, the low U.K. price level is not a product of one or two exceptional groups but is evident in comparisons for almost all the individual machine tool types.

One explanation for the low export share of the United Kingdom, despite its low price level, may be that its delivery delays were longer than those of the United States and Germany. Steuer, Ball, and Eaton estimated that U.K. delivery periods were twice as long as those of the United States and 20 per cent longer than the German ones.

Another possible explanation is that these price ratios are from a biased sample of machine tools. As was mentioned earlier, the United Kingdom tends to specialize in standard types of machine tools, the

United States in special tools, and Germany exports both types. Our ratios of foreign subsidiary prices to U.S. parent company prices for equivalent products are likely to be for standard tools because the most advanced types may be produced only in the United States. A large proportion of the other price comparisons are from less developed countries lacking the industries that would use advanced types of tools. Therefore, these data also would tend to relate to standard types of machine tools. The only way to cover the full range of products in such an index would be through regression analyses or other methods which permit comparison between two very different products that serve the same function. Being unable to collect the extensive data on specifications and performance needed for such a measure, we are obliged to use an index which is restricted to standard machine tools.

A completely independent estimate of price differentials can be derived from a survey of distributors of U.S. machine tools in thirty-six foreign countries by the National Machine Tool Builders' Association.[29] This involved asking distributors of U.S. machine tools in foreign countries to estimate the price differentials and the quality differentials between U.S. and foreign tools sold in their countries. We used the two estimated differentials to calculate price levels unadjusted and adjusted for quality differences. These quality-adjusted ratios on the whole confirmed the NBER price level indexes, coming to 87 for the United Kingdom, 85 for the EEC countries, and 84 for Germany, as compared

[29] *Survey of Foreign Machine Tool Markets,* National Machine Tool Builders' Association, Washington (no date, but probably 1963). These foreign distributors were asked to estimate both the price differential and the quality differential between U.S. and foreign machine tools in their countries. For each importing country we computed a quality-adjusted place-to-place comparison among the exporters' prices from these two estimates by dividing the price ratio by the quality ratio, and further adjusted it for differences in tariffs levied on tools from different sources of supply. We then averaged these across the list of purchasing countries, weighting each purchasing country's observations equally. The results were as follows, for the indexes unadjusted and adjusted for quality differences:

Country of Origin of Tools	*Unadjusted*	*Adjusted*
U.S.	100	100
U.K.	72	87
EEC, total	68	85
Germany	70	84
France	71	90
Italy	62	90
Switzerland	82	86
Japan	57	94

(Both sets of indexes were adjusted to take account of tariff differences, to place the sellers' prices on an f.a.s. basis.)

to 86 for all three in Table 12.28. The Swiss index calculated from this survey was close to the German one while the French and Italian indexes were higher and the Japanese still higher, although still below the U.S. level.[80]

Textile and Leather Machinery [81]

Trade

Germany was the leading exporter of textile and leather machinery, responsible for over one-fourth of OECD exports, followed by the United Kingdom, the United States, and Switzerland with shares of 17 per cent, 14 per cent, and 12 per cent, respectively (see Table 12.29). Europe was the major destination of Swiss and German exports, while for the United States, the American republics, Asia, and Canada were the main markets; and for the United Kingdom, Asia was a more important destination than Europe. Trade sources reported that a significant amount of U.S. exports consisted of used machinery which was exported to Latin America and Canada. The relative importance of used machinery in exports may well be higher for the United States than for the other major exporters because of the higher U.S. rate of obsolescence of equipment due to more rapid technological change and also, in some branches of the textile industry, notably knitted outerwear, to frequent style changes.

Textile machinery accounted for over three-quarters of total OECD exports in this group, and sewing machines constituted the bulk of the remainder; the other subgroup, machinery for leather, made up less than 5 per cent of exports.

Textile Machinery

Textile machinery tends to be highly specialized because of the variety of fibers and processes, and the lines of specialization seem to be drawn more sharply between firms than between countries. The possession of a particular type of machine provides a given firm with

[80] The price estimates uncorrected for quality differences suggested much wider gaps in levels, and the ranking of the countries was quite different. The disregard for quality differences in this type of comparison may account for some of the wide price discrepancies reported in the press.

[81] SITC 717. *Value of OECD exports in 1963:* $1,294 million; 2.9 per cent of study total. *Coverage:* Textile machinery; leather machinery; sewing machines.

Table 12.29
OECD Exports of Textile and Leather Machinery (SITC 717),
by Origin, Destination, and Commodity Subgroup, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 717	Share in OECD Exports (per cent)						
						EEC		Switzer-	
			OECD	U.S.	U.K.	Total	Germany	land	Japan
Total, all destinations	$1,296	100.0	100.0	14.7	17.5	42.9	27.5	12.2	9.2
Destination									
U.S.	98	7.6	100.0		20.4	31.6	23.5	9.2	30.6
OECD Europe	618	47.7	100.0	11.2	11.3	53.2	35.0	17.8	2.3
U.K.	63	4.9	100.0	23.8		44.4	28.6	23.8	1.6
EEC total	364	28.1	100.0	10.7	11.8	51.9	32.4	20.3	1.4
Germany	84	6.5	100.0	13.1	13.1	28.6		33.3	1.2
Italy	86	6.6	100.0	7.0	12.8	59.3	45.3	19.8	0.2
Switzerland	25	1.9	100.0	8.0	8.0	80.0	64.0		
Canada	49	3.8	100.0	73.5	12.2	8.2	6.1	4.1	4.1
Japan	51	3.9	100.0	27.4	13.7	52.9	29.4	5.9	
Latin America	120	9.3	100.0	35.0	10.0	40.0	25.8	6.6	5.8
Other	360	27.8	100.0	8.1	31.1	32.8	19.2	7.8	18.0
SITC commodity subgroup									
Textile machinery (717.1)	1,006	77.6	100.0	14.7	18.5	44.2	27.6	14.4	5.6
Leather machinery (717.2)	46	3.5	100.0	13.0	19.6	56.5	41.3	0.2	0.3
Sewing machines (717.3)	244	18.8	100.0	14.8	12.7	34.8	24.2	5.3	25.8

Source: Appendix A and sources cited there.

an advantage both in its domestic and in the world market. The industry has been characterized by very rapid technological advance in the last ten or fifteen years. The timing of these changes has varied somewhat from one segment of the industry to another. In most fields the United States has been the technological leader, but many think the gap has been closing. The U.S. textile industry tends somewhat to produce more complex machines than the European and Japanese industries. U.S. industry is geared largely to the home market, only about 20 per cent of its production being exported, while exports absorbed around 70 per cent of German and 90 per cent of Swiss output.[32] The underdeveloped countries, which are significant purchasers of textile machinery in world markets, tend to favor the simpler designs. It is interesting to note that in sectors in which the U.S. textile industry is geared to rapid style changes, the U.S. equipment industry appears to have adapted to its market by producing more versatile, less speedy, and sometimes less durable machines. It is the Europeans, for example, who have been turning out machines that will make standard sweaters at high speed. In general, however, U.S. equipment tends to be more durable than foreign although not always so well finished (e.g., castings may be polished on a foreign but not on a U.S. machine).

