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III: PRICE COMPETITIVENESS IN INDIVIDUAL METAL GROUPS

We turn now to the application of our methods of measuring price competitiveness to particular nonferrous metals, such as copper and aluminum.

In considering nonferrous metals, an observer is likely to think that they fall into the category of highly standardized commodities in universal demand, for which prices will act swiftly and efficiently to localize production at the cheapest source. This view may be fundamentally correct as a description of the long-run tendencies at work, but to understand the actual role of prices in the real world it is necessary to consider some of the geographical and institutional factors that interfere with, or at least influence, the operation of the price mechanism in nonferrous metal markets.

Geographical Influences

A conspicuous influence on the direction of trade in nonferrous metals is the location of ores in relation to markets. Among the major metals mentioned above, copper, silver, lead, and zinc ores are relatively common, while deposits of tin and nickel ores are less widespread. Lead and zinc ores are found, for example, both in the United States and in Western Europe. In most cases, however, the advanced industrial countries do not possess sufficient quantities of these ores to meet their needs. This is true even for the United States, which is one of the world's greatest mine producers of each of these metals. The pressure of demand and the exhaustion of the cheaper sources have forced recourse to less desirable ores and thus have tended to make the domestic metals expensive compared with those available from Canada, Latin America, Africa, and elsewhere. In many instances, the absolute volume of output in these places is smaller than in the United States, but much or all of it is exported because domestic demand is small or nonexistent. Thus the net exports of a country depend not

merely upon access to ore supplies but also upon access to ore supplies in quantities that are abundant relative to its home needs. The possession of domestic ore supplies may not be an advantage in the nonferrous metals trade, however, if they can be exploited only at a relatively high cost. A high-cost domestic mining industry frequently demands protective policies that result in high domestic prices and are, therefore, a competitive disadvantage for domestic metal refining and fabricating industries. Many of the price differences between the U.S. and Europe are attributable, in part at least, to the relative freedom of Europe to acquire ore supplies from the cheapest sources.

Some countries without domestic ore supplies, notably Great Britain and Belgium, have been important metal-refining and metal-exporting countries because they have had access to foreign sources of ores and because their metal-refining industries have been close to great markets. The history of the exploration and settlement of the Americas, Africa, and Oceania, the search for ores, and the financing of mining operations has left its mark on today's trade flows. Thus, the United States obtains copper from Chile and lead from Mexico; Britain gets tin from Malaya and lead from Australia; Belgium imports copper from the Congo; and France relies upon New Caledonia for nickel ore. New forces of nationalism and development are weakening many of these trading and financial ties. Many underdeveloped countries are encouraging the processing of their ores at home and even the fabrication of refined metal into semifinished or finished products. The smelting of tin, for example, has been declining in the United Kingdom and Benelux and rising in Malaya and other ore-producing areas.

Another important factor determining the location of some nonferrous metal industries—particularly those dependent upon electrolytic refining—is the availability of cheap power. This appears to be the chief explanation for the development in Canada of an aluminum industry second in the free world only to that of the United States, even though Canada must rely on bauxite supplies from the Caribbean area. Cheap power is also the basis for the Norwegian aluminum industry, whose capacity is exceeded in Western Europe only by the French industry. To a lesser degree, abundant power is helpful in nickel refining also. In this metal, however, Canada's position as the world's leading producer depends mainly on the possession of rich and extensive ore deposits. The location of a nickel refinery in

Norway, even though it has to use Canadian raw material, may be attributable to the attraction of low-cost power.

Institutional Influences

In assessing the role that price may play in international competition in nonferrous metals, it is necessary to take account not only of the way in which geographical factors affect trade patterns but also of the manner in which the structure of the metal-refining industries and the organization of metal markets make it possible for differences in price levels to exist. In these respects there are, as might be expected, important differences from one nonferrous metal to another, but there are also some striking similarities. We shall deal with the similarities first:

1. In the first place, there are two main markets—New York and London—for most of the major nonferrous metals in their unwrought form. The importance of the New York market for some metals, such as copper, lead, and zinc, arises in part from the large volume of United States output. However, the more basic factor, one which applies to all of the nonferrous metals, is the role of the United States as a consumer. In 1963, for example, the U.S. accounted for about one-third of total free world consumption of copper, lead, zinc, and tin and for around half of the consumption of nickel and aluminum (see Table 6). The London market is important because it is the great world trading center where the forces of supply and demand can meet without the restrictions on metal trade that have been imposed in the United States to protect domestic mines. The London Metal Exchange is the world's most important organized metal market and substantial quantities of copper, lead, zinc, and tin that are not actually sold through the market frequently are transferred at prices prevailing on the market.

2. As is implied in the foregoing, government laws and regulations tend to separate metal markets along national boundaries, each market having its own price level. The most common justifications for these interferences are defense, foreign currency shortages, and economic development, although the element of protection is usually large and clearly visible. Contrary to the common impression that trade barriers are being eroded, government impediments to free trade in unwrought nonferrous metals were probably increasing in the period covered by

this study.[1] Certainly, this is true of the U.S. for a number of important metals, although not for aluminum; within the period covered by this study, the United States reimposed a 1.7 cents per pound duty on copper and placed imports of lead and zinc under quota. The effects of such restrictions can be seen in copper, for which the U.S. price tended to be a cent or two a pound higher than the London price. In other countries protecting domestic mining operations, such as Australia, Japan, and Spain, copper prices have been 3 to 6 cents above the London price.[2] One of the most extreme illustrations was provided by a report from India that internal prices of tin, lead, and zinc were about twice as high as those being quoted on the London Metal Market.[3]

Tariffs and quotas are not, however, the only ways in which governments have affected metal markets. One of the most important influences on nonferrous metal markets was the building up and then diminishing of its stockpiles by the U.S. government. During a four-year period beginning in the middle of 1954, for example, the U.S. government bought up the equivalent of 20 to 25 per cent of the domestic production of lead and zinc and acquired substantial quantities of foreign lead and zinc in exchange for agricultural surpluses. The program buoyed up prices—and production also—but when it ended, prices slumped. At the end of the period covered by this study, U.S. disposals served to curb the tendency for prices to rise in the face of supply shortages.

Government intervention may also have other motives. Illustrations are provided by two United States regulations on silver. A United States prohibition against dealing in silver originating in mainland China led to a premium for non-Chinese silver on the London market which was sometimes greater than half a cent an ounce.[4] U.S. law also prevented the export of silver purchased from the Treasury, with the result that in 1959–61, when Treasury sales were an important source

[1] See the statement of an official of a U.S. metal-refining company quoted in the *Metal Bulletin*, July 5, 1963, p. 29. Since 1964, the terminal year of this study, the U.S., faced with sharply rising metal prices, has eased some of its protective measures on imports, but has placed controls on certain exports and intervened vigorously in the domestic pricing of several metals.

[2] J. L. Chender, "Copper," in *Engineering and Mining Journal*, February 1965, p. 114.

[3] *Metal Bulletin*, July 17, 1962, p. 10.

[4] Handy and Harman, *The Silver Market in 1962*, p. 8.

TABLE 6

Geographical Distribution of and Changes in Production and Consumption, Major Nonferrous Metals, 1954-63
(per cent)

Metal[a]	Share in World Production					1963 Production as Per Cent of 1954 Production		U.S. Share in 1963 Consumption		1963 U.S. Consumption as Per Cent of 1954 U.S. Consumption
	U.S.	Europe[b]	Eastern Bloc[c]	Rest of World	Total World	U.S.	World	Free World[d]	World	
	1954									
Copper	37	22	14	27	100	134	154	36	29	136
Aluminum	47	18	15	20	100	158	193	54	42	186
Nickel	16	22	20	43	100	59	160	48	33	132
Zinc	32	30	16	22	100	110	146	34	27	122
Tin	14	36	9	41	100	4	99	34	26	101
Lead	25	28	13	34	100	82	125	31	25	104
	1963									
Copper	32	19	18	31	100					
Aluminum	39	20	22	20	100					
Nickel	6	23	24	48	100					
Zinc	24	26	23	27	100					
Tin	1	18	26	55	100					
Lead	16	31	23	29	100					

(continued)

NOTES TO TABLE 6

Source: Computed from data in Metallgesellschaft Aktiengesellschaft, *Metal Statistics, 1954-1963*, Frankfurt 1964. Some figures, especially those for centrally planned economies, are necessarily rough estimates.

[a]Refinery production for copper and lead; smelting output for nickel, zinc, and tin.

[b]Europe includes Finland, Yugoslavia, and all European OECD countries except Turkey.

[c]Eastern Bloc includes all countries in the Soviet sphere in Europe and all countries in the Chinese sphere in Asia.

[d]All countries except Eastern Bloc as defined in note c.

of silver for industrial uses, New York silver prices were slightly lower than those in London.[5] Perhaps government neutrality is impossible in the market for a monetary metal, but neither of these regulations appears to have been necessitated by the monetary use of silver.

