CHAPTER 4

The Domestic Steel Industry's Competitiveness Problems

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Summary

Although world steel demand more than doubled during the past two decades, domestic steel production increased by only 20 percent during this time. In this same period, the Japanese steel industry increased production sevenfold, and Common Market steel production went up by 70 percent. The declining role of the U.S. steel industry in the international market is reflected in substantially increased U.S. steel imports and flat export levels. Despite major technological and economic difficulties, domestic steel industry profit levels have been higher than those of foreign steel industries. Nevertheless, steel profits were only about half the U.S. manufacturing average.

Historically, the domestic steel industry's indebtedness levels had been relatively low compared to foreign steel industries. Unlike foreign firms, domestic steelmaker have financed capital investments largely from retained profits or through equity financing. Foreign governments play a more direct role than the U.S. Government in facilitating industrial access to capital markets and public funds.

The U.S. steel industry's market decline may be attributed to a number of factors. Its most recent expansion started earlier and was of a much shorter duration than that experienced by competitor industries, particularly that in Japan. Furthermore, the domestic industry has adopted certain productive new steelmaking technologies at a relatively slow rate. As a result, U.S. plants tend to be older, smaller, and less efficient than the steelmaking equipment of many competing foreign steel industries.

The resource-poor Japanese steel industry, benefiting from post-World War 11 technological, economic, and government policy advantages, has been the world's low-cost producer since the early 1960's. Japan has had a long--lasting steel industry expansion, based largely on new plant construction. As a result, Japan now has superior technological steelmaking capability and a strong competitive position. Some steel-producing less developed countries (LDCs), such as South Korea, are also becoming increasingly cost competitive.

Raw materials, including energy, continue to be the most costly input factors. Foreign steel industries have brought down their raw materials unit costs during the past decade, despite major materials price increases. Domestic raw materials unit costs actually increased. Virtually all steel industries are experiencing declining employment levels. The domestic industry no longer has the highest labor productivity, and U.S. unit labor costs are higher than in Japan but lower than in Europe.

Predictions of future supply and demand of steel products are uncertain, but high steel demand and barely adequate world capacity are possible by the mid-1980's. Under these conditions, if domestic capacity is replaced with modern facilities, increased demand can be met and financed. If limited expansion and modernization do not occur, the United States will become dependent on carbon steel imports at high prices during cyclic periods of high demand.

Decline of the U.S. Position in World Steel Production and Trade

Up to and throughout World War II, the United States maintained an unapproachable lead in steel technology and production. However, the postwar rebuilding and expansion of European and Japanese steel mills provided foreign producers with great competitive leverage. U.S. steel firms did not build enough new plants or expand existing capacity sufficiently to capture a portion of the rapidly rising world demand for steel.

The dramatic decline in the growth rate of the U.S. steel industry, compared to that of other countries, is revealed in world production figures. From 1956 to 1978, the U.S. share of total world output of steel dropped from 37 to 17.5 percent and domestic production increased only 10 percent. During this period, Japan increased its production nearly tenfold (table 16). Japan and the European Economic Community (EEC) experienced a combined growth rate from 1950 to 1976 that was 10 times greater than that of the United States.

That the domestic industry did not capitalize on burgeoning post-World War II international steel demand is shown by the fact that steel exports from the United States have remained constant during the past 30 years, even though worldwide exports increased more than tenfold during that time (figure 8). In 1978, the United States exported only 2.5 percent of its total domestic raw steel production, while West Germany exported 53.7 percent; Japan, 36.8 percent; Italy, 37.6 percent; and the United Kingdom, 21.5 percent (table 17). Clearly the industries in these countries were built with the export market in mind, because their capacities far exceed the volume needed to satisfy their domestic needs.

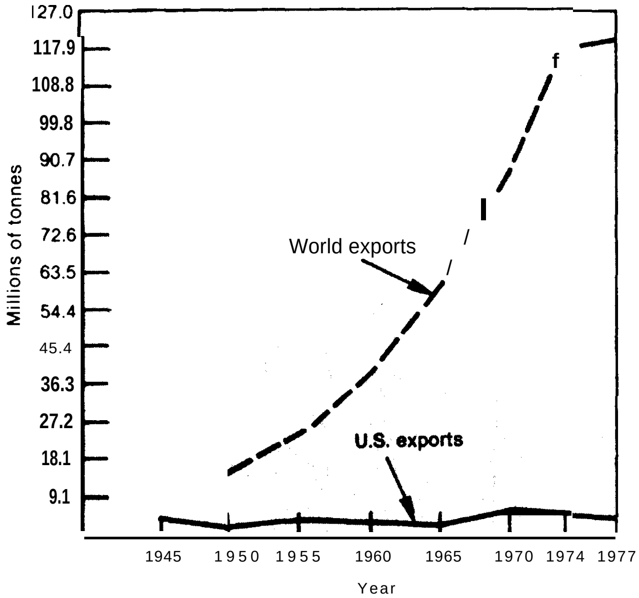
Not only have domestic steel exports failed to keep pace with growing world steel de-

Table 16.—Raw Steel Production: Total World, EEC Countries, Japan, and the United States, 1956-78

Year	Millions of tonnes				U.S. share of total world production (percent)
	Total world	EEC	Japan	United States	
1956	283.8	77.9	12.0	104.5	36.8
1957	291.8	82.0	12.5	102.2	35.0
1958	270.9	78.0	12.1	77.4	28.5
1959	305.8	84.0	16.6	84.7	27.7
1960	346.1	97.9	22.1	90.1	26.0
1961	353.8	96.1	28.3	88.9	25.1
1962	357.4	94.0	27.6	89.2	24,9
1963	382.9	96.5	31.5	99.1	25.9
1964	434.5	109.9	39.8	115.3	26.5
1965	456.3	113.8	41.2	119.3	26.1
1966	470.8	110.2	47.8	121.6	25.8
1967	496.7	114.5	62.1	115.4	23.2
1968	528.3	125.3	66.8	119.3	22.6
1969	573.2	134.7	82.1	128.2	22.4
1970	593.4	137.5	93.3	119.3	20.1
1971	580.4	128.2	88.5	109.2	18.8
1972	629.9	126.2	96.9	120.8	19.2
1973	697.1	150.1	108.2	136.8	19.6
1974	710.0	155.5	117.1	132.1	18.6
1975	645.8	125.3	102.3	105.8	16.4
1976	683.1	134.3	107.4	116.1	17.0
1977	673.9	125.3	102.4	113.1	16.7
1978	711.7	133.1	102.1	124.3	17.5

SOURCE: Compiled from data published by the American Iron and Steel Insitute.

Figure 8.—U.S. Exports—Share of World Steel Trade, 1945-77



SOURCES: American Iron and Steel Institute, Steel *Industry and Federal Income Tax Policy,* June 1975, p 46, U N Secretary of Economic Committee for Europe, Statistics of *World Trade* in *Steel, 1913.59,* Geneva. 1967

mand, but steel imports into the United States since the late 1950's have also grown at the rate of 10 percent per year (table 18). * The increasing gap between domestic steel exports and imports has a negative effect on the U.S. trade balance. Steel imports exceeded exports in dollar value for the first time during the late 1940's and in volume during the late 1950's (figure 9, table 18). Since that time, imports have captured much of the growth in domestic steel consumption. In 1978, steel exports were only 20 percent of imports, and iron ore exports were a mere 6 percent of imports. These trade patterns have led to a very high annual trade deficit (table 19), second only to petroleum as a source of trade deficit. Although exports of ferrous scrap reduce this deficit by a relatively small amount, imports of coke increase it.

*It is generally recognized that the prolonged steel strike in 1959 played a role in the dramatic shift of the United States from being a net exporter to a large net importer of steel.