The distribution of textile and leather machinery exports did not change greatly over the period for which we have data. The EEC countries as a group showed consistent gains in their share; and the United Kingdom, fairly consistent losses (Table 12.30). Since total OECD exports of textile machinery were growing slowly, the decline in the U.K. share and the slight fall in the U.S. share left both countries' exports virtually static over the four-year period.

Textile machinery export prices in general have followed similar movements in the United States and the Common Market. As may be seen in Table 12.31 (top panel), prices rose by about 25 per cent between 1953 and 1964. We do not have sufficient data for the United Kingdom and Switzerland to warrant the publication of separate series for these countries, but the information we do have indicates a somewhat larger rise in the United Kingdom and a still greater one in Switzerland.

[32] These figures, which refer to 1962, were reported in a statement to the U.S. Tariff Commission by Mr. Robert S. Pennock on behalf of the American Textile Machinery Association, March 2, 1964. The statement quoted the German and Swiss figures from trade association sources in those countries.

Table 12.30
OECD Exports of Textile and Leatherworking Machinery, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)						
					EEC			
		OECD	U.S.	U.K.	Total	Germany	Switzerland	Japan
				INCLUDING JAPAN				
1964	$1,504	100.0	15.2	15.3	43.6	27.4	11.4	10.8
1963	1,296	100.0	14.7	17.5	42.9	27.5	12.2	9.2
1962	1,278	100.0	15.6	17.6	41.5	26.1	11.3	10.4
				EXCLUDING JAPAN				
1962	1,145	100.0	17.4	19.7	46.4	29.1	12.6	
1961	1,124	100.0	18.7	20.6	45.5	28.0	11.6	

Source: Appendix B.

Table 12.31
International Prices, Price Competitiveness, and Price Levels, Textile Machinery, 1953, 1957, 1961–64

	1953	1957	1961	1962	1963	1964
INTERNATIONAL PRICE INDEXES (1962 = 100)						
U.S.	80	91	98	100	100	101
EEC	81	88	97	100	100	102
Germany	81	88	97	100	101	103
INDEXES OF U.S. PRICE COMPETITIVENESS (1962 = 100)						
Relative to						
EEC	102	97	99	100	100	101
Germany	102	97	99	100	101	102
INTERNATIONAL PRICE LEVELS (U.S. FOR EACH YEAR = 100)						
U.S.	100	100	100	100	100	100
EEC	88	84	85	86	86	87
Germany	88	84	86	86	87	88

Source: International price indexes from Appendix C; price competitiveness indexes, Appendix D; price levels, Appendix E.

The export prices of Germany and of the EEC as a whole have been lower than U.S. prices for comparable goods by 12 to 16 per cent. The data in Table 12.31 (bottom panel) indicate that the European prices were at their lowest relative to the United States in 1957 and at their highest in 1964, but the differences between the years are small and probably fall within the margins of error that must be assigned to the estimates.

The data for the United Kingdom and Switzerland are adequate to provide estimates of their export price levels for one or two individual years. We estimate that U.K. prices were at about the same level in 1963 as EEC prices, whereas Swiss prices were several percentage points above EEC prices. These facts in conjunction with what has already been said about time trends suggest that the United Kingdom and to a smaller degree, Switzerland, started out the 1953–64 period with price levels that were lower than those of Germany and the Common Market. The scattered data we have for Japanese textile machinery prices in 1964 seem to indicate they were about the same as those of western Europe.

Although there are no sharply drawn lines of international specialization, a few tentative generalizations may be offered. The United Kingdom seems able to offer cotton spinning machinery at lower prices than other countries, while Italy tends to be cheaper on standard looms. Germany has an advantage in finishing equipment; and the United States, in handling machinery (e.g., cloth spreaders). As already noted, each country has firms which offer unique goods in different branches of the textile machinery industry, with U.S. exports probably most heavily dependent upon uniqueness.

While purchases of textile machines are often made on the basis of design, price is undoubtedly a key variable, especially for the less complex machines that probably loom large in world trade. It also seems likely that textile machinery buyers are very sensitive to the trade-off between design and price, so that price is a significant factor even for the more sophisticated type of product.

Machinery for Hides, Skins, and Leather

Germany was the most important exporter of leather machinery in 1963, accounting for over 40 per cent of the OECD total (see Table 12.29). The data indicate that the margins by which European prices

are lower than those of the United States are larger than in the case of textile machinery. Also, unlike the textile machinery case, European vis-à-vis U.S. prices declined between 1963 and 1964.

This, too, appears to have been a field of rapid technological change, especially in the important shoe machinery component, and machine design has been an important factor in a country's ability to export.

Sewing Machines

Japan is the world's leading exporter of sewing machines, having nosed out Germany in the mid-1950s; the two countries accounted for about one-half of OECD exports in 1963 (see Table 12.29). Japan's exports are primarily of the household type while German exports are evenly divided between household and industrial machines. The United States, which absorbs about half of Japan's exports, is the third largest exporter, with virtually all of its exports consisting of industrial machines. Indeed, the bulk of U.S. output consists of industrial machines; by the end of our period only one U.S. firm was continuing to produce household machines in the United States.

The factors affecting the ability of each country to sell in world markets are similar to those that have been described in the case of textile machinery. The U.S. export position rests upon its capacity to provide machines embodying the latest technology and highest productivity. This type of machine can be marketed most readily in countries where labor is relatively scarce, and indeed it is to such destinations that most U.S. exports go. The different character of various foreign markets is clearly suggested by Table 12.32 in which the unit values of U.S. exports of industrial sewing machines are arrayed in ascending order. The first five destinations are clearly low-wage countries which are buying either used or less sophisticated machines. U.S. trade sources state that the market for industrial sewing machines in underdeveloped countries tends to consist largely of the types that are commercially obsolete in the advanced countries. The prices of such machines tend to be lower in Europe and Japan than in the United States, and prices have not been rising as much as they have for the more sophisticated machines. Some of the major U.S. companies produce their more standard models abroad in order to lower their costs.

As in the case of textile machinery, the time-to-time movements of export prices of sewing machines in the three countries are remarkably similar (Table 12.33). The place-to-place data were not sufficient to

Table 12.32
U.S. Exports and Unit Values of Industrial Sewing Machines, 1964

	Exports (millions)	Unit Value
Hong Kong	$0.8	$107
Mexico	1.1	236
Japan	1.3	246
Venezuela	0.8	283
Brazil	0.5	305
Belgium	2.4	322
Germany	1.7	333
United Kingdom	2.9	388
Australia	1.0	437
Italy	0.9	446
France	1.4	492
Canada	3.2	497
Republic of S. Africa	1.0	616
All U.S. exports	24.9	340

Source: *United States Exports of Domestic and Foreign Merchandise; Commodity by Country of Destination*, 1964 Annual, U.S. Dept. of Commerce, Report FT 410, June 1965, pp. 329–330. All countries which received at least $500,000 worth of exports are included in the table. These exports are recorded as complete head assemblies (Schedule B, item 75525).