3. Another common characteristic of nonferrous metals is their susceptibility to alternating phases of overcapacity and extreme shortage. Mining capacity cannot be altered rapidly, and even changes in the rate of utilization of existing capacity apparently cannot be made quickly.[6] The impact of cyclical and secular changes on the demand for a given metal is difficult to foretell, as can be readily ascertained from past forecasts in the trade journals. In these circumstances, nonferrous metal prices are almost inevitably subject to sharp fluctuations; within the dozen years covered by this study, for example, there have been year-to-year upswings *and* downswings in the *annual average* price in excess of 25 per cent for copper, 20 per cent for lead, and 15 per cent for zinc.[7] As is pointed out below in connection with copper prices, many of these fluctuations, because of their timing, are not reflected in the indexes published here.

Many of the differences among the markets for the various non-

[5] Handy and Harman, *The Silver Market in 1959*, p. 9; *The Silver Market in 1960*, p. 8; and *The Silver Market in 1961*, p. 7. Dependence on Treasury silver was attributable in part to a widespread strike in the nonferrous refinery industry during the last half of 1959.

[6] For example, the manager of a large lead and zinc company was quoted as saying that ". . . a decision today to change the rate of mine production in Australia would probably take six months or longer to be reflected in the physical metal available in the large consuming markets" (*Metal Bulletin*, May 3, 1963, p. 14).

[7] Based on data in *Engineering and Mining Journal*, February 1965, p. 83.

ferrous metals stem from differences in the number of producers and other facets of the structure of those industries. For none of the nonferrous metals can the number of primary producers outside the centrally planned countries be counted in terms of hundreds and often not even in tens, but the degree of concentration varies from one metal to another and the same degree of concentration does not always have the same market significance. The number of producers of worked metals is larger, but the big primary producers are often also producers of worked metals. Their pricing policies thus affect worked-metal prices directly and also indirectly since worked metals such as sheet are often priced in terms of a margin over the prevailing primary price. Producers of the major unwrought metals have generally integrated backward into ore production, although to varying degrees. In aluminum, for example, important producers of the metal typically control their own bauxite sources. In tin, on the other hand, there is more of an independent market in ore concentrates, although ties between smelting and ore producers are quite common.

The production of nickel is, perhaps, the most concentrated among the nonferrous metals. One producer—a Canadian firm which has its own ore supply—accounts for over half of the free world output, and the world price of nickel follows closely the price set by this firm.[8] The policy of the company has been to seek stable prices, making price changes at relatively long intervals.[9]

The organization of the world aluminum industry has been in a state of flux during the past decade. For few, if any, other metals was the prospect for rapid growth in consumption so clear, and new companies entered the industry and existing ones tried to break into new geographical markets.[10] In the United States the number of primary producers rose from three in 1953 to seven in 1963; in 1963 the largest of these accounted for 34 per cent of U.S. capacity and the top three for 86 per cent. In Canada, the leading producer had 85 to 90 per cent of the nation's capacity, and in almost all the other

[8] Committee on Armed Services, U.S. Senate, 87th Congress (2nd Session), *Inquiry into the Strategic and Critical Material Stockpiles of the U.S., Hearings*, Washington, 1962, Part 8, pp. 2591 and 2647.

[9] Statement of the company president quoted in *Metal Bulletin*, September 4, 1964, p. 11.

[10] Aluminum was also pushed into new uses by the aggressive research and promotion of its producers.

aluminum-producing countries of the free world primary production was limited to two to four firms, with the largest usually accounting for somewhere between 50 and 80 per cent of output.[11] Most of these firms are integrated into the worked metals stage; in the U.S., for example, producers consume around two-thirds of the ingot they make.[12]

There has been a growing internationalization of the aluminum industry, which has involved the U.S. as a capital importer as well as a capital exporter; by the end of 1964 aluminum metal was being produced in the United States by a subsidiary of a Swiss company, and subsidiaries of French and Canadian companies were producing worked aluminum products. However, a large part of the shares of the leading Canadian producer is owned in the U.S. Elsewhere, one or more of a half-dozen large U.S., Canadian, Swiss, or French producers are to be found with interests in almost every aluminum-producing country of the non-Communist world.[13] In the struggle for new markets, production has often been established in new countries to gain or retain access to markets in the face of protective measures.

The structure of the world copper industry has been relatively stable during the period of our study. In each of the major producing areas of the free world, the bulk of refinery output is accounted for by a few firms—five in the United States, three in Africa (two are British and one is Belgian), and two in Canada. Two of the United States firms are also responsible for a large fraction of copper output in Chile, by far the most important of the Latin American copper-producing countries, and U.S. firms also have interests in African production. In addition, some smaller producers market their copper through one of the large firms. Thus, there are perhaps ten sellers who market some 80 to 90 per cent of the free world production of primary copper.[14]

Among the other major nonferrous metals, the production of tin is most highly concentrated; two smelting companies in Malaya and Singapore supply a major share of the metal consumed by the free

[11] Bureau of Mines, *Minerals Yearbook, 1963* and *1953*, Washington, 1964 and 1956.

[12] U.S. Department of Commerce, *Aluminum Factbook,* Washington, 1963, pp. 16–17.

[13] *Minerals Yearbook, 1963*.

[14] The statements in this paragraph are based in part upon information in the *Minerals Yearbook, 1963*, and in part upon information obtained from trade sources.

world.[15] The smelting and refining of silver, lead, and zinc is much less concentrated partly because these metals are mined and refined in a larger number of countries. Within individual countries, however, there are usually a small number of producers; in the United States, for example, at the end of 1964 there were only five firms which smelted or refined primary lead.[16]

There are, however, several factors that limit the market power that small numbers may confer upon the producers. In aluminum, very rapid growth in consumption has stimulated competitive expansion in which the leading firms have struggled to keep their market position. More generally, an important restraint is imposed by the existence of intermetal competition (including steel) and by the availability of nonmetallic materials, especially plastics, as substitutes. The expansion of aluminum, in particular, has sometimes occurred in uses formerly served by copper, notably in the electrical and automotive industries. While overlapping financial interests in different metals exist—particularly in lead and zinc but also in copper and other metals—by and large the interests which have large stakes in aluminum differ from those involved in copper, and the same tends to be true of other pairs of major nonferrous metals.

Another limitation which varies in importance from one metal to another and, for a given metal, from one country to another is the availability of metal recovered from scrap.[17] This source of metal appears to be most important relative to primary production in the case of lead; in the U.S., for example, it accounts for about one-half of total production.[18] The production of secondary metal tends to be less concentrated than that of primary metals; again taking lead in the U.S. as an example, there are over a score of major secondary smelting

[15] *Minerals Yearbook, 1963.* See also *Inquiry into the Strategic and Critical Material Stockpiles of the U.S.*, Part 5, p. 1740. The extraction of ore in Malaya is much more dispersed.

[16] U.S. Tariff Commission, *Lead and Zinc: Report to the President*, Washington, 1965.

[17] The impact of scrap is affected also by its spectrum of uses, which varies from one metal to another; in some cases, such as aluminum, scrap can be used for fabricating a wide range of products and thus competes directly with the primary metal, while in others, such as copper, it may compete with the primary metal in a more limited range of uses.

[18] Based on data in *Minerals Yearbook, 1963.* About 40 per cent of primary production has been from foreign ore supplies.

firms excluding the six primary producers, some of whom also produce secondary metal.

A different aspect of the organization of the metal industries that must be considered in analyzing price competitiveness is the practice of treating metals on a toll or conversion basis. Much of the copper, lead, and zinc exported by Belgium and Germany represents metal smelted or refined in those countries for a fee paid by the foreign owner, usually the sales organization of a mining company. It is true that comparative costs of conversion in different countries may influence the owner's choice of country of conversion, but the determining factor may be the availability of capacity and of the technical skill and facilities required to obtain maximum recovery of the metal content, including subsidiary elements such as silver, cadmium, and others. To measure the price competitiveness of the processing country, we would have to know the toll charges; the prices of the smelted or refined metal may reflect the price competitiveness of the country of the owner of the metal to a greater degree than that of the processing country.

Another factor of significance from time to time for some metals, particularly aluminum, zinc, tin, and silver, was sales in western markets by the Soviet Union, other Eastern European countries, and China. As may be seen from the figures in Table 6, production of nonferrous metals has been expanding more rapidly in the centrally planned countries than in the free world; these countries probably account for close to one-fourth of the world output. The U.S.S.R. is by far the most important producer in the bloc, accounting for the bulk of output and particularly for sales of aluminum in western markets; China has been a sporadic source of exports of tin and silver to the west.

Copper

The United States is the world's leading producer of mine copper (23 per cent of world production), followed by the U.S.S.R., Zambia (Northern Rhodesia), and Chile (12 to 15 per cent each), Canada (9 per cent), and the Congo Republic (6 per cent).[19] Very little ore moves in world trade; it is generally more economical to ship copper after it has been extracted from the ore by concentration, roasting,

[19] F. L. Wideman, "Copper," Table 44, in *Minerals Yearbook, 1963*.