Table 17.–Selected Countries' Steel Exports' as a Percentage of Their Total Raw Steel Production, 1955-78

						Selected EEC countries		
Year	Total world	EEC	Japan	United States	Rest of world	West Germany	Italy	United Kingdom
1955	13.0	30.3	25.0	4.6	6.8	16.2	8.5	17.1
1956	12.8	30.1	12.9	5.0	6.9	20.4	15.4	16.0
1957	14.1	31.6	9.4	6.3	7.9	26.3	14,7	18.1
1958	14.4	32.9	17.3	4.6	7.4	26.7	17.4	17.4
1959	14.1	36.1	12.0	2.5	7.4	28.2	17.3	18.6
1960	15.0	34.7	13.5	4.0	8.4	30.6	17.6	16.9
1961	14.5	36.3	10.6	2.8	8.0	32.8	12.9	19.0
1962	15.9	36.5	18,4	2.8	10.5	33.1	13.3	20.0
1963	15.8	36.2	22.5	2.7	10.3	33.0	11.6	19.8
1964	16.1	36.1	21.9	3.6	10.4	29.6	18.5	18.7
1965	17.3	39.8	30.8	3.5	9.8	34.5	25.7	19.2
1966	16.6	39.9	26.4	1.7	10.3	36.5	20.7	19.1
1967	16.9	42.3	18.7	1.8	10.7	43.5	16.6	21.3
1968	18.4	42.7	25.5	2.2	11.0	41.4	19.3	22.1
1969	18.7	40.8	25.3	5.0	11.1	37.4	15.5	19.9
1970	19.0	39.0	25.2	7.1	11.3	35.9	13.7	19.9
1971	21.4	46.8	34.9	3.2	11.8	43.7	24.0	27.3
1972	20.7	47.6	28.7	2.9	12.2	42.3	25.7	24.3
1973	20.8	48.2	27.8	3.6	12.0	46.5	22.1	21.4
1974	23.5	53.2	36.6	5.4	11.2	55.7	26.7	19.8
1975	22.5	54.1	37.7	3.4	11.5	53.7	38.2	21.5
1976	NA	NA	44.7	2.8	NA	47.2	43.8	21.6
1977	NA	NA	41.9	2.2	NA	53.2	37.8	21.5
1978	NA	NA	36.8	2.5	NA	53.7	37.6	21.5

NA = Not available
aSemifinished and finished steel exports converted t. raw steel equivalent by dividing exports by O.75 Data include intra-EEC exports for EEC and European nations. For EEC in 1978 exports *outside* the member nations amounted to 25 percent of raw steel production, and Imports from outside member nations was 13 percent of exports

SOURCES U S Congress, Senate Committee on Finance, Steel *Imports,* December 1976, American Iron and Steel Institute, *Annual Statistical Reports,* and U.N. Economic Commission for Europe, *The Steel Market.*

Table 18.—U.S. Imports and Exports of Steel Mill Products, 1956-78

Year	Millions of tonnes: Imports	Millions of tonnes: Exports	Ratio of imports to apparent consumption (percent)
1956	1.2	3.9	1.7
1957	1.1	4.8	1.5
1958	1.5	2.5	2.9
1959	4.0	1.5	6.1
1960	3.1	2.7	4.7
1961	2.9	1.8	4.7
1962	3.7	1.8	5.6
1963	4.9	2.0	6.9
1964	5.8	3.1	7.3
1965	9.4	2.3	10.3
1966	9.8	1.5	10.9
1967	10.4	1.5	12.2
1968	16.3	2,0	16.7
1969	12.7	4.7	13.7
1970	12.2	6.4	13.8
1971	16.6	2.5	17.9
1972	16.1	2.6	16.6
1973	13.8	3.7	12.4
1974	14.5	5.3	13.4
1975	10.9	2.7	13.5
1976	13.0	2.4	14.1
1977	17.5	1.8	17.8
1978	19.1	2.2	18.1

SOURCE Compiled from official statistics of the US Department of Commerce

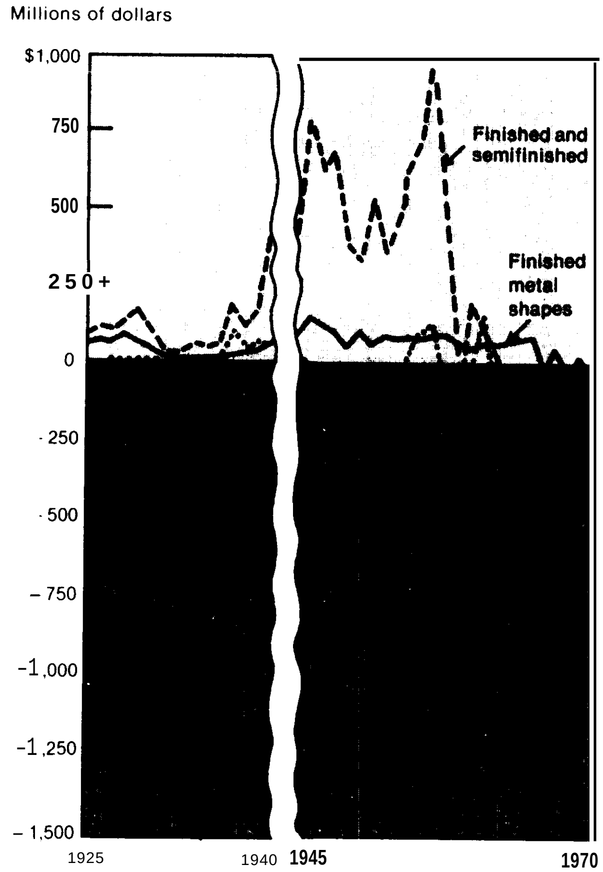
Table 19.—U.S.Iron Ore and Steel Import and Export Levels, 1971-78(millionsofdollars)

Year	Imports: Ore	Imports: Steel	Exports: Ore	Exports: Steel	Combined trade deficit
1971	$ 476,4	$2,636	$36.1	$ 576	$2,500
1972	441.4	2,794	24.9	604	2,607
1973	564.0	2,821	35.7	1,004	2,345
1974	798.3	5,116	38.2	2,118	3,758
1975	1,017.3	4,093	56.3	1,862	3,192
1976	1,078.0	4,025	70.0	1,255	3,778
1977	970.5a	5,531	55.4[a]	1,037	5,409
1978	1,000.0[a]	6,917	60.0[a]	1,329	6,528

[a]Preliminary estimate

SOURCES Ore—Using Import/export tonnage data and average annual prices In U S Bureau of Mines, "Iron Ore, " MCP-13, 1978; steel—U.S. Department of Commerce, *U .S. Industrial Outlook* 1978.

Figure 9.—U.S. Trade Balance in Iron and Steel, 1925-70[a]



[a]Excluding the war years 1941-45

SOURCE: W.H. Branson and H.B. Tunz, *Brookings Papers on Economic Activity,* 2 1971 (based on U S Department of Commerce and U S Bureau of the Census data)

Profitability and Investment in the Steel Industry

Domestic steelmaker' limited exports and the country's growing imports are indicative of the decline in the competitiveness of the U.S. steel industry in the international market. Competitiveness is based on technological capability and its interaction with macroeconomic developments and inputs of labor, raw material, and capital. It is axiomatic that no matter how much technological knowledge exists, it will not be used unless capital is made available to finance applications of that knowledge.

Trends in Domestic Steel Industry Profits

To a significant extent, the problems that the domestic steel industry presently faces can be traced to longstanding low profitability, which according to many people has discouraged equity investment in the industry. Aggregate financial data support this contention. Nevertheless, the domestic steel industry has had a far better financial performance than have many foreign steel producers.* Still, given the prevailing profit status of many domestic steel firms, they will be significantly short of the capital they would need to modernize, solve environmental problems, and no more than maintain current capacity levels, much less expand them.

Conventional comparisons of domestic profitability, measured as aftertax profits as a percentage of stockholder equity, show low steel industry profits compared to other sectors. In only 4 years (1955-57 and 1974) during the past 25 did this measure of steel industry profit exceed the average for all domestic manufacturing firms (table 20). Steel industry profitability has been lower than prime interest rates for 5 of the past 10 years.

Although total revenue for the domestic steel industry has increased steadily, from $9,534.6 million in 1950 to $46,877.3 million in 1978, so have its operating expenses and capital expenditures. Industry net income fluctuated widely during the 1950-78 period (table 21). The real rate of return has declined to very low levels, finally becoming negative during the past few years as inflation rates exceeded steel industry profit margins (figure 10), Dividend payments have been surprisingly stable, however, even in years of very low profitability. In addition, capital expenditures as a percentage of net internally generated cash funds have been relatively high (table 22).

One of the industry's explanations for its shrinking profitability and growing capital problem is the "cost-price'" squeeze, that is, the situation in which steelmaking costs rise more rapidly than do steel prices. The data in table 23 confirm that this has been the case, particularly for all forms of energy and for labor. This trend started in the early 1960's and has continued to the present. Of particular importance has been the inability of the industry to raise prices when it needed to match cost increases and when the world competitive situation would have tolerated higher prices for steel. The industry has always been a prominent target for Government "jawboning" when it announces price increases. During the periods of worldwide steel shortage, the Government directly controlled and held down domestic steel prices. In 1973-74, for example, imported steel reputedly was selling for from $55 to $110/tonne more than domestic steel (at $330/tonne).

Financial Performance of the Steel Industry Segments

The nonintegrated and alloy/specialty steel producers have exhibited much better financial performance than have integrated companies in recent years (table 24). There is wide variation in profitability among integrated companies, however, which seems to reflect major differences in technology, age

*International profitability comparisons should be made with caution since foreign government ownership and direct and indirect support make measures of profitability used for private U.S. firms difficult to apply to all foreign firms.