Table 12.33
International Prices and Price Competitiveness, Sewing Machines, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
INTERNATIONAL PRICE INDEXES						
U.S.	88	100	99	100	99	103
Germany	88	99	97	100	98	102
Japan	NA	NA	99	100	101	105
INDEXES OF U.S. PRICE COMPETITIVENESS						
Relative to						
Germany	99	99	98	100	99	99
Japan	NA	NA	100	100	102	102

Source: International price indexes from Appendix C; price competitiveness indexes, Appendix D.

enable us to include them in the table. The U.K. export prices in 1964 were several percentage points higher, and the German prices several percentage points lower than those of the United States. More scattered data suggest that other EEC prices were in the same range as German prices, while Japanese prices were definitely lower.

Textile and Leather Machinery as a Whole

When the subgroups are combined (Table 12.34), the results more closely resemble those for textile machinery than for sewing machines, as is to be expected from the better than four-to-one ratio of the weights of the two subgroups. The slower rise of sewing machine prices and the more competitive price position of U.S. manufacturers of sewing machines are, however, revealed in the figures. All in all, European

Table 12.34
International Prices, Price Competitiveness, and Price Levels, Textile and Leather Machinery, 1953, 1957, 1961–64

	1953	1957	1961	1962	1963	1964
INTERNATIONAL PRICE INDEXES (1962 = 100)						
U.S.	81	92	98	100	100	101
U.K.	80	90	98	100	102	104
EEC	82	90	97	100	100	102
Germany	82	90	97	100	100	103
Japan	NA	NA	100	100	101	102
INDEXES OF U.S. PRICE COMPETITIVENESS (1962 = 100)						
Relative to						
U.K.	98	97	99	100	102	102
EEC	101	98	99	100	100	101
Germany	101	98	99	100	101	101
Japan	NA	NA	102	100	101	100
INTERNATIONAL PRICE LEVELS (U.S. FOR EACH YEAR = 100)						
U.S.	100	100	100	100	100	100
U.K.	83	83	84	85	86	87
EEC	89	86	87	88	88	88
Germany	89	86	87	88	88	89

Source: Same as Table 12.31.

prices have been a little more than 10 per cent below U.S. prices for SITC 717 as a whole with very little change in price relationships over the last four years, during which prices rose by 4 or 5 per cent both in the United States and in Europe. According to the index we produced (based on ten series from the export price index of the Bank of Japan and a smaller number of series obtained from the United States and other sources), the price increase in Japan has been somewhat smaller.

Mechanical Handling Equipment [88]

Trade

The United States was the leading supplier of mechanical handling equipment, followed by Germany, the United Kingdom (a poor third), and then France (Table 12.35). The poor showing of the United Kingdom is partly a product of differences in classification methods, as is pointed out in the notes to Appendix A, but its rank would not be altered by a reclassification of the U.K. figures to match those of the United States.

Within Europe itself, Germany was the largest supplier, although the United States was also important. Outside of Europe, however, the United States dominated the market by a large margin, and the United Kingdom, rather than Germany, was often the second most important source of equipment. Lifting and loading machinery account for 85 per cent of the group total; and forklift and other industrial trucks, for about 15 per cent. The lifting and loading machinery item is itself a composite of several very different types of machinery. The largest single item is self-propelled loading shovels for the construction industry, but such varied items as cranes and conveyors for construction, mining, and factory use, and oil field derricks are also important.

Some of the elements of U.S. competitiveness are concealed by the broadness of the published trade classes. U.S. companies led in producing self-propelled loaders for construction; and it was not unusual, even when worldwide bidding was solicited, to find only American companies, and sometimes their foreign subsidiaries, offering such machines. It has also been reported that U.S. companies have led in

[88] SITC 719.3. *Value of OECD exports in 1963:* $810 million; 1.8 per cent of study total. *Coverage:* Lifting and loading machinery; forklift and other industrial trucks.

Table 12.35
OECD Exports of Mechanical Handling Equipment (SITC 719.3),
by Origin, Destination, and Commodity Item, 1963
(dollars in millions)

	Value of Exports	Per Cent of OECD Exports in 719.3	Share in OECD Exports (per cent)					
						EEC		
			OECD	U.S.	U.K.	Total	Germany	Japan
Total, all destinations and items	$810	100.0	100.0	34.7	12.0	40.5	24.7	1.6
Destination								
U.S.	18	2.2	100.0		5.6	33.3	22.2	5.6
OECD Europe	424	52.4	100.0	25.5	7.5	55.0	36.6	0.0
U.K.	29	3.6	100.0	34.5		48.3	24.1	
EEC total	238	29.4	100.0	26.5	6.7	56.3	36.1	
Germany	48	5.9	100.0	39.6	8.3	35.4		0.0
Canada	63	7.8	100.0	85.7	7.9	3.2	1.6	0.0
Japan	5	0.6	100.0	25.5	21.3	40.4	31.9	
Latin America	74	9.0	100.0	62.2	5.4	23.0	9.5	1.4
Other	226	27.9	100.0	32.3	23.9	30.1	14.2	4.9
SITC commodity item								
Lifting and loading mach. (719.31)	689	85.0	100.0	34.5	11.3	40.9	25.5	1.7
Fork lift and other industrial trucks (719.32)	121	15.0	100.0	36.4	15.7	37.2	19.8	0.8

Source: Appendix A.

Table 12.36
OECD Exports of Mechanical Handling Equipment, 1961–64
(dollars in millions)

	Value of OECD Exports	Share in OECD Exports (per cent)					
		OECD	U.S.	U.K.	EEC Total	EEC Germany	Japan
		INCLUDING JAPAN					
1964	$917	100.0	35.2	11.5	38.7	22.4	2.6
1963	810	100.0	34.8	12.0	40.5	24.8	1.6
1962	694[a]	100.0	33.6	11.2	42.6	26.5	1.5
		EXCLUDING JAPAN					
1962	684[b]	100.0	34.1	11.4	43.3	26.9	
1961	613[b]	100.0	37.0	12.0	41.0	25.7	

[a]Excluding Iceland and Ireland.
[b]Excluding Iceland, Ireland, and Japan.

the design and production of large cranes for container handling at docks, partly because the United States led in the use of containers for shipping.[34]

Most of the major American firms manufacture abroad as well as in the United States, but the contribution of overseas subsidiaries to foreign exports is not clear. Some indication of the importance of exports for foreign subsidiaries is given in a recent report on one of the important manufacturers of loading equipment. One foreign subsidiary was expected to export 95 per cent of its production, and two others, in larger countries, exported 60 and 70 per cent of their production.[35] Overseas facilities are particularly important in the supply of elaborate conveying systems and elevators, because they must be fitted to the particular job and cannot be standardized. A fairly large part of the sales in this group are supplied mainly through bids for specific jobs, because of their nonstandardized nature.

Data on changes in the share of the various countries, available only back to 1961, show fairly small shifts (Table 12.36). Both the EEC

[34] "Gantry Cranes: Why Buy British?," *Economist*, October 22, 1966, p. 409.
[35] "The Multinational Diet That Helps 'Cat' Thrive," *Business Week*, August 13, 1966. The description applies to the whole range of the company's products, most of which fall into SITC subgroups 711.5, 712.5, and 718.4.