TABLE 7

Copper Exports, OECD Countries, 1963
(million dollars)

Destination	Origin							
	Total OECD[a]	U.S.[b]	U.K.	EEC	Germany	Belgium, Luxem.	Canada	Japan
	Unwrought Copper (SITC 682.1)							
Total	621	188	51	222	48	162	127	1
United States	54	–	1	7	–	7	46	–
OECD-Europe	446	135	39	178	28	138	70	–
U.K.	83	20	–	5	4	2	57	–
EEC	301	106	35	133	8	113	10	–
Germany	102	42	8	39	–	32	4	–
Belgium, Luxem.	24	2	14	6	3	–	1	–
Canada	5	3	2	c	–	c	–	–
Japan	11	9	c	1	–	1	–	–
Latin America	7	4	1	2	2	c	c	–
Asia (excl. Japan)	45	35	1	c	c	c	8	1
Other	53	2	7	34	18	16	3	c

(continued)

TABLE 7 (contd.)

Destination	Origin							
	Total OECD[a]	U.S.[b]	U.K.	EEC	Germany	Belgium, Luxem.	Canada	Japan
	Worked Copper (SITC 682.2)							
Total	313	25	53	151	72	45	28	14
United States	52	–	6	27	20	4	7	3
OECD-Europe	163	7	21	94	38	38	12	–
U.K.	5	1	–	1	1	c	2	–
EEC	83	4	8	61	19	30	c	–
Germany	22	1	2	16	–	11	c	–
Belgium, Luxem.	7	c	1	5	3	–	c	–
Canada	8	6	2	1	c	c	–	c
Japan	2	1	c	c	c	–	c	–
Latin America	12	5	1	3	2	c	2	c
Asia (excl. Japan)	36	3	9	9	3	1	3	10
Other	40	2	15	17	8	2	3	c

(continued)

NOTES TO TABLE 7

Source: *Trade by Commodities,* OECD Statistical Bulletins, Series C, 1963, Vols. I and II; *1963 World Trade Annual,* United Nations, New York, 1964.

[a]Includes eighteen European countries, U.S., Canada, and Japan.

[b]For worked copper, U.S. figures include $4.6 million worth of copper foil, c.i.f. value estimated from OECD countries' import statistics, because U.S. copper foil is classified elsewhere in its export statistics. The total includes these estimated U.S. figures. U.S. exports figures are from unpublished tabulations of the U.S. Department of Commerce and are a corrected version of the figures published by the OECD and the U.N.

[c]Less than $500,000.

or, most commonly, by smelting. Latin American copper exports have been divided into roughly equal proportions between Europe and the U.S. A good part of the Latin American copper reaching the U.S. is refined and re-exported to Europe, and this copper accounts for the bulk of U.S. exports. Canada has shipped more copper to Europe than to the United States. African copper has gone mainly to Europe with the United Kingdom receiving over 40 per cent of Zambia's output and Belgium about two-thirds of the Congo's production. African and Latin American exports of unwrought copper were more than one and a half times greater than the exports of the advanced countries shown in Table 7.[20]

While the United States used to be an important exporter of copper, it has generally been a net importer in recent years.[21] Most of its imports have consisted of blister copper (the unwrought product obtained by smelting the ore), mainly from Chile and to a lesser extent from Peru and Mexico. At the same time the U.S. has been importing refined copper; most of these imports, mainly from Canada, have apparently been absorbed domestically. Exports of refined copper in the form of cathodes, ingots, and wire-bars to Western Europe, India, and Japan, and other destinations have not been large enough to offset all the imports of copper.

OECD countries' exports of worked copper, such as sheet and tube,

[20] See *Metal Bulletin,* September 24, 1963, pp. ii–iii.

[21] The net export position shown in Table 7, attributable in part to the refining and re-export of Latin American copper, covers exports to all countries but imports only from the OECD countries.

have been about half the dollar volume of their exports of unwrought copper, although trade in worked copper is less important relative to unwrought copper for the world as a whole. Germany and Belgium are the leading exporters of worked copper and European destinations account for most of the shipments.

While the large producers of primary copper have generally preferred to sell directly to fabricators, some copper, chiefly secondary metal, is traded on the London Metal Exchange (LME). The prices established on the LME are free market prices. The 1961 turnover on the LME amounted to only 16.6 per cent of estimated world consumption, and, as a result of speculation and hedging, only a fraction of the copper traded was for actual consumption.[22] The price of copper on the LME, however, has a significance (which varies at different times) beyond that indicated by the amount of metal traded. At times, the large producers sold copper to markets outside the U.S. under long-term contracts setting minimum and maximum quantities, with the price for each lot to be determined by the quotation on the LME at the time of shipment or delivery. However, the LME tends to be very sensitive to changes in supply and demand conditions and to produce sharp fluctuations in price. In 1956, for example, the price of copper was driven up to £437 per ton only to fall back by the end of the year to £240. Such fluctuations led the European producers to abandon the system of pricing based on freely determined LME prices. They controlled the LME price through open-market operations while simultaneously curtailing production and accumulating stocks. From the latter part of 1961 to the beginning of 1964, the producers succeeded in stabilizing the LME price of copper at £234 per ton (29.25 cents per pound).[23] In the U.S. the price remained at 30.6 cents per pound (31.0 cents delivered) during this period. It was reported that the producers had disposed of the surplus stocks they had acquired in their

[22] According to one source, deliveries amounted to about 20 per cent of the trading volume (*Economist*, February 22, 1964, p. 733). The estimate of trading turnover as a share of world consumption was reported to the *Metal Bulletin*, March 20, 1962, p. 8.

[23] Altogether about 160,000 tons of copper (worth over $100 million) were purchased in this operation (*Metal Bulletin*, June 19, 1964, p. 12). According to one estimate, the 1962 price might have been about £220 per ton (27.5 cents per lb.) without producer support (J. Zimmerman, "Copper," *Engineering and Mining Journal*, February 1963, p. 101). For a brief assessment of the copper price operations of the producers, see the *Economist*, October 9, 1965, pp. 185–187.

price support operations through cut-rate sales to Eastern Europe, Japan, and India.[24] A new, and apparently unanticipated, surge of demand in 1964, coupled with strikes in the U.S. and Chile, caught the producers without the stocks necessary to prevent price increases. The Chilean government also was pressing for price increases.[25] In January 1964, the producers abandoned their efforts to control the LME price and toward the end of the year they were prorationing supplies to their customers at £260 per ton while the LME price was £520.

The producers made these determined efforts to keep prices from rising for fear that high copper prices would, beyond a certain point, encourage the long-run substitution of aluminum and plastics for copper and thus adversely affect the value of their ore deposits. Price instability was also thought to encourage such substitution particularly because aluminum prices were very stable until the last few years of the period.[26] Finally, the producers feared that the high temporary profits created by high prices would have a ratchet effect on wages, leaving copper less able in the long run to compete with other materials. The fact that these motives are common to all the major producers does not mean that they always acted together. The U.S. producers were enjoined by law from collaborating to fix prices,[27] and the European producers did not always agree on the proper course. In 1955–56, for example, one British firm, in an effort to keep prices from rising, sold its copper at prices lower than the LME prices which were used by the other major producers. On the other hand, the U.S. and the European-based primary producers apparently have

[24] See *Metal Bulletin*, June 19, 1964, p. 12, and *Engineering and Mining Journal*, February 1964, p. 115.

[25] *New York Times*, October 6, 1964.

[26] It was reported, for example, that aluminum was substituted for copper in making lamp bulb bases when the price of copper soared to 46 cents a pound in 1956 and that bulb makers feared to switch back to copper even after the price fell to 25 cents (*New York Times*, March 15, 1964).

[27] See *New York Times*, December 29, 1963, for a report that describes one U.S. copper mining official as resenting the notion of U.S. collaboration in price maintenance; the official referred to the attitude of U.S. producers as one of "benevolent neutrality" toward the price stabilization efforts of foreign producers. The U.S. producers could hardly avoid taking account of the pricing policies of the foreign producers and the impact that their own production policies would have on the world-wide copper situation. Thus, as was pointed out by a copper merchant, the U.S. producers cut their production by 5 to 10 per cent in July 1962 when foreign firms were supporting the LME prices even though U.S. consumption exceeded U.S. production. See J. Zimmerman, "Copper," in *Engineering and Mining Journal*, February 1963, p. 102.

not competed in each others' home markets. For example, one large U.S. buyer of unwrought copper stated in the course of an interview that his company could never obtain foreign copper at a price lower than the domestic price. In general, the U.S. producers appear to have been more able to curtail and expand production to meet the swings in demand, with the result that the producers' price in the United State has tended to be more stable than that in Europe. The U.S. producers' price has also tended to be slightly higher, the main exceptions being in the years 1953–55. The reimposition of the 1.7 cents per pound duty by the U.S. in July 1958 made it more likely that a differential between the European and U.S. producers' prices would be maintained.[28]

Merchants were critical of the pricing policies followed by the producers in 1961–64. They argued that the producer-controlled prices did not permit the price mechanism to provide guidance to consumers and producers. The producers, on the other hand, felt that the merchants were more interested in the active trading that would come with frequent price changes than in the long-run trend of copper consumption.

In any case, producer pricing led to a multiple price system for copper. In periods of slack, consumers in the United States and Europe were able to obtain merchant copper at prices lower than those maintained by producers, and in periods of tightness they had to pay higher prices for a part of their supplies. According to one estimate, for example, about 25 per cent of free world copper was purchased at premium prices in 1964; in the U.S. about 20 per cent was exchanged at premium prices.[29] In markets outside the United States and Europe, the producers themselves were reported sometimes to have departed from their regular prices, particularly, as we have already noted, in the case of occasional sales to Eastern Europe, Russia, and Japan.