Table 20.–Trends in Steel Industry Profits, 1954-78

	Profits after taxes					
	Steel		Percent of stockholder equity[a]			
Year	Millions of dollars	Percent of revenues	Steel	All mfg.	Ratio of steel/mfg.	Prime interest rate (percentage)
1954	$ 637	6.0	9.4	12.4	75.8	3.05
1955	1,099	7.8	15.4	15.0	102.8	3.16
1956	1,113	7.3	14.1	13.9	101.4	3.77
1957	1,132	7.3	13.1	12.9	101.6	4.20
1958	788	6.3	8.3	9.8	84.7	3.83
1959	831	5.8	8.4	11.7	71.8	4.48
1960	811	5.7	7.9	10.6	74.5	4.82
1961	690	5.2	6.5	9.9	65.7	4.50
1962	566	4.1	5.3	10.9	48.6	4.50
1963	782	5.4	7.3	11.6	62.9	4.50
1964	992	6.1	9.0	12.6	71.4	4.50
1965	1,069	5.9	9.4	13.9	67.6	4.54
1966	1,075	5.9	8.9	14.2	62.7	5.63
1967	830	4.9	6.9	12.6	54.8	5.61
1968	992	5.3	8.2	13.3	61.7	6.23
1969	879	4.6	7.0	12.4	56.5	7.96
1970	532	2.8	4.1	10.1	40.6	7.91
1971	563	2.8	4.3	10.8	39.8	5.72
1972	775	3.4	5.8	12.1	47.9	5.25
1973	1,272	4.4	9.3	14.9	62.4	8.03
1974	2,475	6.5	17.1	15.2	112.5	10.81
1975	1,595	4.7	9.8	12.6	77.8	7.86
1976	1,337	3.7	7.8	15.0	52.9	6.84
1977[b]	22	.1	0.1	14.9	0.7	6.83
1978	1,292	2.8	7.3	15.9	45.0	9.06

aBased on equity at beginning of year. [b]Data influenced by Bethlehem Steel's plant closing and large loss.

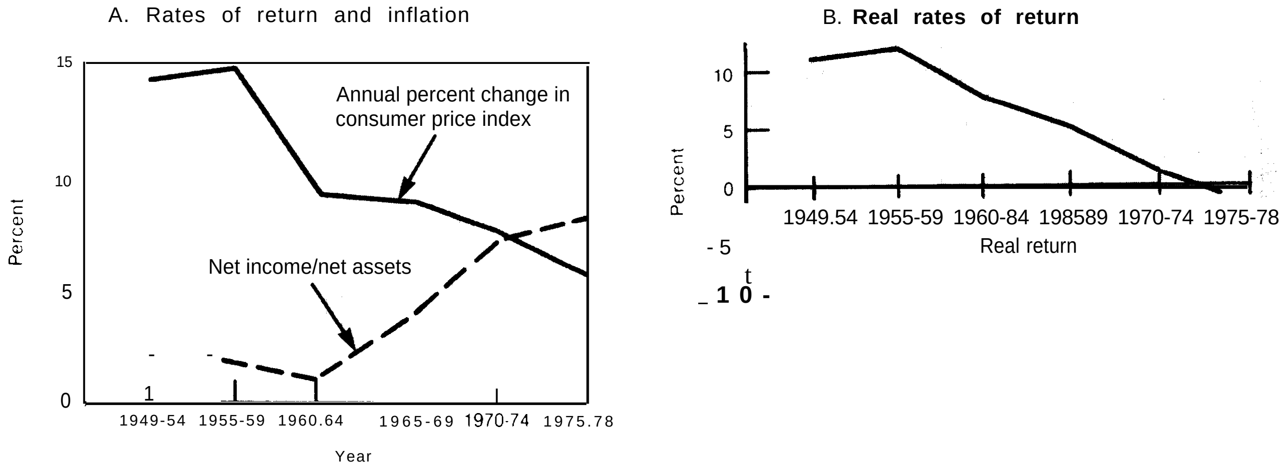
SOURCES: American Iron and Steel Institute; Citibank Corp.

Table 21.—Selected Financial Highlights, Iron and Steel industry, 1950-78 (dollars in millions)

Year	Total revenues	Net income	Net Income as a percentage of revenues	Stock-holders' equity[a]	Net Income as a percentage of stockholders' equity	Working capital ratio	Long-term debt	Captial expenditures
1950,	$ 9,534.6	$ 766.9	8.0	$ 5,458.3	14.1	2.1	$ 763.1	$ 505.3
1951	11,845.0	682.2	5.8	6,037.9	11.3	2.0	1,029.6	1,050.9
1952	10,858.2	541.0	5.0	6,373.0	9.5	1.9	1,447.3	1,298.3
1953	13,155.8	734.9	5.6	6,780.9	10.9	2.2	1,485.7	987.8
1954	10,593.3	637.3	6.9	7,139.6	8.9	2.0	1,485.7	608.9
1955	14,049.3	1,098.6	7.8	7,920.2	13.9	2.0	1,546.5	713.7
1956	15)271.8	1,113.3	7.3	8,664.7	12.8	2.1	1,567,7	1,310.6
1957	15,592.1	1,131.6	7.2	9,465.6	11.4	2.3	1,801.5	1,723.0
1958	12,551.3	787.6	6.3	9,898.2	8.0	1.9	2,144.8	1,136.9
1959	14,233.3	830.6	5.8	10,248.4	8.1	2.0	2,303.2	934.3
1960	14,221.3	810.8	5.7	10,545.1	8.2	2.1	2,488.2	1,520.7
1961	13,295.4	689.6	5.2	10,646.9	6.5	2.7	2,968.5	959.5
1962	13,980.6	566.4	4.1	10,676.1	5.3	2.9	2,853.6	911.4
1963	14,612.6	782.0	5.4	11,008.3	7.1	2.7	2,694.8	1,040.0
1964	16,357.1	992.3	6.1	11,393,4	8.7	2.4	2,874.2	1,599.5
1965	17,971.7	1,069.3	5.9	12,031.9	8.9	2.4	3,120.1	1,822.5
1966	18,288.4	1,075,3	5.9	12,045.1	8.9	2.3	3,782.3	1,952.7
1967,	16,880.4	829.8	4.9	12,168.5	6.8	2,2	4,205,3	2,145.7
1968	18,679.6	992.2	5.3	12,617,5	8.2	2.0	4,6014	2,307,3
1969	19,231.0	879.4	4.6	12,836.0	7.0	1.8	4,608,2	2,046.6
1970	19,269.5	531.6	2.8	12,966.0	4.1	1.9	5,1339	1,736.2
1971	20,357.8	562.8	2.8	13,281.4	4.1	1.9	5,1444	1,425.0
1972	22,555.7	774.8	3.4	13,674.5	5.8	1.9	5,2296	1,174.3
1973	28,863.2	1,272,2	4.4	14,513.5	9.3	1.9	4,9629	1,399.9
1974	38,243.6	2,475.2	6.5	16,243.2	17.1	1.8	4,6512	2,114.7
1975	33,676.3	1,594.9	4.7	17,192.2	9.8	2.0	5,7053	3,179.4
1976	36,462.4	1,337.4	3.7	18,027.3	7.8	1.9	6,9665	3,252.9
1977	39,787.4	23.2[b]	0.06	17,603.7	0.1	1.8	7,9307	2,857.6
1978	46,877.3	1,291.9	2.8	18,403.3	7.3	1.7	7,7389	2,5383

[a]As of January 1 of each year. [b]Reflects substantial impact of Bethlehem Steel plant closings.

Figure 10.—Steel Industry Annual Average Rates of Return and Annual Average Rates of Inflation, 1949-78



SOURCE American Iron and Steel Institute; U S Bureau of Labor Statistics

Table 22.—Selected Financial Data, U.S. Steel industry, 1954-78 (dollars in millions)

Year	Profits after taxes	Depreciation, depletion, etc.[a]	Gross cash flow	Cash dividends	Net cash flow	Capital expenditures	Captial expenditures as a percent of net internally generated funds
1954 . . . , .	$637	$703	$1,340	$343(53.8)[b]	$ 997	$ 609	61.1
1955 ,	1,099	783	1,882	437(39.8)	1,445	714	49.4
1956 ,	1,113	794	1,907	508(45.6)	1,399	1,311	93.7
1957, ...	1,132	816	1,948	566(50.0)	1,382	1,723	124.7
1958 .	788	713	1,501	540(68.5)	961	1,136	118.2
1959 . ,	831	653	1,484	553(66.5)	931	934	100.3
1960 . . . . ,	811	840	1,651	564(69.5)	1,087	1,521	139.9
1961 . ,	690	749	1,439	557(80.7)	882	960	108.8
1962	566	958	1,524	508(89.8)	1,016	911	89.7
1963 . . .	782	1,034	1,816	433(56.6)	1,373	1,040	75.7
1964 . . . . . ,	992	1,046	2,038	462(46.6)	1,576	1,600	101.5
1965 ,	1,069	1,117	2,186	468(43.8)	1,718	1,823	106.1
1966 .	1,075	1,199	2,274	483(44.9)	1,791	1,953	109.0
1967	830	1,444	2,274	481(58.0)	1,793	2,146	119,7
1968 .	992	1,316	2,308	452(45.6)	1,856	2,307	124.3
1969, ...	879	1,173	2,052	489(55.6)	1,563	2,047	131.0
1970 ,	532	1,128	1,160	488(91.7)	1,172	1,736	148.1
1971	563	1,123	1,686	.390(69.3)	1,296	1,425	110.0
1972 . ,	775	1,196	1,971	402(51.9)	1,569	1,174	74.8
1973	1,272	1,329	2,601	443(34.8)	2,158	1,400	64.9
1974	2,475	1,553	4,028	675(27.2)	3,354	2,115	63.1
1975	1,595	1,591	3,186	658(41.5)	2,528	3,179	125.8
1976 .	1,337	1,614	2,951	637(47.6)	2,314	3,253	140.6
1977 . . ,	22	1,888	1,910	555[c]	1,355	2,850	210.3
1978	1,292	2,010	3,302	533(41.3)	2,769	2,538	91.7