Table 12.37
International Prices, Mechanical Handling Equipment, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
U.S.	NA	91	100	100	101	103
U.K.	NA	101	99	100	100	103
EEC	76	86	95	100	100	102
Germany	75	85	95	100	100	102

Source: Appendix C.

and the German shares were lower in 1964 than in 1961, falling particularly in 1963 and 1964. The U.S. share, after falling in 1962, rose slightly between 1962 and 1964 but remained below the initial level. Gains were made by Japan and several smaller countries.

Price Trends

International price trends for materials handling equipment are described by the indexes of Table 12.37. For the group as a whole, they indicate a gradual rise in price after 1962 in both the United States and the European countries. Before that date there were widely contrasting price movements: stability from 1957 to 1962 in the United Kingdom (judged on the basis of rather poor data), large increases in both 1957–61 and 1961–62 in Germany and the EEC as a whole, and a slightly smaller price increase in the United States. Since lifting and loading machinery account for 85 per cent of the weight of the whole group, its indexes tell essentially the same story and need not be described separately.[86]

In the small subgroup SITC 719.32, forklift and other industrial trucks, the indexes for the United States and the EEC countries moved almost identically between 1957 and 1963, but diverged in 1964 as

[86] On the whole, indexes derived from U.S. wholesale price data for both SITC 719.31 and SITC 719.3 move closely with the international price indexes, never deviating by more than two percentage points. If the difference is at all significant, it is in the direction of showing a slightly slower price increase in domestic prices than in international prices over the period as a whole.

Foreign wholesale price series are available only for Japan, and they fell substantially between 1961 and 1964 for subgroup 719.31. This contrasts with a rising trend in the U.S. wholesale price series and in the U.S. and European international price series.

Table 12.38
Price Levels, Mechanical Handling Equipment, 1953, 1957, 1961–64
(U.S. for each year = 100)

	1953	1957	1961	1962	1963	1964
U.S.	100	100	100	100	100	100
U.K.	NA	86	84	83	89	91
EEC	72	80	81	86	85	85
Germany	NA	73	74	78	78	77

Source: Appendix E.

U.S. prices took a major jump (which is partly responsible for the larger increase, in SITC 719.3 as a whole, in the United States compared with other countries). The validity of the observed international price change is, however, suspect: The international price data can be divided between sellers' reports and buyers', and while the former showed a substantial rise in 1963–64, the latter showed a very small one. Furthermore, the index from buyers' prices resembles that for SITC 719.31 more closely than the sellers' price index does.[37] None of this is conclusive evidence, of course, but it suggests some doubt about the 1964 increase in SITC 719.32.[38]

Price Levels

Working from a set of data largely independent of those used in the international price indexes we can calculate relative international price levels for mechanical handling equipment. These, summarized in Table 12.38, show that German price levels for the group as a whole have

[37] The wholesale price index, which followed the international price index closely between 1957 and 1962, showed no increase after that date.

[38] Still another set of observations relating to U.S. exports is provided by export unit values for two items in this group which are used for the official Department of Commerce export unit value index. The unit value for loaders resembles our U.S. international price index in showing a large rise between 1958 and 1961 and a 1964 value a little above 1961 and 1962. However, the rise in the unit value between 1958 and 1961 is much larger than that in either the international price index or the wholesale price index between 1957 and 1961, and may well include the effects of increases in the size and power of these machines.

For SITC 719.32 the export unit value fell between 1961 and 1962, when wholesale and international prices rose, and increased sharply in 1963 when the other two moved very little. In 1964, when the international price index and the wholesale price both rose, the unit value declined.

We conclude that the unit value series is not a reliable guide to international price changes in either of these subgroups.

consistently been the lowest among the countries listed. The EEC countries taken together show price levels somewhat higher than the German ones but lower than those of the United Kingdom; and the United Kingdom, in turn, has been below the U.S. level in every year shown.

When the materials handling equipment group is divided up into its components, major differences appear. In the category of forklift and other industrial trucks, which are used for materials handling within factories and warehouses, prices in the United Kingdom and, on the average, in the EEC countries have been above U.S. prices. German prices have been at about the U.S. level, except in 1964, when they dipped slightly.

In the much larger category of lifting and loading machinery, only France apparently had higher prices than the United States, while all the other countries in the group reported substantially lower prices—ranging from 10 to 20 per cent lower in the United Kingdom and 25 to almost 40 per cent lower in Germany, with Japan at about or slightly above the German level. Even within this subgroup, however, there was a great deal of variation. For front-end loaders, used in construction, countries other than the United States and the United Kingdom rarely even submitted offers, and U.S. offers were generally equal or superior to those of other countries, including the United Kingdom.[89] The United States was sometimes at an advantage, also, in complex conveying systems, such as for ores. In the larger group of cranes, hoists, and parts of materials handling equipment, the price relatives ranged from half to twice the U.S. offers, but low ratios predominated, particularly on smaller items, bringing down the averages to considerably below U.S. levels. A fair number of bids on these products were at prices more than 40 per cent and sometimes more than 50 per cent below U.S. prices, without, according to the purchasers, any clear U.S. quality margin.

In loaders and forklift trucks, in which the competitive position of the United States is strongest, prices offered by U.S. companies can be compared with those offered for the same models by the companies' foreign subsidiaries. The number of cases is too small to be conclusive, but they suggest that the foreign subsidiaries of U.S. firms compete on more favorable terms with their U.S. parents than the general run of

[89] The inclusion of front-end loaders in SITC 719.3 has been questioned. They are more akin to the construction machinery of SITC 718.42, and are so placed in the U.K. export statistics (see note to Appendix A).

firms in those countries. The differences average about 5 or 6 per cent, for both the United Kingdom and the Common Market countries, on items for which the place-to-place indexes run between 100 and 110 per cent.

If we compare the price levels for SITC 719.32 with the export data of Table 12.35 we find that the United States and Germany, with the lowest prices, were the leading exporters, although there is nothing in the price data to explain the large U.S. lead over Germany. The United Kingdom, next in price level by a very narrow and probably not significant margin, followed in importance as an exporter, while France, Italy, and Belgium, all higher-priced sellers, exported comparatively minor amounts.

Comparisons for SITC 719.31 are made difficult by inconsistencies among the trade statistics of the various countries. The dominance of the United States is somewhat surprising, since price levels in the other countries are much lower. However, a large part of U.S. exports, about $110 million, were front-end loaders, in which the United States was clearly the major world exporter by a considerable margin. These machines, in which the United States has a favorable price position, are omitted from the U.K. export total and may not be included in the figures for other countries. Furthermore, the German price level for SITC 719.31 may be understated because there were no German price data for loaders, an item for which U.S. prices tended to be much more competitive than for the cranes and hoists which make up the rest of the subgroup. The U.K. index for 1963, for example, would have been almost five percentage points lower if loaders had been excluded.

Another large element of U.S. exports was petroleum and natural gas field production equipment and parts, for which we have no price data. The U.S. competitive position was probably stronger in this item than in the rest of SITC 719.31.

If the loaders are excluded from U.S. exports, Germany becomes the largest exporter by a substantial margin. However, the United States remains a considerably larger exporter than the United Kingdom despite the apparently lower U.K. prices.