The price relationships produced by these structural and market features of the world copper industry are shown in Table 8. The time-to-time indexes indicate that the levels of world copper prices

[28] The statements about prices in this paragraph are based largely on the *Engineering and Mining Journal* average prices for copper sales in the U.S. and outside the U.S. The prices are taken from reports of producers accounting for 80 to 85 per cent of the copper trade (*E & MJ Metal and Mineral Markets*, June 24, 1963).

[29] J. L. Chender, "Copper," in *Engineering and Mining Journal*, February 1965, p. 113.

TABLE 8

Indexes of International Prices and Price Competitiveness, Copper, SITC Group 682, 1953-64

Country	1953	1957	1961	1962	1963	1964
		A. International Price Indexes (1962 for each country = 100)				
U.S.	98	95	100	100	100	107
U.K.	98	94	99	100	100	112
EEC	100	96	101	100	100	119
		B. International Price Levels (U.S. for each year = 100)				
U.S.	100	100	100	100	100	100
U.K.	94	93	93	95	94	99
EEC	97	96	95	94	94	104
		C. Indexes of U.S. Price Competitiveness[b] (1962 = 100)				
Relative to U.K.	100	99	99	100	100	105
Relative to EEC	102	102	101	100	100	111

Source: As indicated in the text, we had extensive data on producers' export prices of unwrought copper for the last few years of our study. For the earlier years, we had to rely on prices supplied by two very large purchasers in U.S. and European markets and by several smaller U.S. and foreign purchasers; these sources were also available for the later years. For worked copper, the sources were almost entirely buyers; the main exception was Germany, for which we had a number of index series of export prices. Counting the latter as a single source, we had a dozen sources of information on worked copper prices; only a minority was from the U.S.

Method: As noted in the text, different price relationships seem to prevail for brass and copper. Trade statistics do not differentiate between copper and its alloys and we had to assume that about one-fourth of trade consisted of alloys on the basis of the facts that brass mills absorb one-third of copper refined in the U.S. and that copper alloys take about one-fifth of U.K. copper. (*Metal Statistics*, 1954-63, pp. 161 and 135.) The method of handling premium-price copper sales is given in the text; a similar technique was used for other years in

(continued)

NOTES TO TABLE 8 (concluded)

which copper appeared to be available at prices other than those quoted by producers although the discounts and premiums were much smaller than the 1964 premiums.

The indexes were computed separately for SITC groups 682.1 and 682.2 and then combined with the 1963 trade weights. For worked copper at least, the more important five-digit categories were weighted separately. These were bars, rods, shapes, and wire (682.21), plate, sheet, and strip (682.22), and tubes and pipes (682.25); these categories accounted for 41, 23, and 26 per cent, respectively of SITC subgroup 682.2. In the case of unwrought copper (subgroup 682.1), 96 per cent consisted of refined copper (682.12) and no attempt was made to weight at the five-digit level.

In each case foreign to U.S. place-to-place indexes for 1961 or 1962 were used as the starting point for the calculation of the place-to-place figures for the other years. Indexes of price competitiveness, derived from the time-to-time indexes, were used to derive the place-to-place relatives for other years from the 1961 or 1962 relatives. The years 1961 or 1962 were taken as the starting point because data were abundant and/or subject to smaller dispersion than the 1963 and 1964 data. In a few instances, wholesale price series were used to fill gaps in the time-to-time data.

In calculating the EEC indexes, the time-to-time series for the different member countries were combined at the five-digit level by weighting the series for each member country for which data were available according to the country's relative importance in EEC exports in the category involved. In the EEC-U.S. place-to-place comparisons, the lowest EEC price was taken for each available price comparison with the U.S.

[a]SITC group 682.

[b]These indexes show how the prices of each foreign area changed relative to U.S. prices. For example, the figure 105 for the U.K. in 1964 indicates that U.K. export prices of copper were 5 per cent higher relative to U.S. export prices of copper than they were in 1962 (the base year).

were not very different at the various dates of reference used in our study, except for the last one (see panel A). While this is true, it gives a misleading impression of the stability of copper prices over the twelve-year period; prices soared to high levels between 1953 and 1957 and sank to low levels between 1957 and 1961. Using the midyear prices of U.S. producers to indicate the magnitude of the changes, we find that the price of primary copper was between 28.5 and 32 cents a pound at every one of our reference dates, but it was over 45 cents in 1956 and less than 25 cents in 1958.

For our reference years, movements in U.S. and U.K. prices corresponded closely, and until the very last year U.K. prices were 6 or 7 per cent lower than those of the United States (see panel B). The same relationship with U.S. prices characterized the Common Market, in which the Belgian prices were the most important, for 1962 and 1963, but EEC prices were a little closer to U.S. levels at the beginning of the period and higher than U.S. prices in the final year. Germany, with less direct access to primary copper, was sometimes in a less favored position relative to the United States than were the United Kingdom and Belgium.

The European export prices of worked copper products, such as sheet and pipe, tended to be lower relative to the United States prices than was the case for unwrought copper; this was particularly true of brass products. U.K. export prices were only a few percentage points below those of the U.S. for unwrought copper, but around 12 per cent lower for worked copper in 1962, for example. However, unwrought copper was about twice as important as worked copper in the exports of the advanced countries, and this fact was reflected in the weights used in preparing the indexes.

Until the final year of our period, the price position of the United Kingdom and the Common Market as a whole relative to that of the United States hardly changed (see panel C). There is some evidence, on the other hand, that the German position relative to the United States improved; this improvement appears to reflect the movement of high initial German prices closer to the prices prevailing in Belgium, the other important Common Market exporter (see Table 7).

The indexes for 1964 are subject to additional margins of error because, while in general we had rather comprehensive information, there was a key piece missing. For 1964 as for other recent years, we have extensive data covering sellers' prices of unwrought copper abroad, as well as a good sample of prices of worked copper products. We also have good information about the premium prices that were paid for unwrought copper; these varied widely during the year and from market to market but the mean premium seems to have been in the range of 25 to 40 per cent above the producers' price. What we do not know is the fraction of each country's exports of unwrought copper that was sold at premium prices. On the basis of information

gleaned from trade journals [30] and from conversations with people in the trade, we have taken the premium-price exports to be 10 per cent for the United States, 25 per cent for the United Kingdom, 100 per cent for Germany, and 50 per cent for the Common Market as a whole. The possible margins of error introduced by this assumption may be indicated by the fact that the alternative assumption—that premium-price exports constituted 10 per cent of the unwrought copper exports of each country—results in 1964 price levels lower by two points for the United Kingdom and four points for the EEC than the figures shown in Table 8 (panel B). Corresponding adjustments in the indexes of competitiveness would affect the magnitude but not the fact of a relative improvement in the competitive position of the United States between 1963 and 1964.[31]

Aluminum

The United States, the U.S.S.R., and Canada accounted for about 68 per cent (38, 18, and 12 per cent, respectively) of primary aluminum production in 1962–63. World production has been expanding rapidly and has become more dispersed; in 1953–54, for example, world output was only about half of the 1962–63 level and the three leading countries accounted for about 78 per cent of production (47, 12 and 19 per cent, respectively). Production has been rising most rapidly in Japan, India, and the Soviet sphere. The number of producers has tended to expand within each country, although it still remains small.[32]

About 20 per cent of unwrought aluminum production enters world

[30] See, for example, *Metal Bulletin*, October 6, 1964, p. 15, and Chender, in *Engineering and Mining Journal*, February 1965, p. 113.

[31] Actually, the figures in the table probably understate slightly the improvement in the U.S. position since the 10 per cent estimate is more likely to be too high than too low.

[32] The data in this and the following paragraphs are based mainly on *Minerals Yearbook, 1963*, and earlier editions, and *Metal Statistics*, 51st and earlier annual issues (Metallgesellschaft Aktiengesellschaft, Frankfurt am Main, Germany). These sources also show the patterns of production and trade in bauxite. The U.S. imports over 80 per cent of its bauxite requirements; the U.S.S.R. less than one-fourth. France alone of the major aluminum producers is a net exporter of bauxite; most others, like Canada and Norway, import virtually all they use. Almost half of the world's supply of bauxite is produced in the Caribbean area, particularly in Jamaica, Surinam, and British Guiana. In Europe, Hungary, Yugoslavia, and Greece follow the U.S.S.R. and France in production. (Production data for the centrally planned economies are necessarily rough estimates made in the sources cited.)

TABLE 9

Aluminum Exports, OECD Countries, 1963
(million dollars)

Destination	Origin								
	Total OECD[a]	U.S.[b]	U.K.	EEC	Germany	France	Canada	Norway	Japan
	Unwrought Aluminum (SITC 684.1)								
Total	531	70	3	65	7	57	266	91	6
United States	160	–	c	14	1	12	109	32	5
OECD-Europe	287	47	2	45	3	41	113	54	1
U.K.	124	22	–	1	c	1	76	23	–
Norway	c	–	c	c	c	–	c	–	–
EEC	130	20	1	43	3	40	22	23	1
Germany	55	8	c	2	–	2	13	16	–
France	5	3	c	c	c	–	2	–	–
Canada	1	1	c	–	–	–	–	c	–
Japan	9	1	c	–	–	–	8	c	–
Latin America	29	10	c	2	c	2	14	2	–
Asia (excl. Japan)	18	7	c	2	c	1	10	c	c
Other	27	4	1	2	2	1	13	3	–

(continued)

TABLE 9 (contd.)