[a]Includes changes in reserves
bNumbers in parentheses are dividends as of percent of after taxcredlts
cThe industry percent was 104, omitting Bethlehem Steel because of its extraordinary one time loss. **For Bethlehem** itself, dividends represented 146 percent ($65.5 million) of the net loss ($448.2 million)

SOURCE: American Iron and Steel Institute

Table 23.—index of Steel Industry Prices and Costs, 1965-78

Year	Consumer price index	Wholesale price index for industrial commodities	Producer price indexes: Steel mill products	Metallurgical coal (high volume)	Iron ore (pellets)[a]	Steel scrap	Electrical power	Fuel oil	Wages[b]
1965	94.5	96.4	97.5	96.8	NA	112.6	03.0	07.7	94.05
1966	97.2	98.6	98.9	98.4	NA	106.6	99.8	05.0	97.37
1967	100.0	00.0	00.0	00.0	NA	100.0	00.0	00.0	100.00
1968	104.2	02.5	02.5	01.8	NA	93.0	00.9	95.7	105.76
1969	109.8	06.0	07.4	10.2	100.0	110.8	02.2	93.3	112.97
1970	116.3	10.0	14.3	150.9	105.1	138.8	06.6	25.5	119.31
1971	121.3	13.9	23.0	185.3	111.1	114.6	15.5	66.0	131.59
1972	125.3	17.9	30.4	198.4	111.1	121.8	23.9	58.8	148.70
973	133.1	27.0	34.1	216.5	116.4	188.0	32.6	90.4	161.43
974	147.7	153.8	170.0	232.8	140.3	353.2	172.3	485.4	190.79
975	161.2	171.5	197.2	622.1	181.2	245.6	193.2	495.5	222.57
976	170.5	182.5	209.7	657.8	201.6	259.0	226.9	451.7	246.82
977	181.6	195.1	229.9	671.3	220.2	233.7	257.2	521.4	273.76
1978	195.4	209.3	254.5	704.9	230.1	278.2	279.7	496.8	300.36

NA = Not available [a]December 1969 base. [b]Including fringe benefits.

SOURCES: U.S. Department of Labor, American Iron and Steel Institute

Table 24.—Steel Company Profitability by Industry Segment, 1977-78

Company	Steel sshipped (thousand net tonnes) 1977	1978	Return on Investment (percent) 1977	1978	Pretax profits from steel only (dollars per tonne shipped)' 1977	1978
integrated companies						
United States Steel	17,868	18,866	**3.7**	5.3	- 530	– 1. 04[a]
Bethlehem Steel	11,251	11,859	**(11.0)**	9.3	-1048	26.60[a]
LTC . .	4,427	4,881	**(0.4)**	5.8	– 1168	5.26[b]
National Steel . .	6,912	7,438	**5.8**	82	9.45	25.66[a]
Inland Steel .	5,067	5,661	**6.4**	9.7	1538	36.24[a]
Wheellng.Pittsburgh Steel .	2,477	2,655	**(2.0)**	63	– 1327	8.80
Kaiser Steel	1,440	1,443	**0.6**	1.6	- 840	-1225
McLouth Steel	1,286	1,466	**(3.8)**	5.2	– 1873	7 .36[b]
CF&I Steel	1,009	980	**8.8**	6.6	2040	11.64
Interlake	738	787	**5.9**		418	– 31. 64[b]
Average			**1.4**	6.2		
Republic Steel	6,038	6X01	**4.2**	10.4	6.36	23.35[a]
Armco. .,	4,973	5,457	**7.2**	10.4	- 402	12.79[a]
Nonintegrated companies						
Northwestern Steel & Wire	763	1,077	7.2	139	3338	53.33
Nucor . . .	563	718	16.7	250	4169	7004
Florida Steel	418	600	48	138	854	2727
Keystone Consolidated Industries .	461	497	0.2	23	– 14.88	1.35[b]
Laclede Steel. .	397	471	42	94	- 099	1664
Atlantic Steel.	346	430	4,0	96	3.00	2098
Average “.	—	—	6.2	123	—	—
Alloy and specialty steel companies[c]						
Sharon Steel[d]	965	1,055	10.6	153	29.38	5783
Cyclops	776	666	55	103	1614	4111
Allegheny-Ludlum Industries	344	357	52	85	47.75	6330
Copperweld	297	351	111	84	77.41	5413
Washington Steel	42	45	93	116	150.29	190. 29[b]
Carpenter Technology	—	—	168	169	NA	NA
Lukens Steel	—	—	100	9.6	NA	NA
Athlone Industries (Jessop Steel). .,	–	—	7.5	9.9	NA	NA
Eastmet (Eastern Stainless Steel) .,	—	—	6.0	90	NA	NA
Average	—	—	9.1	11.1	—	—

[a]Source: *World Steel Dynamics, Business Week* (Sept. 17, **1979)** has given data on U S Steel Indicating a 1978 loss of $15.00/tonne of steel shipped.
bFrom Steel Form 10-k reports. (U.S. Securities and Exchange Commission.)
CAlloy and specialty steels account for more than 10% of the steel shipments of these companies.
dAlthough Sharon Steel is **integrated**, most of its business is in alloy and specialty steels.

SOURCE *Iron Age,* May 7, 1979

and scale of facilities, and management practices. Although the financial performance of many domestic fully integrated steel firms is relatively poor when compared to other domestic manufacturing sectors, their overall performance appears to be far superior to major steel producers in other nations.

Several factors account for the far better financial performance of the nonintegrated and alloy/specialty companies compared to the integrated companies. Importantly, the alloy/specialty mills and many of the nonintegrated mills use advanced and efficient technologies to a greater extent than do integrated plants, and these technologies tend to yield higher profit margins than do older methods. Alloy/specialty mills, since 1973, have been provided with effective quota barriers against competing imports. Furthermore, their comparatively high-priced products have intrinsically greater profit margins than the products the other segments produce. Nonintegrated firms have lower costs than integrated firms because they use ferrous scrap almost exclusively as a raw material, they make a smaller range of simpler products, and they have lower marketing and other overhead costs.

Trends in Steel Industry Investment

The steel companies' net income has been insufficient over time to meet all of their capital needs and the industry has been forced to borrow extensively for investment in new equipment. The industry's long-term debt increased tenfold between 1950 and 1978, from $763.1 million to $7,738.9 million. One of the principal reasons for the increasing debt has been the steady growth in capital expenditures in actual dollars. In real dollars, these expenditures have fluctuated widely (table 25).

In the same 1950-78 time period, stockholders' equity increased only by a factor of three from $6,812,6 million to $17,603.7 million (see table 21). As a result, the debt-to-equity ratio increased from 11.2 percent in 1950 to 44.0 percent in 1978. The debt-to-equity ratio is an important variable, which significantly affects industry's ability to enter equity markets. With a ratio of nearly 45 percent and low profits, most steelmaker cannot issue new stock or increase their debt.