Price Competitiveness

Combining the place-to-place and time-to-time price data, we derived the indexes of U.S. price competitiveness set out in Table 12.39. For

Table 12.39
U.S. Price Competitiveness, Mechanical Handling Equipment, 1953, 1957, 1961–64
(1962 = 100)

	1953	1957	1961	1962	1963	1964
Relative to						
U.K.	NA	104	101	100	107	110
EEC	84	94	95	100	99	99
Germany	NA	94	95	100	99	98

Source: Appendix D.

the group as a whole, and for the main component, SITC 719.31, they show U.S. price competitiveness to have improved relative to both the United Kingdom and the EEC, if the final year's indexes are compared with the earliest ones. The improvement in the U.S. position between 1953 and 1962 relative to the EEC and Germany was followed by a slight decline. The United States lost ground relative to the United Kingdom until 1962 and then gained. The indexes for SITC 719.32 suggest smaller changes in price competitiveness, with the United States gaining slightly over the United Kingdom and declining relative to Germany and the EEC as a group.[40]

Appendix: Price Estimates Based on Regression Analysis

Aircraft Engines

Place-to-place indexes of aircraft engine prices, shown earlier in this chapter, were based mainly on a regression analysis of prices of British and American aircraft engines as related to power and weight. As is the case for many machinery products, we are unable to make

[40] Two of the larger changes in price competitiveness shown by the indexes are questionable because data not included in the indexes, and too weak to be conclusive, do show different relative price movements. U.K. time-to-time data for SITC 719.31 fail to confirm the large jump in U.S. price competitiveness in 1963. They suggest approximate stability since 1961 and, therefore, that the U.S. position has deteriorated somewhat since 1957, rather than improved. Similarly, place-to-place data on SITC 719.32 for Germany indicate very little change in 1962–64, rather than a decline in U.S. price competitiveness, and therefore imply that the U.S. position in this subgroup remained virtually unchanged throughout the whole period. It must be stressed, however, that both of these are suggestions from very fragmentary data, and that the indexes shown in the table are supported by greater numbers of observations.

direct comparisons of U.S. and foreign prices because the engines produced in one country do not have exact counterparts in the other, even though the range of weight and power is similar. Therefore, the comparison between the two countries has been made by fitting an equation to price, take-off thrust, and weight of engines produced in both countries. Each country's price level was estimated by inserting the country as a variable in the equation or by taking the ratio of each actual engine price to that derived from the equation for an engine of identical characteristics, and averaging these ratios separately for the United Kingdom and the United States.

Unfortunately the number of engines available for this analysis was small. One set of equations includes 24 engines and another set, limited to the range of thrust in which most U.S. and U.K. engines fall, is based on only 20 engines. However, these engines do include a very high proportion of the value of commercial jet engines produced in the two countries in 1962, and the five major producers are all represented in the sample. The sample is weakest at the low end of the scale, and omits all military engines and the piston engines that were used for executive, private, and other small aircraft.

Some problems were encountered in determining which engines were available for sale in 1962. Four U.S. engines were eliminated from the initial list because Civil Aeronautics Board data on purchases by U.S. airlines showed that none of them was delivered after 1961. Since these data were intended to represent prices of engines for order in 1962 we felt that these four were probably obsolete by the standards of 1962 and that the prices were therefore nominal. However, it was not possible to make the same analysis of the U.K. engines, and some out-of-date engines may therefore be included in that list.

The whole list of twenty-four engines covered a range of take-off thrust from about 3,000 pounds to 22,000 pounds. The lowest pair were U.S. engines in the 3,000–4,000 pounds thrust range, and the next two were U.K. engines in the 7,000–8,000 pounds range. Only at about 10,000 pounds and over was there a fair representation from both countries all along the scale. For this reason, all equations were computed not only for the entire range of engines but also excluding the four low-power engines, the smaller group representing those engines sold by both countries.

Seventeen equation forms were used for both sets of data, yielding

thirty-four equations. The coefficients for thrust were all statistically significant at the 1 per cent level. A majority of those for weight were significant at the 5 per cent level, and only one of those for country was even equal to the associated standard error. In eight cases we could compare equations including thrust, country, and weight as variables with corresponding equations excluding weight. The coefficient for the dummy variable representing the United Kingdom was negative (U.K. prices lower than U.S.) in seven of the eight equations without weight as a variable, but when weight was included, it shifted to positive in six of the seven cases and increased in the other two also. Thus the U.K. engines were cheaper, but heavier, than U.S. engines of corresponding thrust, and they were no longer cheaper when the negative value of extra weight was taken into account. Since the country coefficients were not significant and the weight coefficients were, we discarded all the eight equations excluding weight, along with six others which excluded both weight and country.

Thrust and weight, taken separately, are both highly correlated with engine price. However, the two are also highly correlated with each other, and it seems likely that the thrust-weight relationship accounts for the high positive gross correlation of weight and price.

We have, in several equations, substituted residuals from the relationship between thrust and weight for the weight variable. Thus, instead of

$$Y\ (\text{Price}) = aX_1\ (\text{Thrust}) + bX_2\ (\text{Weight}) + cX_3\ (\text{Country}) + d$$

we calculated the regression of weight on thrust

$$X_2 = eX_1 + g$$

and substituted the residuals from this relationship for the weight variable above, to give

$$Y = hX_1 + k(X_2 - eX_1 - g) + mX_3 + n$$

The effect of this transformation of the weight variable is to change the thrust coefficient and the constant term, leaving the weight coefficient, the country coefficient, and the level of $\bar{R}^2$ unchanged. The effect on the coefficients can be seen in the following rearrangement of terms:

$$Y = (h - ke)X_1 + kX_2 + mX_3 + (n - kg)$$

The relationships with the original equation are thus that:

$$h - ke = a$$

$$k = b$$

$$m = c$$

$$n - kg = d$$

The country variable was also measured in two different ways. One was to insert it in the equations. The other was to omit it from the equations and compare the relative deviations from the regression line for U.S. engines with those for U.K. ones. The latter procedure was, in effect, a decision to put under thrust and weight any effects on price which, because of interrelations between country and the other variables, might have been attributed to the country variable if all three variables had been combined in one equation.

The twenty equations remaining after those omitting the weight variable were dropped, are summarized in Table 12.40. The $\bar{R}^2$ range from .85 to .95, and the standard errors are all between 5 and 7 per cent of the mean price. Despite changes in the coefficients as the form of the equations is altered, the ratio of U.K. to U.S. prices, which was the main object of the regression analysis, is extremely stable, varying only from 102 to 103 among the equations for all twenty-four engines; and from 99 to 101 among the equations which excluded the small engines. The stability of the index estimates is important for this study because it suggests that the country-to-country price relationships may be satisfactorily estimated by regressions that are not reliable for the estimation of other influences on price, and that it may therefore be possible to ignore some of the problems that frequently arise in the estimation of other variables. However, there are dangers in the omission of variables correlated with country of origin, since these could seriously affect the country coefficients.