Destination	Origin								
	Total OECD[a]	U.S.[b]	U.K.	EEC	Germany	France	Canada	Norway	Japan
	Worked Aluminum (SITC 684.2)								
Total	326	55	48	149	54	28	46	15	11
U.S.	34	–	2	23	6	4	9	2	3
OECD-Europe	157	12	15	98	37	16	31	3	–
U.K.	20	4	–	11	1	6	7	1	–
EEC	78	6	5	56	19	11	18	1	–
Germany	18	1	1	13	–	3	6	c	–
France	12	1	1	9	5	–	2	c	–
Belgium, Luxem.	14	1	1	11	5	3	–	c	–
Canada	26	20	5	1	c	c	c	–	c
Japan	1	1	c	c	c	c	–	c	–
Latin America	18	7	2	3	1	c	1	4	1
Asia (excl. Japan)	33	9	8	7	4	c	2	3	6
Other	56	6	18	18	5	7	3	3	c

(continued)

NOTES TO TABLE 9

Source: *Trade by Commodities*, OECD Statistical Bulletins, Series C, 1963, Vol. I; *1963 World Trade Annual*, United Nations.

[a]Includes eighteen European countries, U.S., Canada, and Japan.

[b]U.S. export figures are from unpublished tabulations of the U.S. Department of Commerce and are a corrected version of the figures published by the OECD and the U.N.

[c]Less than $500,000.

trade. The pattern of trade differs substantially from the pattern of production. The U.S., with its high absorptive capacity for metals, has played a smaller role in world trade than might be inferred from its importance in world production. In recent years, U.S. exports of primary aluminum have been less than 15 per cent of the free world total, with the United Kingdom, Germany, and Latin America the main destinations. U.S. exports have been equivalent to 7 or 8 per cent of domestic production; imports—well over half from Canada, and the rest almost entirely from Norway and France—to 17 or 18 per cent (see Table 9).

Canada, which consumes about 15 per cent of its own production of unwrought aluminum, supplies about half of the world's exports. Norway and France are also important exporters; the former, like Canada, sells most of its output abroad.[33] A limited number of destinations tend to account for a large share of each country's exports. Over half of French exports are to the Common Market and over a quarter to the U.S.; about two-thirds of Canadian exports are sent to the U.S. and the U.K.; and about three-quarters of Norwegian exports are shipped to the U.K., the U.S., and Germany. U.S. exports, however, have a more varied list of destinations.

The smaller trade in worked aluminum is more dispersed. Canada and Norway are smaller factors; and Germany, Belgium, the United Kingdom, and the United States (with about equal export volumes) furnish about two-thirds of the exports of the advanced countries. Germany and Belgium send their exports largely to European destinations; the U.K. and the U.S. to more varied markets.

Aluminum was not traded on any metal exchange during the period

[33] The U.S.S.R. is also a significant exporter, with the bulk of its shipments going to other communist countries.

of this study and hence was producer priced. The price leadership of the major Canadian producer appears to have been widely accepted at least for nominal purposes in world trade. The Canadian firm has generally avoided any challenge to other price leaders in their domestic markets (as in the U.S.);[34] the existence of tariffs and transport costs has permitted small differences between prices in different countries. While changes in the posted world prices of aluminum ingot—the key item in the price structure—have not been frequent,[35] sales below the nominal world price have been common, especially in the last few years when the struggle for the growing world market among the major producers seems to have intensified. Sales of Russian aluminum added to the competitive pressures. Price cutting appears to have been common in sales made by major producers of one country in the markets of other major producing countries. Large buyers in these markets, willing to follow aggressive purchasing policies and not setting a high premium on the continuity of their sources of supply, could usually find aluminum at 1 or 2 cents below the list price.[36] As a result there was cross shipping of identical products between the U.S. and Europe; indeed, more than one reliable source reported occasional purchases of U.S. aluminum in Europe for reshipment to the U.S. The market for European aluminum in the United States appears to have been confined largely to the coastal areas, particularly the Eastern seaboard and the Great Lakes region. The aluminum industry is more highly integrated vertically than the copper industry, and competition sometimes focused on worked aluminum products as well as on ingot.[37]

[34] On price leadership, see the *Metal Bulletin*, April 1, 1958, p. 13; February 16, 1962, p. 13; and December 13, 1963, p. 13. See also Carl M. Loeb, Rhoades & Co., *Aluminum Industry*, September 1965, p. 10.

[35] Though the ingot price changed three times in 1964, there were only twenty changes in the previous eighteen years. Irving Lipkowitz, in *Engineering and Mining Journal*, February 1965, p. 98.

[36] Public statements about these practices are naturally infrequent, but the head of the largest French aluminum firm was quoted in the press near the end of 1962 as acknowledging that French aluminum was being offered in the U.S. at 22.5 cents a pound at a time when the U.S. list price was 24 cents. (The U.S. duty of 1.25 cents and freight were apparently paid by the seller.) He was also cited as saying that foreign aluminum—U.S., Canadian, or Japanese—was being offered in France at less than the French domestic price of 22.5 cents despite a duty of 15 per cent (*New York Times*, November 16, 1962).

[37] *Metal Bulletin*, January 1, 1963, p. 18.

TABLE 10

Indexes of International Prices and Price Competitiveness, Aluminum, 1953-64

Country	SITC Group	1953	1957	1961	1962	1963	1964
		A. International Price Indexes (1962 for each country = 100)					
U.S.	684	100	108	103	100	97	103
	684.1[a]	104	109	103	100	94	103
	684.2[b]	92	107	102	100	101	103
U.K.	684	98	112	105	100	100	107
EEC	684	107	109	103	100	97	104
		B. International Price Levels (U.S. for each year = 100)					
U.S.	684	100	100	100	100	100	100
U.K.	684	91	94	94	92	95	95
EEC	684	96	90	90	89	91	90
		C. Indexes of U.S. Price Competitiveness[c] (1962 = 100)					
Relative to U.K.	684	99	103	102	100	104	104
Relative to EEC	684	108	101	101	100	100	101

Source: Information on aluminum prices comes from about a score of sources in addition to the various German exporters whose data contributed to the German price series. A little over half of the sources are American and a large majority are purchasers. As noted in the text, our data include prices for a large fraction of U.S. exports and the place-to-place comparisons are, in some instances, based on as many as several hundred observations.

Method: Separate indexes were computed for SITC groups 684.1 (unwrought aluminum) and 684.2 (worked aluminum), and the figures in the table represent the combination of these two sets of indexes with the aid of 1963 trade weights.

(continued)

NOTES TO TABLE 10 (concluded)

The points made in the notes to Table 9 (copper) about the derivation of the place-to-place indexes and about the calculation of the EEC indexes apply here also.

[a]Unwrought aluminum.

[b]Worked aluminum.

[c]These indexes show how the prices of each foreign area changed relative to U.S. prices. For example, the figure 104 for the U.K. in 1964 indicates that U.K. export prices of aluminum were 4 per cent higher relative to U.S. export prices of aluminum than they were in 1962 (the base year).

The dispersion of prices makes the average relationships shown in Table 10 less representative than others shown in similar tables. Furthermore, the time-to-time figures for the United Kingdom and the underlying figures for some of the Common Market countries are not based on a broad enough sample of prices to produce reliable averages in this situation.[38] The figures for the U.S. and Germany, on the other hand, are believed to be reliable; the former are based on producers' data that represent a high fraction of U.S. exports, as well as on buyers' information of more limited scope, and the latter on both purchasers' data and on more than a score of export price series.

The time-to-time indexes of the U.S., the U.K., and the EEC (panel A) show similar directions of change for the most part, although there are sufficient differences to cause variations in relative price levels. In general, the European prices have been 5 to 10 per cent lower than those of the U.S. (see panel B). Within Europe, EEC prices have generally been lower than U.K. prices.

The differences between U.S. and European prices have generally been significantly smaller for ingot and other forms of unwrought aluminum; indeed, European export prices have in some instances been higher than those of the United States. For worked aluminum, however, European prices have in many cases been 15 to 20 per cent lower than those of the U.S. In 1962, a year for which there was a substantial number of observations, the international price levels were as follows (U.S. = 100):

[38] However, the place-to-place comparisons for the Common Market and the U.S. in 1961 and 1962 are reliable, each being based on several hundred observations.

	U.K.	EEC Total	EEC Germany
Aluminum (684)	92	89	94
Unwrought aluminum (684.1)	95	95	101
Worked aluminum (684.2)	86	80	82

Within the EEC, French prices have tended to be relatively low for unwrought aluminum while German and Belgian prices have been relatively low for worked aluminum. As in the case of copper, where a similar situation prevailed between U.S. and European prices, trade in the more highly fabricated stage is only half as important as trade in the less processed material, and the indexes are weighted accordingly. The over-all changes in price competitiveness (panel C) have been relatively small and, with the exception of the improvement of the EEC and German positions after the earlier years, there does not seem to have been any trend.