Table 25.—Replacement Rates for Domestic Steel Production Facilities, 1950-78

Year	Capital expenditures on productive steelmaking facilities (millions of 1978 dollars)	Capital expenditures on steelmaking facilities per tonne of finished steel shipped (1978 dollars per net tonne)	Replacement rate[b] (percent)
1950	$1,181	$19.03	1.73
1951	2,268	32.56	2.96
1952	2,749	45.87	4.17
1953	2,055	28.71	2.61
1954	1,258	22.33	2.03
1955	1,447	19.36	1.76
1956	2,484	34.10	3.10
1957	3,094	43.89	3.99
1958	2,045	38.17	3.47
1959	1,647	27.28	2.48
1960	2,675	43.01	3.91
1961	1,698	29.37	2.67
1962	1,600	25.96	2.36
1963	1,811	27.39	2.49
1964	2,760	37.07	3.37
1965	3,107	38.83	3.53
1966	3,405	43.45	3.95
1967	3,367	46.42	4.22
1968	3,576	44.66	4.06
1969	2,869	36.52	3.32
1970	2,214	29.37	2.67
1971	1,705	23.10	2.10
1972	1,265	16.28	1.48
1973	1,630	17.16	1.56
1974	2,163	23.54	2.14
1975	2,684	40.48	3.68
1976	2,599	34.98	3.18
1977	2,054	27.72	2.52
1978	1,706	21.67	1.97
Annual averages			
1950-58	2,065	31.57	2.87
1950-78	2,245	31.68	2.88
1959-68	2,565	36.30	3.30
1969-78	2,089	27.06	2.46

aCapital expenditures less environmental expenditures and estimated non steel capital expenditures. Current dollars (adjusted by using the GCP Non-residential Investment Implicit Price Deflator) Capital expenditures shown are for American Iron and Steel Institute reporting companies only
bCapital expenditures (1978 dollars) on productive steelmaking facilities per tonne of shipments divided by replacement cost of facilities per tonne of shipments. Replacement facility cost per tonne of shipments assumed to be $1,100 (1978 dollars)

SOURCE: D.F. Barnett, American Iron and Steel Institute

The relative profitability of the U.S. steel industry compared to foreign steel industries, the large size of the domestic market, and the sizable proportion of imports in domestic steel consumption have made domestic steel mills and steel distributors attractive targets for foreign investment and outright purchase.

The existence of stocks that are undervalued relative to book value and exchange rates favorable to foreigners add to the relative attractiveness of domestic steel mills to foreign investors. As a result, a number of small nonintegrated mills have been purchased or built by foreign interests; these include Chaparral Steel (50-percent interest) and Raritan Steel, by Co-Steel International Ltd. of Canada; Auburn Steel, by Japanese interests; Korf and Georgetown Steel, by West German interests; Atlantic Steel, by Ivaco Ltd. of Canada; Bay Steel by VoestAlpine of Austria; New Jersey Steel and Structural, by Van Roll of Switzerland; Azcon and Knoxville Iron, by Consolidated GoldFields of the United Kingdom; Phoenix Steel (50-percent interest), by Creusot-Loire of France; Judson Steel, by Australian interests; and Schindler Bros. Steel Co. by West German interests. In November 1979, Kaiser Steel Corp. held discussions with Nippon Kokan KK concerning potential takeover. These particular negotiations were discontinued, but further takeovers of domestic steel producers by foreign investors are expected in the future.

Ownership and Financial Performance of Foreign Steel Firms

The financial performance of the domestic steel industry is somewhat difficult to compare with that in other nations because of the significantly different economic settings in which foreign steel firms operate. The principal difference is that many foreign steel firms are at least partly owned and/or controlled by their governments (table 26). Furthermore, in many countries, government support of steel is based on public policy considerations, such as employment stability or growth of other industries, rather than steel industry profitability alone. The same type of socioeconomic considerations in some foreign countries at least partly account for the lower labor productivity in their steel industries compared to the United States (table 27).

The domestic steel industry generally has lower production costs than foreign industries and recently has had higher rates of capacity utilization (table 28). As a result, most foreign steel producers havtl been less profitable during the past decade than domestic steel producers, particularly if the comparison is with the best performing U.S. firms rather than with industry averages (table 29). Only the Canadian steel industry has been consistently more profitable than the U.S. industry but the Canadian industry is much smaller. Data on world rank by size, production, sales, and profitability for a number of foreign steel firms are given in table 30. These data underestimate financial losses, because the most unprofitable companies, often state-owned, generally do not publish their financial results. World Steel Dynamics (1979) has estimated that, for 1978, Western world steel exports represented a loss of $4 billion, suggesting that considerable dumping is occurring and that foreign steel industries are being operated at rates for purposes other than profitmaking.

Summary data on profitability of steel industries in Europe, several foreign nations, and the United States are given in table 31. These data show that the U.S. industry has been much more profitable than Europe's, which has experienced large losses. Though the technological and cost competitiveness of

Table 26.—Government Ownership of Raw Steel Facilities, Selected Countries
(percent government owned)

Country	1974 production	1978a	1979 capacity
Canada	17	0	13
Brazil	60	75	68
Mexico	47	75	74
Venezuela	86	NA	85
Other Latin America	NA	NA	56
France	o	75	69
West Germany	11	0	9
Italy	57	75	57
United Kingdom	90	75	79
Spain	45	50	39
Netherlands	93	25	NA
Sweden	21	75	59
Belgium	0	50	NA
Austria	100	100	NA
Other Western Europe	NA	NA	60
Republic of South Africa	87	NA	72
Other Africa	NA	NA	70
India	100	75	82
Taiwan	100	NA	12
South Korea	100	75	NA
Other Asia	NA	NA	75
Oceania	NA	NA	30
Total non-Communist countries	19	NA	30
Total Communist countries	100	NA	100
Total world	44	NA	"45

NA = not available
aProductlon or capacity not stated (probably capacity), numbers apparently rounded off to 0, 25, 75, or 100%.

SOURCES 1974 production—D.F. Barnett The Canadian Steel Industry in a Competitlve World Environment Canadian Government. 1977: 1978 production – *The Economlst* Dec. 30, 1978 and 1979 capaclty—American Iron and Steel Institute

the Japanese steel industry cannot be refuted, it still has not been very profitable. A number of factors explain this relatively low profitability: low capacity utilization (about 70 percent for the past several years), high financial costs, increasing energy prices and labor costs, and high transportation costs for raw material imports and finished steel exports. With the exception of Canada, * foreign steel industries continue to suffer either large losses or only moderate profits. Nevertheless, as a result of government support, many foreign steel-producing firms have experienced considerably greater expenditures than have domestic steel firms both on a per-tonne basis and as a percentage of the countries' gross national products (GNPs) (figures 11 and 12).

Japanese companies are about 83-percent debt-financed, compared to an average of 44 percent for U.S. steelmaker. Japan's close government/business cooperation, aimed at maintaining a strong, export-oriented steel industry, provides Japanese steelmaker with considerable access to external funds. The Japanese Government, through the Bank of Japan and indirectly through commercial banks, facilitates loans to steel companies to finance modern capacity additions in order to increase production or permit economies of scale. This capital is not a subsidy: the companies pay interest at a rate slightly lower than the prevailing rate. *

The steel industries of developing countries have been given considerable help from international organizations. For example, the U.N. International Development Organization (UNIDO) has considered underwriting the expansion of ironmaking and steelmaking in LDCs, and the World Bank has made available many loans for this purpose. A UNIDO report argues that steel firms in developed countries are planning to build up production of semifinished steel in LDCs. The report states:

> Steel industry projects in developing countries in many parts of the world are being pursued steadily . . . The shift presents the developing countries with an exceptional opportunity. They are able to pursue their own development schemes with technical assistance and deliveries of equipment more readi-

*For the three largest Canadian (integrated) steel companies, The Steel Co. of Canada, Dominion Foundries & Steel, and Algoma Steel, the average returns on equity for 1974 to 1978 were 11.6 percnt. 12.9 percent, and 10.8 percent respectively. The best performing large U.S. integrated firms for this period were Armco with 11.3 percent and Inland with 11.2 percent return on equity. ("The Steel Industry of America. " Price Waterhouse & Co., 1 979.)

*The rate paid is about 1/2 to 1 percent lower than the market interest rate in Japan. A subsidy of this magnitude would be less than $0.55/tonne on a $330/tonne product.

Table 27.—Comparison of Productivity and Labor Costs in the U.S. Iron and Steel Industries With Four Other Countries, 1964,1972-77

Measure and year	United States	Japan		West Germany		United Kingdom		France	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Output per hour									
1964	100	46	53	53	60	48	51	48	52
1972	100	85	101	76	84	51	54	62	69
1973	100	94	112	73	80	48	51	59	66
1974	100	95	113	80	88	43	46	61	68
1975	100	103	123	82	91	43	46	61	68
1976	100	108	128	82	91	48	51	63	70
1977	100	104	123	81	89	43	46	64	72
Hourly labor costs									
1964	100	16	16	35	35	29	38	34	35
1972	100	33	34	58	58	33	34	44	44
1973	100	41	42	71	71	33	34	54	54
1974	100	44	46	78	78	35	36	55	65
1975	100	44	46	76	76	37	38	63	63
1976	100	44	45	72	72	33	34	63	63
1977	100	49	51	78	78	33	34	64	64
Unit labor costs									
1964	100	**24**	30	59	67	57	61	66	72
1972	100	32	40	68	75	62	67	64	71
1973	100	37	45	88	97	66	71	83	91
1974	100	39	48	88	97		81	82	98
1975	100	36	44	83	92	80	87	97	107
1976	100	34	42	79	87	65	70	92	101
1977	100	40	40	88	97	72	77	90	99

SOURCE U.S. Bureau of Labor Statistics.