For the place-to-place indexes of Table 12.7 a single choice among the country indexes of Table 12.40 was required. For several reasons we decided not to use the 24-engine equations, although they covered a wider range of engine types. The number of engines of low take-off thrust was small, and the U.S. and U.K. engines occupied different parts of the power range. We were therefore unable to separate the

Table 12.40
Regression Analysis of Aircraft Engine Prices
(figures in parentheses are ratios of coefficients to standard errors)

Equation Number	Coefficients of Independent Variables: Take-off Thrust (100 pounds) Actual	Take-off Thrust (100 pounds) Log	Weight (100 pounds) Actual	Weight (100 pounds) Weight-Thrust Residual[a]	Weight (100 pounds) Log Weight	U.K.[b]	Constant Term	$\bar{R}^2$	S.E. (as % of Mean)[c]	Index: U.K./U.S.
A. ALL ENGINES										
1A	1,444		-1,693				46,836	.9449	6.8	103.4
	(6.83)		(1.96)				(6.01)			
2A	1,485		-1,861			3,281	45,443	.9431	6.9	101.7
	(6.54)		(2.00)			(.55)	(5.46)			
3A	1,043			-169			47,327	.9449	6.8	103.4
	(19.82)			(1.96)			(6.07)			
4A	1,044			-186		3,280	45,983	.9431	6.9	101.7
	(19.50)			(2.00)		(.55)	(5.55)			
5A		226,882			-100,159		-569,284	.9452	6.8	102.2
		(8.67)			(4.70)		(9.70)			
6A		235,234			-107,179	4,949	-587,973	.9444	6.8	102.6
		(8.34)			(4.65)	(.83)	(9.29)			
7A	.0063		.0006				2.0051	.8617	5.9	102.6
	(2.93)		(.07)				(25.23)			
8A	.0067		-.0008			.0285	1.9930	.8564	6.0	102.8
	(2.88)		(.09)			(.47)	(23.45)			
9A		.9598			-.2121		-1.0289	.9498	5.6	101.8
		(5.95)			(1.62)		(2.84)			
10A		.9941			-.2410	.0203	-1.1056	.9480	5.6	102.0
		(5.66)			(1.68)	(.55)	(2.81)			

(continued)

Table 12.40 (concluded)

Equation Number	Coefficients of Independent Variables: Take-off Thrust (100 pounds) Actual	Take-off Thrust (100 pounds) Log	Weight (100 pounds) Actual	Weight (100 pounds) Weight-Thrust Residual[a]	Weight (100 pounds) Log Weight	U.K.[b]	Constant Term	$\bar{R}^2$	S.E. (as % of Mean)[c]	Index: U.K./U.S.
B. ENGINES OTHER THAN FOUR OF LOWEST THRUST										
1B	1,495		-2,461				68,295	.9176	5.2	99.5
	(8.08)		(3.01)				(5.97)			
2B	1,494		-2,456			-90	68,308	.9125	5.4	100.0
	(7.43)		(2.75)			(.02)	(5.78)			
3B	976			-246			58,159	.9176	5.2	99.5
	(14.30)			(3.01)			(5.32)			
4B	976			-246		-90	58,192	.9125	5.4	100.0
	(13.87)			(2.75)		(.02)	(5.09)			
5B		245,841			-106,551		-642,465	.9009	5.7	100.6
		(7.94)			(3.42)		(9.64)			
6B		248,805			-109,610	2,108	-647,121	.8955	5.9	101.0
		(7.57)			(3.31)	(.35)	(9.28)			
7B	0.0072		-.0124				2.3662	.8944	5.0	99.0
	(7.20)		(2.80)				(38.32)			
8B	0.0071		-.0118			-.0108	2.3677	.8887	5.0	98.9
	(6.54)		(2.46)			(.36)	(37.27)			
9B		1.1955			-0.5406		-1.0366	.8918	5.0	100.0
		(7.76)			(3.49)		(3.12)			
10B		1.1959			-0.5411	.0003	-1.0359	.8850	5.1	100.0
		(7.27)			(3.27)	(.01)	(2.97)			

Notes to Table 12.40

Note: In equations 1A–6A and 1B–6B, the dependent variable is priced in dollar amounts. In the other equations, the dependent variable is the natural logarithm of price in tens of thousands of dollars.

Data are order prices for 24 U.S. and U.K. jet aircraft engines available early in 1962. They were supplied by both buyers and sellers of engines and were checked also against Civil Aeronautics Board data on engines purchased by U.S. airlines. Four U.S. engines nominally available for sale at this date were excluded because they appeared to belong to an earlier generation of engines, and no deliveries were reported after 1960 or 1961. It is possible that further exclusions should have been made on the same grounds.

Of 34 equations originally fitted, 14 were dropped immediately for the reasons cited in the text. The equations dropped were identical to numbers 1, 2, 5, 6, 7, 8, and 10, both A and B, except that they omitted the weight variable.

The indexes were calculated in several different ways. Where there was a U.K. term in an equation for the log of price the coefficient (actually 100 [coefficient plus one]) was taken as the price index. Where there was a U.K. term in an equation for the actual price, the average specifications for 20 or 24 engines were inserted, U.K. and U.S. prices computed for that point, and the ratio taken as the index. Where there was no U.K. term in the equation the index was measured, in the actual price equations, from the averages of ratios of actual to expected price for U.K. and U.S. engines. In the log equations, the index was the antilog of the difference between average U.K. and average U.S. residuals. The last two procedures imply two different types of average: an arithmetic mean of ratios in the former case and a geometric mean in the latter.

[a]Residual from equation relating weight to thrust.

[b]Dummy variable taking value of 1 for U.K. engines and zero for U.S. engines.

[c]For the logarithmic equations these are ratios of the antilog of the logarithmic standard error to the mean of actual prices.

influence of country of origin from the influence of the other variables in this range.

Among the 20-engine regressions, the highest correlations were for 1B and 3B, which produced U.K.-U.S. indexes of 99.5. The logarithmic equations had slightly lower standard errors, but the average of their U.K.-U.S. price indexes was also 99.5. We used this value as the 1962 place-to-place index for the complete aircraft engine component of the index for aircraft engines and parts in the computations for Table 12.7.

Outboard Motors

Retail prices of outboard motors ranging from 3 to 100 horsepower were made available from a market survey by a large producer. The survey included motors of four U.S. producers and six producers in

Belgium, Canada, Italy, Sweden, and the United Kingdom (see Table 12.41).

For our study we would have preferred to have f.a.s. export prices for each country's producers. Instead, we had each producer's retail prices in a number of different places, usually including his home market and one or more foreign markets. We tried to come a little closer to the approximation of relative export prices by excluding the observations relating to a producer's price in his home market.