Other Nonferrous Metals

For the one-third of world nonferrous trade that does not consist of aluminum and copper, we do not present separate indexes. However, the more important of these metals are commented upon in the following paragraphs.

NICKEL

Canada accounted for 58 per cent of the world's mine production of nickel in 1962–63; about 80 per cent of Canadian output came from one company. The other major producing countries are the U.S.S.R. (23 per cent), and New Caledonia (8 per cent).[39] The sole U.S. producer accounted for only about 3 per cent of the world's supply of mine nickel. The United States, which uses over a third of all the nickel consumed in the world, imports about 90 per cent of its requirements.

As might be expected from this situation, Canada is by far the

[39] These figures are based on data in G. C. Ware, "Nickel," *Minerals Yearbook, 1963*. Metallgesellschaft Aktiengesellschaft data (*Statistical Tables on Metals*) give a little higher share for Canada and a somewhat lower share for the U.S.S.R. The latter source also indicates that both the Canadian and U.S.S.R. shares have fallen in the period since 1953–54, while the successive editions of the *Minerals Yearbook* indicate a sharper drop for Canada (from 67 per cent) and a slight rise for the U.S.S.R. (from 20 per cent).

most important factor in world trade in nickel; it accounts for about two-thirds of free world exports of unwrought nickel and its alloys. Most of the rest of the export trade is carried on by Norway and the United Kingdom which rely almost entirely on Canadian ore. Canada exports little ore to the U.S., but around 75 to 85 per cent of her exports of unwrought metal have gone to the U.S. The United States also gets some unwrought nickel—about 20 per cent of its imports—from Norway, France, and the U.K. In European and other markets outside North America, the U.K. and Norway often match and sometimes exceed Canadian sales. France, using New Caledonian ore, is a smaller exporter.

The countries with the most advanced metallurgical industries —the U.S., the U.K., and Germany—accounted for about 75 per cent of 1963 trade in worked nickel and nickel alloys in such forms as bars, sections, wire, plates, sheets, and tubes. The main destinations were other industrial countries. Canada and France, mentioned above as exporters of unwrought nickel, were net importers of worked nickel.

As already noted, the Canadian firm that is the world's largest producer acts as a price leader and has followed a policy of stable prices. During the early part of the period covered by this study, nickel was in short supply owing in large measure to the impact of the Korean War upon U.S. government demands for current use (jet engines, among others) and stockpiling. During these years of shortage (1953–57), the posted price of nickel rose only by 20–25 per cent, but smaller producers sometimes got higher prices, and free market sales at extremely high prices were reported.[40] By 1957 free world output was 50 per cent higher than in 1953 and U.S. government demands had eased. The producers' price remained constant for a period of four and a half years beginning in December 1956. At the end of June 1961, there was a 10 per cent price increase, but the demand conditions were such that small producers were reported to be shading the official price.[41] The price was reduced by about 2.75 per cent in May 1962, but even at this level production had to be cut in the latter part of the year. Demand strengthened in 1963 and even more markedly in 1964, but no further price changes were made.

[40] *Metal Bulletin*, May 29, 1962, p. 9. The *Engineering and Mining Journal* reported free market prices of $3 a pound when the producers' price was 64.5 cents (February 1963, p. 142).

[41] *Metal Bulletin*, May 29, 1962, p. 9.

The evidence we have, from a half dozen sources, mainly foreign, suggests that European export prices have been slightly lower than those of the U.S. The differences are more marked for worked nickel products, but these were only about one-fourth as important as unwrought nickel, for which price differences appeared to be small. Prices seem to have moved largely along parallel lines in the different countries.

SILVER AND PLATINUM METALS

At least small amounts of silver are produced in a large number of countries, but the Americas (chiefly Mexico, Peru, the U.S., and Canada) accounted for about three-quarters of free world output in 1963.[42]

In most years the United States consumes more silver than it produces and it imports significant quantities from Canada, Mexico, and Peru. Germany and Belgium have also been important in the world silver markets (mainly as re-exporters), and China disposed of large quantities in 1960–62 (probably in large part from the demonetization of coins) although the U.S. was not, of course, a buyer of silver from this source. Until recently, consumption of silver for coinage and for industrial uses had been expanding at about equal rates, with coinage absorbing between 20 and 35 per cent of world silver consumption. The enormous increase in U.S. coin requirements in the last few years has greatly altered the world silver market; the *increase* in silver absorbed for U.S. coinage in 1964 compared with 1962 was equivalent to more than one-third of all world silver consumption in 1962. In addition, world consumption of silver for industrial uses alone has, for some years, exceeded world production.[43]

Despite the homogeneity of silver and its worldwide use, silver prices in different places are not always equal, even allowing for transfer costs. Some U.S. regulations causing price differences have already been mentioned but other illustrations may easily be found. One of the largest price differences—resulting from strict controls over

[42] J. P. Ryan, "Silver," in *Minerals Yearbook, 1963*, Table 14. According to estimates given in this source, the main producer in the Soviet Bloc is the U.S.S.R. with more than 10 per cent of world output.

[43] Handy and Harman, *The Silver Market in 1964*, p. 19. Beginning in 1965, however, U.S. coinage requirements were sharply curtailed by a shift to the use of filler materials in "silver" coins.

imports and exports—has been between the Indian price and others. The lowest Indian price during 1964, for example, was $1.58 an ounce compared to a U.S. high of $1.293 and an English high of $1.302.[44]

Silver prices in New York and London rose from around 83 cents an ounce in 1953 to 85 cents in 1954–55 and then to the 89–91 cents range in 1956–61. The suspension by the U.S. Treasury of sales of nonmonetized silver at the end of 1961, an action related to growing coinage requirements, led to a sharp increase in prices to $1.293 (in September 1963), a ceiling established by the availability of Treasury silver at this price through the redemption of silver certificates.

London and New York silver prices have moved in close accord, with the London price usually slightly higher. Prices have moved somewhat more independently on the Continent, apparently at a higher level than U.S. or U.K. prices. The only deviation from published prices that was reported to us referred to silver originating in the Soviet Bloc.

Of the platinum metals grouped with silver in the SITC, platinum and palladium are the most important; iridium, osmium, rhodium, and ruthenium are also included. These metals have properties of chemical inertness, hardness, and ability to withstand heat that make them useful as catalysts in chemical processes, as refractory materials, and as durable electrical contacts in communications switchgear.[45]

The U.S.S.R., Canada, and South Africa are the major sources of supply. The United States, which accounts for half to two-thirds of free world consumption, has obtained its platinum metals chiefly from Canada and the United Kingdom, with lesser supplies coming from the U.S.S.R. and Switzerland.[46] The U.K. is by far the most important exporter of these metals, supplying not only the U.S. but also the Common Market, Japan, and even Canada.

Platinum metals have been exported from the U.K. at prices slightly below those of the U.S., and Continental prices have been only a shade above those of the U.K. There was, however, a relatively sharp rise in the German price of platinum between 1963 and 1964, and,

[44] *Ibid.*, pp. 12, 16, and 22.

[45] G. C. Ware, "Platinum Group Metals," in *Minerals Yearbook, 1963*, pp. 4–5.

[46] The U.K. refines ores from South Africa and the U.S.S.R., and Switzerland is a trading center for metals primarily of U.S.S.R. origin.

as a result, the German and EEC indexes of price competitiveness for SITC group 681 as a whole moved favorably for the U.S.

The NBER indexes for this group were based in part on prices published by trade sources and in part on information from about a score of other sources.

ZINC

Lead and zinc are linked together because they are frequently found in the same ores. Since zinc is more important in trade, it will be discussed first.

About 40 per cent of the mine production of zinc is accounted for by the New World and about one-third by Europe; the United States is responsible for about one-third of the output of the Americas, and the U.S.S.R. for a similar share of European output. Australia is the third most important producer, providing about 10 per cent of the world supply. U.S. production plummeted from high Korean War levels and the gradual comeback since the 1958 low had not, by 1964, restored output to its former level. World production, on the other hand, showed a more persistent expansion; 1963 output was 30 per cent above 1954.[47]

Most of the ore-producing countries also export unwrought zinc, particularly Canada, the U.S.S.R., and Australia. However, as with lead, smelter production tends to be located in industrialized areas. The United States and Europe account for over two-thirds of world smelter output, with the U.S. and the U.S.S.R. alone accounting for 23 and 13 per cent, respectively. The shares of Japan, Canada, Belgium, France, Poland, and Australia fall in the 5 to 8 per cent range.[48] Belgium, without ore supplies of its own, is a major factor in the world zinc trade. The leading importers are the U.K., the U.S., and Germany.

U.S. government intervention has been a more important factor in the lead and zinc markets than in other metals. Although at times, especially in wartime, the United States has adopted measures to stimulate exploration and production, during most of the past decade

[47] *Metal Statistics*, p. 21. Belgium, the U.S., France, the U.K., and Germany were the big importers of zinc ores and concentrates. In general, the U.S. relied heavily on Canada and Latin America for supplies while the European importers drew upon European as well as Latin American and Canadian supplies. The U.K. obtained over three-quarters of its raw material from Australia.

[48] H. J. Schroeder, "Zinc," in *Minerals Yearbook, 1963*, p. 29.