Table 28.—Capacity Utilization in Several Steel Industries (percent of capacity)

Year	United States	Canada	Japan	United Kingdom	West Germany	France	ECSC (six countries)	Total EEC
Annual averages								
1956-65	75.8	86.8	84.2	–	—	—	89.8	
1966-75	86.5	88.7	85.0	–	—	—	81.5	=
1956-75	81.1	87.7	84.7	–	—	—	85.6	–
Annual								
1973	**97.5a**	**—**	**85.8**	**92.5**	**84.2**	90.0	—	86.3
1974	93.5a	—	77.7	80.3	88.1	88.5	—	86.9
1975	76.2	—	67.3	74.2	64.3	64.0	—	66.1
1976	80.9	—	66.6	77.7	64.4	69.7	—	67.9
1977	78.4	—	61.1	70.9	57.6	66.4	—	62.8
1978	86.8	—	67.3	73.6	60.0	68.5	—	65.9

[a]Estimate.

SOURCES: Averages—D.F. Barnett, "The Canadian Steel industry in a Competitive World Environment," Canadian Government, 1977,annualdata—American Iron and Steel Institute, Eurostat, European Coal and Steel Community, and Japan's Ministry of International Trade and Industry.

ly available from developed countries than at any time during the past ten years. As the developing countries make rapid progress with their steel industries, they will reduce their dependence upon imports, improve their balance of payments, and create a sound basis for further industrialization. '

[1]U.N. International Development Organization, Progress Report on the World Iron and Steel Industry (draft, no date, Vienna, Austria).

Table 29.—Steel Industry Net Income as a Percentage of Net Fixed Assets, Five Countries, Averages for 1969-77

Country	Net income/ net fixed assets
United States.	6.7
Japan	1.7
West Germany.	2.9
United Kingdom	– 5.3
France (1972-76)	– 8.3

SOURCE. International Iron and Steel Institute

Thus, it is clear that the privately owned and financed U.S. steel industry is largely competing in an international market with foreign steel industries that have significantly better access to capital but that are no more profitable, and in many cases less profitable, than the U.S. industry.

Table 30.— Financial Statistics, Selected Steel Companies, 1978

Company	Country	1978 world rank	1978 production (millions of tonnes)	Sales: 1978 (millions of dollars)	Sales: 1977-78 (percent change)	Profits after taxes: 1978 (millions of dollars)	Profits after taxes: 1978-77 (percent change)	1978 return on book value[a] (percent)
British Steel	United Kingdom	4	16.7	$ 5.882.0	3	-$690.0	NM	-32
Creusot-Loire	France	—	1.5	2,974.8	17	– 85.0	NM	–36
FINSIDER	Italy	6	13.0	—	—	—	—	—
Dalmine	Italy	—	—	630.2	4	– 75.0	NM	–81
Italsider	Italy	—	—	2,941.5	15	-419.6	NM	- 6 6
Thyssen	West Germany	9	11.8	12,086.1	12	66.0	– 18	4
Krupp	West Germany	23	5.1	6,556.3	7	– 10.5	NM	–1
Klockner-Werke	West Germany	28	4.1	1,882.5	13	– 38.6	NM	– 14
Salzgitter	West Germany	29	3.9	3,464.2	5	– 52.0	NM	- 1 6
COCKERILL	Belgium	20	5.3	3,294.4	NA	– 0.2	NA	NA
ESTEL (Hoogovens and Hoesch)	Netherlands	21,22	5.3,5.1	5,571.7	8	-146.6	NM	-11
Empresa Nacional Siderurgia	Spain	25	4.9	1,390.1	7	– 174.1	NM	NA
Nippon Kokan	Japan	5	13.4	5,523.8	– 4	49.3	98	6
Nippon Steel	Japan	1	31.2	11,526.3	4	216.1	185	10
Sumitomo	Japan	7	12.0	4,918.3	6	72.9	183	10
Kawasaki	Japan	8	12.0	4,591.1	3	83.3	156	11
Kobe Steel	Japan	16	7.1	4,223.9	6	65.4	95	11
Stelco	Canada	24	5.0	1,496.9	23	101.3	33	12
Dominion Foundries	Canada	33	3.3	994.5	22	80.0	39	16
Algoma Steel	Canada	34	3.0	728.5	26	58.7	85	13
Broken Hill	Australia	14	7.6	2,680.2	11	95.5	62	4
Steel Authority of India	India	18	6.3	1,798.8	NA	33.1	NA	NA
Tata Iron & Steel	India	47	1.9	426.1	9	9.5	–36	8
South African Iron & Steel	South Africa	19	6.1	1,306.1	24	– 84.4	NM	– 7
Comp. Siderurgia Nacionale	Brazil	43	2.1	865.8	48	– 2.2	NM	– 2

NM = not meaningful, NA = not available
[a]Book value is common equity at end of fiscal year

SOURCES Rank and production—international Iron and Steel Institute, other data–Business Week, July 23, 1979

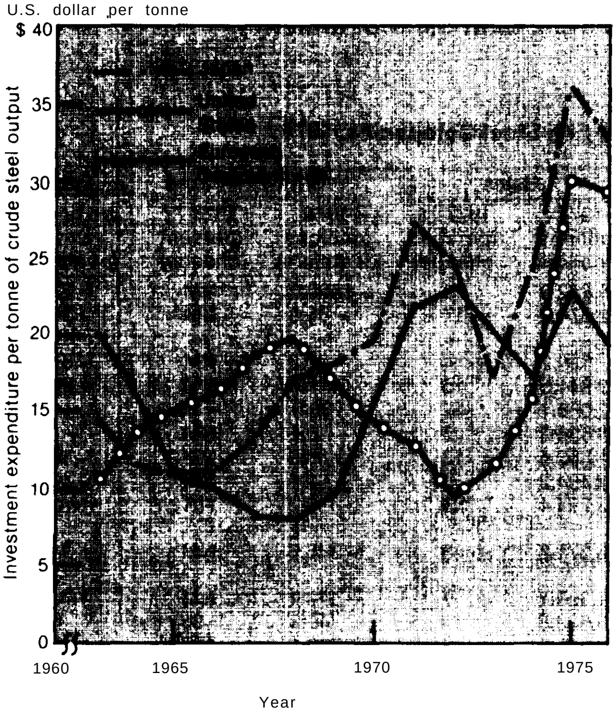
Table 31.— Average Profitability for Steel Industries in Six Nations and Europe, 1978

Country/area	1978 dollars: Profit per tonne raw steel	1978 dollars: Pretax profit per tonne shipped[a]	1978 profit (percent): Sales	1978 profit (percent): Return on equity
Europe	–21 .19 (1977 = –25.86)b	—	1.6	—
Japan	6.43 (1 977= 2.45)	9	7.6	3.2c
Canada	21.24 (1977= 15.32)	—	—	13.7
France	– 56.67	–48	—	—
West Germany	– 1.41	– 2	—	—
United Kingdom	– 41.32	–50	—	—
United States	10.48 (1977 = 4.81)[d]	31	2.8	7.3

aFrom World Steel Dynamics, September 1979, for commodity carbon steels made m integrated plants only.
bFrom data in Fortune, Aug. 13, 1979, for 17 European steelmaker representing897 million tonnes of raw steel, 1978 production (only 3 firms showed proflt).
CThe average of 96 percent for th five firms was normalized to 32 percent in order to compensate for the widely different debt-to-equity ratio, assuming that for the United States the ratio is4060 and for Japan it is8020
dExcludes extraordinary losses of Bethlehem Steel and their raw steel production.

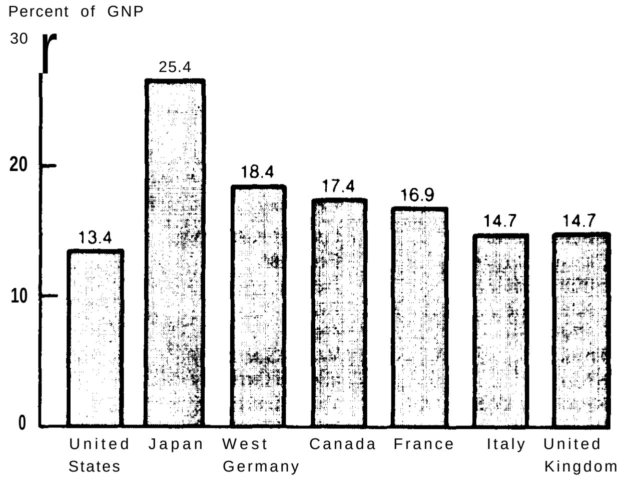
SOURCE American Iron and Steel Institute data. except as noted

Figure 11.— Rates of Investment in Major Steel Industries, 1963-76



SOURCES. Organization for Economic Cooperation and Development, International Iron and Steel Institute

Figure 12.—Capital Expenditures in Steel Manufacturing as Percent of GNP, Selected Steel-Producing Countries, 1960-78



SOURCE U N. International Monetary Fund

Factors in International Competitiveness

The production factors—capital, labor, and raw materials—are combined in various ways, through technology, to produce steel. The productivity of these inputs is partly determined by the technologies in use. Their productivity and prices, in turn, determine production costs, a major element of the profitability needed to attract capital.