There were 127 usable observations for 1962 and 97 for 1963, of which, it may be seen from Table 12.41, 79 and 54, respectively, were U.S. models. The prices were those prevailing on the French, German, Italian, or British markets. Where a producer sold the same model in two or more different markets the prices usually differed, and

Table 12.41
Number of Observations and Average Horsepower of Outboard Motors, 1962 and 1963

Country of Producer	No. of Producers	No. of Observations in Market of					Average Horsepower
		France	Germany	Italy	U.K.	Total	
1962							
U.S.	4	26		22	31	79	34
U.K.	1			8		8	23
Belgium	2	7		8		15	27
Italy	1				8	8	19
Sweden	2				7	7	16
Canada	1				10	10	26
Total	11	33		38	56	127	30
1963							
U.S.	4	21	8		25	54	35
U.K.	1	4	5			9	22
Belgium	1	7				7	26
Italy	1	5			7	12	16
Sweden	1	4			3	7	8
Canada	1				8	8	29
Total	9	41	13		43	97	28

the model was treated as a separate observation in each market. The number of different U.S. models was in each year about half the number of U.S. observations. Non-U.S. firms tended more to restrict their operations to one foreign market, so there were only about a dozen foreign models that had to be treated as more than one observation.

The 1962 data also contained information on motors equipped with electric starters, generators, and stern drive. The few that had the last two features were eliminated, but those with electric starters, accounting for about a fourth of both the U.S. and foreign observations, were retained. Two small, inexpensive motors made by a Japanese producer were excluded because they used kerosene as fuel rather than gasoline.

In deriving price comparisons from these data, we experimented with several approaches to regression analysis. Partly because we had information about the electric starter in one year but not in the other, it was more convenient to do separate regressions for the two years. In each case, there was one continuous independent variable, horsepower. The other variables—country of producer, market, and (in 1962 only) an electric starter—were used as dummies.[41]

Arithmetic and logarithmic regressions for the two years yielded $\bar{R}^2$'s of 0.95 or 0.96; the coefficients are presented in Table 12.42.[42] The producer coefficients tell us the amount by which the price or log price of each country differed from that of the United States. For example, the 1962 arithmetic regression indicates the U.K. retail prices in foreign markets were $28.34 less than U.S. retail prices in foreign markets. The difference, like all the other differences for producing countries, is not statistically significant. Indeed, all the Canadian coefficients are less than half their standard errors and the same is true for Italy, Belgium, and Sweden in at least one of the four regressions. We nevertheless converted the coefficients to price index numbers with the United States as the base in Table 12.43, since they represent our best, if somewhat uncertain, estimates of the price relationship. We took the arithmetic price differences as percentages based first on a 30-horse-

[41] The omitted variable for the producer dummies was for U.S. firms; thus each of the regression coefficients for the included variables could be regarded as giving the difference in price between the United States and the country to which the particular dummy variable referred. For the market variables, the United Kingdom was omitted.

[42] Correlations involving the log of price and arithmetic horsepower or arithmetic price and the log of horsepower yielded $\bar{R}^2$'s around 0.82.

Table 12.42
Regressions for Outboard Motors, 1962 and 1963

	Pooled Regressions			
	Arithmetic		Logarithmic[a]	
	1962	1963	1962	1963
Horsepower	14.52	15.30	.5593	.5857
	(0.30)	(0.35)	(.0119)	(.0151)
Producers				
United Kingdom	-28.34	-25.92	-.0636	-.0547
	(29.94)	(32.14)	(.0468)	(.0557)
Italy	20.37	-45.34	-.0012	-.0905
	(29.07)	(26.87)	(.0457)	(.0470)
Belgium	-16.75	33.51	-.0129	.0523
	(21.18)	(34.41)	(.0343)	(.0602)
Sweden	7.08	-20.64	-.0290	.1107
	(30.77)	(33.95)	(.0487)	(.0615)
Canada	-7.40	-10.59	-.0159	-.0026
	(26.61)	(32.49)	(.0418)	(.0569)
Markets				
France	149.88	104.29	.2250	.1862
	(19.25)	(19.88)	(.0302)	(.0348)
Germany		90.71		.1785
		(29.46)		(.0513)
Italy	112.71		.1924	
	(19.74)		(.0309)	
Electric starter	101.29		.1320	
	(15.99)		(.0258)	
Constant	168.21	172.83	4.5630	4.5147
	(16.02)	(19.27)	(0.0296)	(0.0374)
$\bar{R}^2$	0.9639	0.9601	0.9633	0.9501
Standard error				
(per cent of mean)	10.4	12.5	1.9	2.2

[a]In terms of natural logarithms.

power motor, which is close to the overall average of the whole sample, and then on a 15-horsepower motor, which is closer to the average size of the Italian and Swedish exports. The logarithmic form yields a constant percentage difference for every size motor.

Table 12.43
Comparative Prices of Outboard Motors, Based on Pooled Regressions, 1962 and 1963

	Arithmetic				Logarithmic	
	1962		1963			
	30 H.P.	15 H.P.	30 H.P.	15 H.P.	1962	1963
Prices of producing countries						
U.S.	100	100	100	100	100	100
U.K.	95	93	96	94	94	95
Italy	103	105	93	89	100	91
Belgium	97	96	105	108	99	105
Sweden	101	102	97	95	97	112
Canada	99	98	98	97	98	100
Prices in various markets						
U.K.	100	100	100	100	100	100
France	125	139	117	126	125	120
Germany			114	123		119
Italy	119	129			121	

Confining ourselves to the cases in which the arithmetic and logarithmic forms yield substantially similar price comparisons [43] and in which standard errors are not much larger than the coefficients, we hazard the following conclusions about European vs. U.S. producers' prices: (1) U.K. prices were about 5 per cent lower than U.S. prices in 1963, and perhaps a shade lower still in 1962. (2) Italian prices in 1963 were around 9 per cent below those of the United States. (3) Belgian prices were probably around 3 per cent lower than U.S. prices in 1962 and about 5 per cent higher in 1963. Reliable comparisons between the United States and Italy in 1962 and between the United States and Sweden or Canada in either year could not be made from the available data.

Retail prices on the Continent were higher than those in the United Kingdom. Foreign producers charged about 20 per cent more in the

[43] The arithmetic form produces $\bar{R}^2$'s which are marginally higher than those of the log form, but the differences are too small to warrant ignoring the results given by the latter.

French and Italian markets in 1962 and the French and German markets in 1963 than in the U.K. market in the same years.

We could not readily derive time-to-time indexes from the data because we did not know whether or not motors with electric starters were included in the 1963 observations. If we assume that they were not, the estimated U.S. price increase, for example, would be about 3 per cent between 1962 and 1963.[44] It seems more likely, however, that electric starters were included, and that their inclusion rather than a genuine rise in prices, accounts for the 3 per cent increase.

Regressions for the individual producing countries yielded similar coefficients. In the arithmetic form, for example, horsepower coefficients were almost invariably in the $15 to $17 range. The U.S. coefficients tended to be near the bottom of the range.

U.S. Tractors

Data obtained from six U.S. manufacturers included 61 diesel engine tractors for which export prices (to distributors), weight, and net or belt horsepower were available. The distribution of these observations by type of tractor and reference years is shown below:

	Crawler	*Wheel*	*Total*
1953	4	–	4
1957	5	1	6
1961	9	1	10
1962	10	4	14
1963	9	5	14
1964	9	4	13
Total	46	15	61

Our sample is heavily weighted in favor of crawler tractors, correctly reflecting their importance in U.S. exports but not in world trade. Ten of the wheel-type tractors were intended for farm use and five were construction-type (i.e., large earth movers, graders, or scrapers); some of the smaller crawler tractors were also used in agriculture.