U.S. policy has been faced with a high-cost domestic industry in a world in which other sources of supply were capable of substantial expansion in output. The basic fact is that U.S. deposits of high-grade ores have been so depleted that in recent years the domestic mining industry has been working ores that are only half as rich in metal content as ores mined in foreign countries.[49] The U.S. industry thus has required higher prices than foreign producers. In the slump after the Korean War boom, the U.S. government rejected the domestic producers' application for additional protection against imports and embarked upon a stockpiling program that absorbed the equivalent of one-fifth to one-fourth of the domestic mine production of lead and zinc in the four years beginning in mid-1954.[50] A still larger quantity of lead was acquired from foreign producers in 1956–61 by bartering surplus agricultural commodities. Zinc was also acquired from foreign sources through barter in 1956–57 in an amount equal to a little more than 70 per cent of the quantity acquired from domestic producers in 1954–58.[51] This program was accompanied by efforts to induce foreign producers to restrict this production.

It seems likely, however, that the net effect of government stockpiling was not only to push up prices but also to stimulate lead and zinc production, especially in the U.S. where acquisitions from domestic sources were confined almost entirely to metal from newly mined ore.[52] As long as the government was absorbing substantial quantities of lead and zinc, the excess of production over consumption did not depress prices. When the government announced the curtailment of its procurement programs in 1957, there was a worldwide decline in lead and zinc prices. Indeed, world prices fell below those in the U.S. by more than freight and insurance, with the result that foreign refined pig lead and slab zinc were sold in the U.S. at substantial discounts below the U.S. producers' prices.[53]

In these circumstances, the U.S. abandoned its effort to avoid pro-

[49] U.S. Tariff Commission, *Lead and Zinc: Report to the President on Escape-Clause Investigation No. 65*, Washington, 1958, p. 18.

[50] Based on data in *Inquiry into the Strategic and Critical Material Stockpiles of the U.S.*, Part 4, p. 1240.

[51] *Ibid.*, pp. 1264–1265.

[52] *Lead and Zinc: Report to the President*, 1958, p. 29.

[53] *Ibid.*, pp. 39–42. The duty on lead has been 1.0625 cents per pound and on zinc .7 cents per pound since 1951. Freight and insurance costs have of course varied but they have generally been less than 1 cent per pound.

tective measures in the course of aiding its domestic producers. Effective in October 1958, the U.S. limited imports of unmanufactured lead and zinc to 80 per cent of the average annual commercial imports in 1953–57. The effect was to raise U.S. prices and to increase the difference between the U.S. and foreign prices.[54]

The demand for zinc was stronger than that for lead, and the operation of market forces outside the U.S. changed the price relationship of the two metals earlier than in the U.S.; the price of zinc, which had been 2 or 3 cents lower per pound than the price of lead for a number of years, first exceeded the lead price in London at the end of 1958, whereas the price crossover did not occur in the U.S. until a year later. The resumption of a notable upward trend in the free world consumption of lead and zinc began in 1959, but the expansion in zinc was greater.[55]

The recovery of metal markets in early 1964 caused first a narrowing of the differential between New York and London zinc prices and then a reversal of the historical pattern, in which the London price had been lower than the New York price.

In July 1964 zinc producers outside the U.S., fearful of the adverse effect of rising London Metal Exchange zinc quotations upon the competitive position of the metal, began an effort to maintain a producers' price as in copper. The U.S. released 75,000 tons—equivalent to about 7 per cent of a year's domestic production—from its stockpile to alleviate the shortage.[56]

As a result of these developments the U.K.-to-U.S. index of competitiveness fluctuated more than the indexes for other nonferrous metals; it wound up in 1964 in a position reflecting much higher relative U.K. prices than in any former year. Zinc export prices from the Continent tended to conform to the U.K. pattern of changes over time.

LEAD

The Americas account for about one-fourth of the world's mine production of lead, the centrally planned economies for one-fourth,

[54] See *Lead and Zinc: Report to the President,* Washington, 1960, Tables 10 and 11; and 1965, p. 26 and Tables 11 and 12.

[55] *Metal Statistics,* 1954–63, pp. 11 and 23.

[56] F. R. Jeffrey, "Zinc," in *Engineering and Mining Journal,* February 1965, p. 108.

Australia for one-sixth, and non-Soviet Europe for one-seventh. U.S. mine output, which still makes up over one-third of the New World production, declined by nearly 25 per cent from 1953–54 to 1962–63. World output increased by about the same percentage, expansion being most rapid in the Soviet Bloc.

Belgium, Germany, the U.S., and France import large quantities of ore from Canada, Latin America (especially Peru and Bolivia), and Australia. The European countries also rely upon closer sources such as Sweden, Bulgaria, and Morocco. Belgium and the U.S. obtain substantial supplies from southern Africa. There has been a growing tendency to process ores in the countries in which the mines are located.

The geographical distribution of smelter lead production nevertheless is still dominated by the pattern of industrialization. The Americas and non-Soviet Europe each produce one-third of the world total, and the Soviet Bloc one-fourth. The U.S. accounts for half of the New World output, its production having declined in absolute as well as relative terms during the past decade.

The most marked increases in the consumption of lead have been in the Soviet Bloc and non-Soviet Europe; U.S. consumption has hardly increased over the past decade. In the U.S. over half of current consumption is supplied by recovered scrap.

Manufactured lead is traded predominantly in unwrought form. The chief exporters are Australia, Mexico, the U.S.S.R., and Canada. Belgium, without ores of its own, is a significant net exporter of lead. Germany and the U.K. also export small quantities, but they are net importers by a substantial margin. The U.S., an important net exporter of lead before World War II, is the largest importer, followed at some distance by the U.K. and Germany.

With only brief exceptions at the very end of the period, the New York price of lead exceeded the London price during the period covered by this study. In the early years the difference between lead prices in New York and London fluctuated around the transfer costs of approximately 2 cents a pound (1.0625 cents duty plus freight and insurance). With the announcement of the end of stockpile purchases in 1957 and the subsequent imposition of quotas by the U.S. government, the differential tended to be larger—around 3 or even 4 cents a pound—and more variable. It shrank again with the recovery of metal

markets in 1964 as U.S. producers restrained the extent of price increases in the face of tightening supplies; in the latter part of the year it actually reversed direction for a time. The U.S. released 50,000 tons of lead from its stockpile in 1964.

As in the case of zinc, official prices tend to reflect actual transactions prices more fully when supply and demand are in balance and prices are stable. In periods of excess supply, a number of export transactions take place at lower prices, and in periods of shortage, some exports are sold at premium prices. Even where producers attempt to maintain the published quotations, secondary metal is readily sold at a discount or premium. Thus, in the case of the U.S. price movement for lead exports between mid-1963 and mid-1964, for example, we have estimated the export price increase at 26 per cent, although the several publicly available wholesale and producers' price series show increases ranging from 18 to 22 per cent.

Our indexes show that European prices were lowest relative to the U.S. in 1961 and 1962 when there was a differential of about 20 per cent, with U.K. prices slightly lower than those of Germany and the EEC. Differences were much smaller in 1964 and, in the case of the EEC, prices were almost up to the U.S. level.

TIN

Tin is one of the few important metals which were not marked by rising world production during the period under review. Mine production of tin in 1962–63 was within 1 per cent of the 1953–54 level. The major sources of supply in the terminal years were Malaya (32 per cent), China (15 per cent), Bolivia (12 per cent), the U.S.S.R. (10 per cent), and Indonesia and Thailand (8 per cent each). Increases in output in China, the U.S.S.R., and Thailand were offset by declines in Indonesia, Bolivia, and the Republic of the Congo. Only as the period drew to an end did it appear that serious supply shortages and premium prices might begin to stimulate a new surge in output.

In some cases, such as Malaya and the U.S.S.R., tin concentrates are smelted and only tin metal is exported. In others, particularly Bolivia and Indonesia, tin concentrates are exported. Bolivian concentrates have gone mainly to the United Kingdom, while the destination of Indonesian concentrates has varied with political circumstances including, at times, the Netherlands, Malaya, and the U.S., among

others. In recent years some developing countries, notably Nigeria, which exported concentrates, have begun to establish local smelting facilities. The result of these changes, already noted, was that the share of the U.S. and Western Europe in world tin smelting declined from more than 50 per cent in 1953–54 to around 20 per cent in 1962–63.

Malaya has been the world's major exporter of unwrought tin, probably accounting for more than 75 per cent of world trade. The U.K., the Netherlands, Belgium, the U.S.S.R., China, and Germany have accounted for most of the balance. A large part of the tin consumed in the United States and Western Europe is used to make tinplate (SITC subgroup 674.7), which is five times more important in international trade than tin itself.

The price of tin has been influenced by the International Tin Agreement, which came into effect in 1956. A buffer stock financed by the producer countries was established and its manager was required to buy tin when the price was below the floor (successively raised from £640 per long ton in 1956 to £1,000 near the end of 1964) and to sell when the price was over the ceiling (£800 in 1956 and £1,200 by the end of 1964). When the price was between the floor and ceiling but near one or the other, the manager could buy or sell (according to the case) at his discretion, but when the price was in a middle £50 or £100 range between the floor and ceiling he could not come into the market. Export quotas were also assigned to the six producing member countries from December 1957 to October 1960; quotas were curtailed during 1958 but expanded in 1959–60.