Technology

Technology has direct and indirect effects on total steelmaking productivity because investments in up-to-date processing equipment help slow down real production cost increases. * During the 1960's, the domestic steelmaker made major technological gains in hot wide-strip mills, rod and bar mills, and in secondary refining. * The use of low-cost electric furnaces also increased considerably, driven mostly by the construction of domestic nonintegrated plants that take advantage of locally available scrap. The production of raw steel from electric furnaces is comparable to that in Japan, greater than that in West Germany and France, but lower than that in the United Kingdom (table 32).

The Federal Trade Commission (FTC) has concluded that the U.S. steel industry adopted new basic oxygen and continuous casting technology more rapidly than any

*Adoption of new technology is discussed more thoroughly in ch. 9.

*One of the newest U.S. hot strip mills. computer-controlled from start to finish, requires only 32 workers on each shift compared to about **80** in other facilities. (U.S. Department of Labor. Bulletin No. 1856.)

Table 32.—Comparative Trends in Raw Steel Production in Electric Furnaces, 1964-78 (percent of total production)

Year	United Kingdom	France	West Germany	Japan	United States	Total world (excluding the United States)
1964	—	—	—	—	9.98	—
1965	—	—	—	—	10.50	—
1966	—	—	—	—	11.09	—
1967	—	—	—	18.3	11.86	—
1968	—	—	—	18.2	12.79	—
1969	—	—	—	16.7	14.25	13.7
1970	18.9	—	—	16.7	15.33	14.6
1971	17.5	—	10.0	17.6	17.39	14.7
1972	18.9	—	10.2	18.6	17.80	15.5
1973	19.4	10.7	10.4	17.9	18.40	15.6
1974	22.9	11.5	10.8	17.8	19.67	16.2
1975	26.9	14.2	12.6	16.4	19.44	17.2
1976	29.7	14.2	12.4	18.6	19.23	19.1
1977	30.0	14.5	13.0	19.1	22.25	18.5
1978	34.7	15.0	14.5	21.9	23.53	17.3

SOURCES American Iron and Steel Institute Ministry of Industry and Trade, Japan, Statistlches Bundesamt, West Germany, and Steel Statistics Bureau, United Kingdom

other nation. [2] However, FTC only considered the degree to which new steelmaking capacity used new technologies, not the extent to which total steelmaking used new technologies.

The replacement of still usable and undepreciated facilities by new technology requires ample justification. Domestic steelmaking equipment, largely of the 1950's and earlier vintage, in the industry's view, had not depreciated enough by the late 1960's and early 1970's to warrant replacement. Yet it was inefficient compared to large Japanese integrated plants and some recently acquired European and Third World facilities. Coupled with an alleged unwillingness in the mid-1950's* to adopt advanced, but not widely proven steel production processes, U.S. production capability has not kept pace with constantly modernized Japanese mills and some new production facilities in developing nations. For example, Japanese production increased 5 percent between 1962 and 1978, and capacity increased 50 percent; while U.S. production in this period increased 3 percent, and capacity increased 1 percent.

It appears, in retrospect, that domestic producers did not adequately project the future economic advantages of certain technological options. In particular, they did not fully predict the rising costs of energy, labor, and capital. When these increases did hit, along with environmental control costs, the steel companies were not in a good position financially to adopt available technology. * As of 1978, 26 percent of steel industry plant and equipment was reported to be technologically outmoded, as compared to 12 percent for domestic durable goods industries. ' A more recent estimate is that 20 percent of steel facilities is obsolete.[4] The age of facilities is particularly high for open hearths, blooming mills, and plate mills, followed by cold strip mills and coke ovens (table 33).

Adams and Dirlan have criticized the U.S. failure to adopt new technology rapidly enough. [5] They argue that since the 1960's domestic steelmaker have lagged behind other

U.S. Federal Trade Commission, "The U.S. Steel Industry and Its International Rivals, " November 1977.

*This is a highly controversial topic.

* . . . much of the steel industry's apparent unwillingness to invest in energy-conserving equipment can be made to appear completely rational (i. e., consistent with profit maximization) by using constant, rather than steadily increasing energy prices. " F. T. Sparrow, "A Public-Private Sector Interactive Mixed Integer Programming Model for Energy Conservation Policy," Purdue University, 1979.

'McGraw-Hill. "How Modern Is American Industry?" November 1978.

"International Iron and Steel Institute, 33 Metal Producing, January 1980, p. 9.

'Walter Adams and Joel B. Dirlan, "Big Steel, Invention and Innovation" *Quarterly Journal of Economics (May 1966),* p. 167ff.

Table 33.—Age Distribution of Domestic Steel Production Facilities, 1979

Facility	Average age (years)[a]	Percent older than— 30 years	25 years	20 years
Coke ovens	17.3	14.2	25.6	45.9
Open hearth furnaces	33.2	43.0	78.5	100.0
Basic oxygen furnaces.	11.0	0.0	0.0	2.3
Electric furnaces. . . .	14.3	6.1	13.8	25.3
Plate mills	25.6	40.8	45.1	53.6
Wire rod mills.	13.7	12.6	17.3	17.9
Hot strip mills	19.0	11.6	16.1	31.5
Cold strip mills	21.2	14.7	29.2	54.1
Galvanizing lines. . . .	18.8	4.4	8.9	40.1
Aggregate	17.5	12.5	20.4	33.3

[a]As of Jan 1, 1979

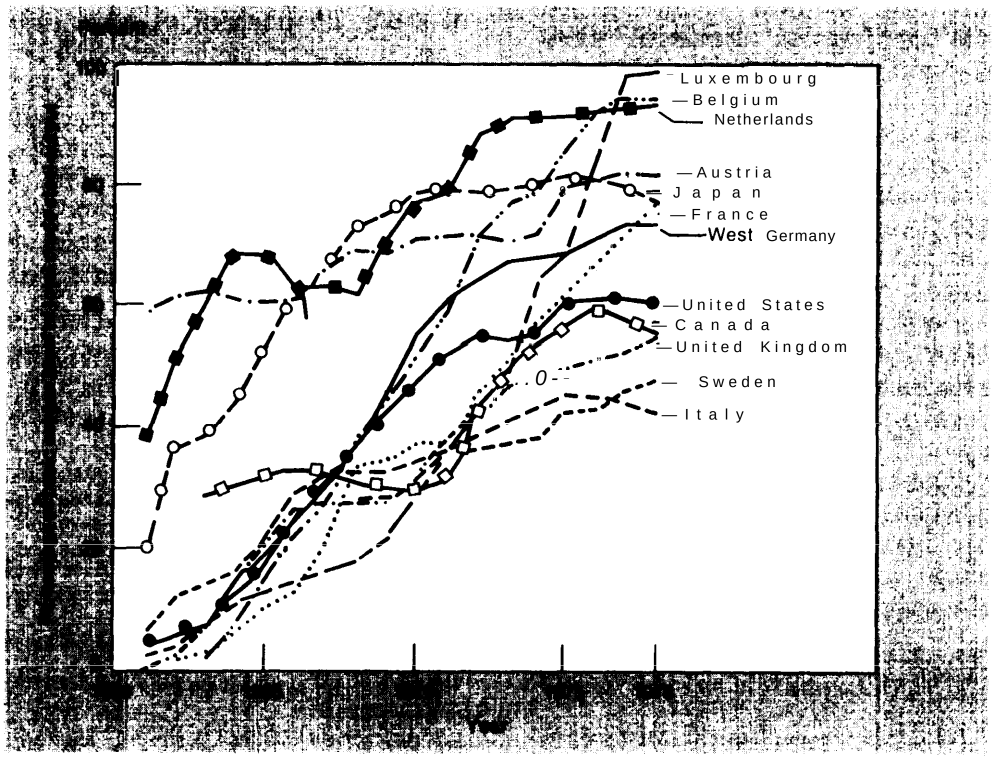
SOURCE: American Iron and Steel Institute, *The World Steel Industry Data Handbook, vol. 7.*

major producing nations in the adoption of certain high-performance steelmaking technologies. Basic oxygen steelmaking* was pioneered in Europe, and adopted faster in Europe and Japan than elsewhere from the late 1950's onwards (figure 13). All new U.S. steelmaking facilities built since 1957 have been either basic oxygen or electric furnaces, but the percentage of total steelmaking capacity that uses basic oxygen has not increased as rapidly as in some other countries because the U.S. industry was already so much larger than the others (see table 16). Japan, for example, which was not replacing old facilities but expanding its total industry, was able to advance its use of basic oxygen, as a percentage of all facilities, quicker and easier than was the United States.

Continuous casting did not achieve full commercial success, on a worldwide basis, until the late 1960's, and domestic steelmaker were involved in its development. Again, new steelmaking facilities built since about 1968 have incorporated continuous casters, but few previously existing ingot

*Basic oxygen steelmaking and continuous casting are discussed fully in ch. 9.