The basic procedure was to correlate tractor prices with horsepower

[44] This result is produced consistently by log equations including those given in Table 12.42, others relating to the United States only, and still others in which data for all years and countries are pooled. The results given by arithmetic equations vary from 2 to 5 per cent.

or weight or both, in a regression in which data for all years were pooled. A dummy variable was used to distinguish the prices of wheel tractors from crawlers, and dummy variables were employed also to distinguish the 1962 level of prices from the level in each of the other years.

Horsepower obviously should be included as an explanatory variable; it is probably the key element in the product mix that makes up a tractor. There are, however, many other significant specifications which affect price and which have been changing over the years.[45] Lacking these variables, we used weight as a proxy for the many other features of a tractor which add to its utility. Weight, however, is itself highly correlated with horsepower, and when both are included, their sampling errors are much larger than when only one is used.

A regression in which the log of price rather than price in arithmetic terms is the dependent variable is preferable if, as seems likely, price changes for all sizes of tractors (from 2,900 to 70,000 pounds and from 30 to 425 horsepower) can be expected to conform more nearly to a uniform percentage change than to a uniform dollar price change. Partly on this basis, the regression that has been chosen as most appropriate for measuring price changes is one in which price and the two independent continuous variables are all expressed as logs. The regression contains dummy variables for wheel tractors and for years other than 1962. The coefficients of the regression, which yielded an $\bar{R}^2$ of .990, are shown in Table 12.44, and the price indexes derived from it in Table 12.45.

A number of other regressions were computed, and we comment briefly on them. From a purely statistical standpoint, a log regression in which horsepower was omitted was marginally better since its $\bar{R}^2$ was the same and its standard error was slightly smaller. However, horsepower rather than weight is the important economic variable, and this fact more than offsets the slight statistical ground for excluding it. In any case the two log equations yield price indexes that differ by no more than one percentage point at any date. Correlations in which the log of price was made dependent upon the arithmetic values of the

[45] Cf. Lyle P. Fettig, "Price Indexes for New Farm Tractors in the Postwar Period," unpublished Ph.D. dissertation, University of Chicago, 1963; and Fettig, "Adjusting Farm Tractor Prices for Quality Changes, 1950–1962," *Journal of Political Economy*, August 1963. See also Deere & Co., *Facts about John Deere Tractor Wholesale Prices in the U.S., 1935–61*, May 1961.

Table 12.44
Coefficients of Tractor Regressions, 1953, 1957, 1961–64

	All Tractors		Construction Type	
	Arithmetic	Log	Arithmetic	Log
Weight	.2407	.8918	.2293	.2611
	(.0550)	(.0915)	(.0351)	(.0540)
Horsepower	67.88	.0996	66.21	.6554
	(9.00)	(.1000)	(5.82)	(.0525)
Wheel	-1,624	.0748		
	(677)	(.0601)		
Constant	1,067	.1640	1,836	3.8578
	(598)	(.0478)	(497)	(0.6688)
1953	-4,422	-.4304	-4,763	-.3967
	(787)	(.0542)	(671)	(.0289)
1957	-2,378	-.1265	-2,750	-.1566
	(671)	(.0437)	(579)	(.0241)
1961	-24.98	-.0112	-234.1	-.0155
	(562.81)	(.0374)	(489.8)	(.0206)
1963	397.0	.0256	573.1	.0355
	(509.5)	(.0337)	(489.7)	(.0206)
1964	1,092	.0399	1,345	.0664
	(518)	(.0343)	(490)	(.0206)
$\bar{R}^2$	.988	.990	.990	.993
Standard error (per cent of mean)	7.2	1.8	5.2	0.9

Table 12.45
Tractor Price Indexes Derived from Regressions, 1953, 1957, 1961–64
(1962 = 100)

	All Tractors		Construction Type	
	Arithmetic	Log	Arithmetic	Log
1953	76	65	78	67
1957	87	88	88	86
1961	99	99	99	98
1962	100	100	100	100
1963	102	103	103	104
1964	106	104	106	107

continuous variables did not produce any $\bar{R}^2$ in excess of 0.859. However, the explanatory power of an equation in which all variables were taken in arithmetic terms was almost as good as that of the preferred log equation, and its coefficients and the price indexes derived from it are shown in Tables 12.44 and 12.45. On the other hand, the arithmetic equation, which indicated somewhat different price changes for some of the time links, did not provide a good fit for the ten lower-priced farm-type tractors (wheel tractors under 6,000 pounds and under 70 horsepower) in the sample.[46]

It is questionable whether we are justified in including the ten farm tractors in the same regression with the construction-type tractors. Even in terms of the simplified models of price explanation used here, the two types of tractors are strikingly different. Farm tractors are built to give more power for their weight than earth-movers; in our sample, for example, the ten farm tractors averaged about 1 horsepower per 100 pounds, while the others were closer to 0.5 horsepower per 100 pounds. Farm tractors tend to be cheap in terms of horsepower; and construction-type tractors, cheap in terms of weight.[47]

In addition, the two types of tractors are not only sold largely to different industries but they are produced, to a considerable degree, by different firms, both in the United States and in Europe. Thus, the prices of construction and farm tractors may behave differently. This, indeed, seems to have happened between 1963 and 1964 when farm tractors did not rise in price while the others did. In the regressions the price rise of the construction-type tractors dominates the results, and the price indexes do not adequately reflect the importance of the price movements of farm tractors in international trade.

We could try to meet this problem by introducing weights into the regression, but our sample of ten tractor prices is much too limited to rely upon for the measurement of price changes for the four time links.

[46] The residuals obtained by subtracting the estimated from the actual values for the small tractors were all negative, indicating consistent price overestimation. This was not the case in the log equation.

[47] Thus, when weight is excluded and horsepower used as the only continuous independent variable, wheel tractors will be cheaper in both the arithmetic and logarithmic forms, and when only weight is used they will be more expensive in both forms. When weight and horsepower are included together, a different balance in each equation is struck between these opposite tendencies. Hence, the arithmetic equation in Table 12.44 shows that wheel tractors (mainly farm-type) were $1,624 cheaper than crawlers (mainly construction-type) in 1962, holding weight and horsepower constant, while the log equation indicates that wheel tractors were 7 per cent more expensive.

This would be particularly inadvisable since we have a number of other price comparisons between the periods made by respondents who did not supply weight or horsepower data, and thus have the opportunity to make conventional indexes based on a larger sample of time-to-time price relatives.

In these circumstances, we prepared regressions in which only the construction-type tractors were included. The coefficients of these regressions and the indexes based upon them are shown in Tables 12.44 and 12.45.[48]

We used the log regression for construction-type tractors as a component of the U.S. international price index given in the main body of this report. It was weighted in with indexes for farm tractors and tractor parts produced by conventional methods.

[48] It will be noted that we omitted the dummy variable for wheel tractors from the regressions although 5 of the 51 prices represent construction-type wheel tractors. The coefficient for this variable was not statistically significant, and we have no basis for believing that wheel tractors should be more or less expensive than crawlers when weight and horsepower are the same. Fortunately, the price indexes resulting when the wheel variable is included are virtually identical with those given in Table 12.45.