In the first few years of the period covered in this study, U.S. stockpile purchases buoyed up the world tin market.[57] By 1957, these purchases had been ended and this shift, combined with low tin demand due to recession conditions and with Russian sales, forced the buffer stock manager to buy tin to keep the price from falling below the floor. Nevertheless, the producer members insisted upon raising the floor price in 1958 and the buffer stock manager ran out of money. In the final years of the period, the opposite difficulty appeared; the buffer stock manager had no tin to sell. This situation

[57] Deliveries to the U.S. under stockpile contracts in 1953–56 were equivalent to more than one year's world production (*Inquiry into the Strategic and Critical Material Stockpiles of the U.S.*, Part 5, pp. 1724–1725).

first appeared in mid-1961, when it was attributed to speculation.[58] Prices subsequently declined partly because of a U.S. decision to release 50,000 long tons (nearly a third of a year's world production) from its stockpile, and the buffer stock manager was led to buy tin again in the latter part of 1962. However, the basic situation was one of shortage since consumption had exceeded production for several years, and prices began to climb again. In October 1963 the buffer stock ran out of tin once more and prices rose, first moderately and then at an accelerating rate, reaching a peak in October 1964 that was about twice the October 1963 level. The price increases came despite U.S. stockpile releases of 6,000 tons in 1963 and 22,000 tons in 1964.[59]

There are three major tin markets: the London Metal Exchange, which includes both spot and future transactions and which is the focus of consumers, traders, and speculators from all over the world; the Penang market (Singapore before May 1964), which deals in tin for physical delivery; and the New York market, which caters chiefly to U.S. consumers. All three markets are closely related, but short-run divergent price movements are possible in narrow limits since it takes four to six weeks to move tin from Malaya to London or New York and one or two weeks between London and New York. Transfer costs usually ensure that the London and New York prices will be higher than the Malayan price; the New York price, in turn, has tended to run slightly higher than the London price. The index of price competitiveness has thus not varied very much from year to year.

We had to rely on published prices to a considerable extent in making up our indexes for this group, as we had independent data only from a few U.S. and a few German sources, all buyers. However, our U.S. sources rather consistently showed smaller fluctuations than the published prices and we based our indexes for the U.S. mainly on these private data.

MISCELLANEOUS NONFERROUS METALS

This category covers about a score of nonferrous metals. Belgium is the largest exporter, followed by the U.S., the U.K., Japan, and Germany. Our time-to-time indexes are based on the more important metals in the group such as magnesium, tungsten, molybdenum,

[58] *Engineering and Mining Journal,* February 1963, p. 111.
[59] K. Friedlander, "Tin," in *Engineering and Mining Journal,* February 1965, p. 93.

antimony, cobalt, chromium, cadmium, titanium, and manganese. More extensive use was made of wholesale price data in this category than in any other nonferrous group. For example, five of the seventeen series used in preparing the U.S. index represented published wholesale price series. The German indexes are based on the smallest number of series, six, although in this case none of them represents a published series. The indexes for all of the areas (the U.S., the U.K., Germany, and the EEC) reveal a sharp drop in prices between 1953 and 1957. Aside from a further decline in the U.S. between 1957 and 1961, prices tended to remain stable through 1961 and 1962, only to rise again in 1963 and more sharply in 1964. The rise in these recent years carried European prices beyond the levels that had prevailed in 1953, whereas the same was not true of the U.S. prices. Thus by 1964 European miscellaneous nonferrous metal prices which had often been 15 to 20 per cent below U.S. prices were about the same as U.S. prices (U.K. prices were actually still a little lower while German prices were a little higher than U.S. prices).

Conclusion

During most of the years covered by this study, European international prices of nonferrous metals were 5 to 10 per cent below U.S. prices, taking the bundle of nonferrous metals exported by the advanced countries as a whole. The gap between American and European prices was widest in 1961 and 1962, but had diminished substantially, to only a couple of percentage points, by 1964. Among the European countries, Germany appeared to have less of a price advantage over the U.S. than either the U.K. or the EEC countries as a group. In both copper and aluminum, the two most important nonferrous metals in the exports of developed countries, the difference between U.S. and foreign price levels was larger for worked metals than for unwrought metals.

There is considerable variability among the individual metals. In some instances, such as lead in 1962, European international prices were as much as 20 per cent below those of the U.S., and in other, less frequent cases European prices were higher. The latter was true, for example, of EEC copper prices in 1964, German prices of primary aluminum in 1962, European silver prices more often than not, and U.K. zinc prices in 1964. It was quite generally the case among the

metals that the U.S. was least competitive with respect to price in 1961–62 and that the U.S. position in 1964 was more favorable than at any other time except, possibly, the very beginning of our period.

For primary metal products, direct price competition in the sense of cutting prices in order to enter new markets, including the home markets of rival producers, appears to have been confined to the aluminum industry. For worked metals, price competition has been somewhat more common.

In a number of the other major nonferrous metals, U.S. prices have often been maintained at comparatively stable levels, usually higher than those abroad. In slack markets the U.S. producers have not been completely immune to pressures from lower foreign prices because, when the price difference becomes large enough, foreign primary metal is brought into markets ordinarily served by U.S. producers, and, more frequently, because products fabricated out of foreign metals begin to displace those produced from U.S. metals. Pricing policies, particularly in copper, have been influenced by the threat of price competition from rival metals and other substitute products.

The pricing policies followed in Europe tend to differ from those of the U.S. There is a greater tendency in Europe to differentiate between home and foreign markets and to export metals at prices reflecting current world supply and demand conditions, although by the end of the period under study both primary copper and primary zinc were being sold in Europe at prices established by producers rather than at prices set on the free market.

These differences in pricing policy between the United States and Europe do not seem to be attributable to different degrees of concentration, because the degree of concentration in the nonferrous metal industries tends to be high in both the U.S. and Europe, particularly at the primary stage. It is more likely the natural outcome of the difference in the capacity of the nonferrous metal industries relative to home demand in the two areas. For the U.S. producers, the home market is of overwhelming importance and since it is protected —always by transport cost and time, and frequently by trade restrictions as well—it is only sensible to gear price policies to it. Of course, separate pricing policies can be applied to exports, and sometimes they have been.

The nonferrous industries of the European countries, on the other hand, are built to serve external markets; in some extreme cases such as Belgian copper and Norwegian aluminum, for example, the domestic market absorbs only a small part of output. The pressure on firms in this position to meet world supply and demand condition is, of course, much greater. This situation also leads to differential pricing for various markets.

Thus, the imperfections and fragmentation of world nonferrous metal markets are greater than might have been expected for goods which, in their homogeneity and ubiquity of use, conform so well to the stereotype of standardized internationally traded goods. Tariffs and quotas, the division of markets, the tendency to maintain customary trade channels, technical know-how, and other factors operate to varying degrees—not so much in the dynamic aluminum industry as in the slower-growing copper industry—to reduce the impact of price differences on trade flows.

Although, as noted, the direction of trade in nonferrous metals is influenced by a great variety of factors other than price, to an extent probably greater than for other products included in this study, much of the trade pattern is consistent with price relationships. For example, if we rank the 1963 ratios of U.K. and EEC exports to U.S. exports for the five categories of metals for which price ratios were considered at least partially publishable, we find them, as expected, inversely related to the price ratios (Table 11).

There may be an element of chance involved, in view of the roughness of the data and the fact that the differences between some of the price ratios are quite small, but there is, in any case, considerable consistency between the prices and the export movements for these metals.

One result of the computation of these indexes of international prices is to show that for nonferrous metals, as for iron and steel, the existing wholesale price and export unit value indexes are at times seriously misleading as measures of international price movements and of international price competitiveness.

Some of the deficiencies of the official data are due to the inadequacy of commodity coverage. The improvement of coverage through the addition of trade journal prices for commodities not in the official series moves the index for U.S. wholesale prices closer to the NBER

TABLE 11

Comparison of Export Value and Price Ratios for Five Categories of Metals: U.K. to U.S., EEC to U.S., and U.K. to EEC
(value ratios ranked from high to low; price ratios from low to high)

	U.K./U.S.		EEC/U.S.		U.K./EEC	
	V	P	V	P	V	P
682.1 Copper, unwrought	4	4	4	4	4	4
682.2 Copper, worked	2	3	2	3	2	1
684.1 Aluminum, unwrought	5	5	5	5	5	3
684.2 Aluminum, worked	3	2	3	1	3	5
685 Lead	1	1	1	2	1	2

Note: Price ratios are from Tables 8 and 10 and text discussion. Values are from same sources as Table 1.

index in every period, and the effect is usually, although not always, the same for foreign country indexes.

The unit value index differs more from the NBER index than the wholesale price indexes in most years. Part of this discrepancy may again be coverage, since the unit value data used for the index cover only copper and aluminum. However, even if we examine the relationship of NBER indexes to unit values within copper and aluminum we find large differences, and these do not seem to be explainable in terms of differences in coverage within the group. They are apparently the result of defects in the basic unit value data for individual commodities.

We conclude, therefore, that even in a relatively uncomplicated group such as nonferrous metals, the existing price measures give inadequate or misleading impressions of international price competitiveness.