Figure 13.–The Diffusion of Oxygen Steelmaking, 12 Countries, 1961.78



SOURCES" Organ ization for Economic Cooperation and Development; International Iron and Steel Institute casting facilities have been replaced (figure 14). Also by the late 1960's, Japanese and West German rolling mill builders had outpaced domestic engineering design firms specializing in this field, and they have installed this new technology with its higher outputs.

The major innovations during the 1960's were productivity enhancing, so failure to construct plants incorporating any given higher output process cost the United States some of its competitive edge in world markets.[1] Clearly, expansion opportunities, timing of new investments, and the size and cost of new steel plants are among the most important factors affecting technological productivity and competitiveness.

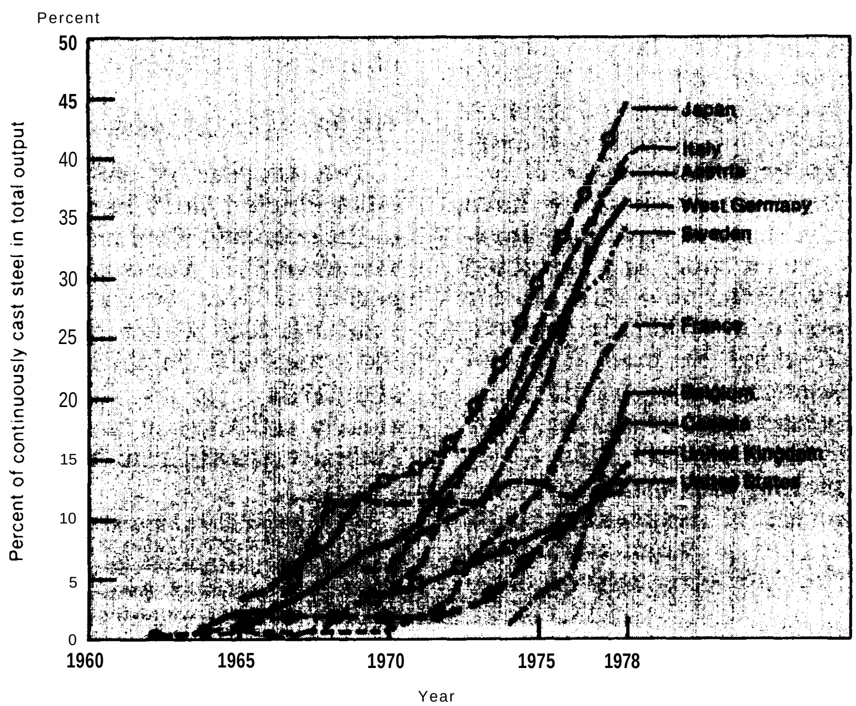
[1] Jonathan Aylen, "Innovation, Plant Size and Performance: A Comparison of the American, British and German Steel Industries," a paper presented at the Atlantic Economics Association Conference, Washington, D. C., Oct. 12, 1979, pp. 34.

Expansion Opportunities

Steel producers in industrialized nations have on several occasions benefited from periods of rapid demand growth, which have justified capacity expansion. The most recent domestic expansion period took place from 1960 to 1965, when production increased about 20 percent (see table 16). Nevertheless, U.S. steelmaking capacity increased only about 1 percent per year during the 1962-78 period. Domestic steelmaker have emphasized the removal of bottlenecks in existing plants. Such investments do not produce productivity gains as large as does construction of greenfield plants, but they also require less capital.

The most recent European expansion took place during a longer period than that in the United States, lasting from about 1956 to 1975. Japanese post-World War II steelmaking capacity was limited, and capacity in-

Figure 14.—The Diffusion of Continuous Casting, 10 Countries, 1962-78



SOURCE: Organization for Economic Cooperation and Development creased in subsequent years more than in any other major steel-producing country. During a 15-year timespan between 1962 and 1978, Japanese steelmaker added approximately 50-percent new steelmaking capacity.

In the early 1970's, foreign steel producers planned expansion programs for the decade to follow in such a way as to maintain rapid growth patterns. To a large extent, realizing these plans depended on offers of assistance by governments who shared their industries' desires to break into new markets. This optimism about expansion for the late 1970's, which no doubt stemmed from the 1973-74 steel shortages, was premature. Demand in 1975 fell below the peak demand of the shortage years, creating an overcapacity for production. The events of 1975 and thereafter seem to have daunted most expansion plans in steel-producing nations, including Japan, and the EEC and LDCs. Capital investments have declined since 1975, but generally increasing world steel demand has succeeded in broadening the export market for foreign steel-producing countries, and they expect to hold that market,

Japan's steel industry has been a prominent part of her postwar industrial development. Japan has recognized that the steel industry is critical to the manufacture of capital goods and is an important source of foreign exchange. Japanese steelmaker have benefited more than those in any other steel-producing nation from a rapid and sustained growth in capacity. Based on a strategy for building a large and internationally competitive industry, and aided by their financial structure[7] and economic philosophy, the Japanese have maintained and increased their large capital investment in steel mills. Many large greenfield plants, with excellent infrastructures and access to deep-water ports, have been constructed in Japan during the past 20 years. The infrastructure of these new plants is such that they can be "rounded out" on a cost-effective basis, thereby reducing average unit production costs after capacity increases. Furthermore, Japanese steelmaker with their newer facilities have not had to replace outdated equipment to the extent that U.S. and European producers have. As a result, Japanese investments in large, efficient facilities have more than offset comparatively significant cost increases for input factors.

Efforts in LDCs to attain economies of scale have contributed to the creation of steelmaking capacity in excess of current world demand. * South Korea in particular has an ambitious steel production program and low labor costs. The Central Intelligence Agency has estimated that steelmaking capacity in LDCs will total 112 million tonnes in 1985, as compared with 64 million tonnes in 1978.[8] UNIDO estimates that Brazil, Iran, Argentina, Venezuela, India, and South Korea will collectively contribute 54 million tonnes of additional steelmaking capacity between 1979 and 1985. Steel consumption in LDCs is expected to increase 6.5 percent per year and those industries should reach a capacity utilization level of 85 percent by 1985.

Timing of Investments in New Technology

The process of substituting capital for labor started much earlier and went further in the domestic steel industry than in Europe. The older U.S. plants were designed during a period of labor scarcity and, for that time, relatively high wages, and the industry's capital equipment was highly mechanized by the standards of its day. Now, however, its age is clearly reflected in the declining labor productivity growth rate of the U.S. steel indus-

[7]See Caves and Masu Uekusa, "Industrial Organization in Japan, " in Asia's New Giant, High Patrick and Henry Rosovsky, eds., The Brookings Institution, 1976; and Bank of Japan, Economic Research Department, The Japanese Financial System, July 1970.

*LDCs benefit from indigenous steel production. For example, the cost of importing steel products to LDCs is from 15 to 30 times greater than the revenues gained from the sale of iron ore, However, many of these countries will remain net importers of steel for the foreseeable future. (Ingo Walter, Trade and Structural Adjustment Aspects of the international Iron and Steel Industry: The Role of the Developing Countries, prepared for the U.N. Trade and Development Board, New York, 1978.)

'Central Intelligence Agency, "The Burgeoning LDC Steel Industry: More Problems for Major Producers, " 1979.

try. Without new investments in more productive steelmaking technologies, the domestic steel industry may lose its technological and cost competitiveness.

For the time being, domestic steel industry productivity may have reached a plateau, while some other major producing nations have a much higher rate of productivity growth, helped along by improved technology and enlarged plants. Newer plants, embodying newer techniques, are likely eventually to achieve higher output rates than older plants. As "learning" occurs, efficiency should increase at a faster rate with respect to time. Thus, it is expected that the newer foreign plants will have higher trend rates of productivity growth and ultimately achieve higher productivity levels, even though they may initially start up at lower levels of productivity than their more mature, long-commissioned U.S. rivals.[9]

Size and Cost of Steel Plants

Many U.S. steel plants have smaller capacities than foreign plants, particularly those in Japan (table 34). As of 1979, domestic basic oxygen furnaces had about 20 percent less capacity than those in the United Kingdom and about 25 percent less than those in West Germany, U.S. and West German blast furnaces are of similar capacity, while British furnaces average 5 percent more capacity. U.S. hot wide-strip mills have an average capacity about 25 percent more than British mills, but about 63 percent less than West German mills.[10] Japanese steel plants, on average, have more capacity at all stages of production than either domestic or European steel plants.

Domestic steel plants are generally smaller because they are older. Additional factors have also been thought to encourage small plant size, including high transportation costs, the lower capital intensity of the smaller scale, management policies, and labor relations practices associated with large plants. Because domestic producers, on average, operate smaller plants than some of their foreign counterparts, they are less able to realize economies of scale and have higher operating costs than they would with larger plants.[11]

In addition to differences in plant size, there are also marked differences among countries in median per tonne capital costs for plants. * This is largely because of differences in construction labor costs and construction efficiency. In 1976, domestic steelmaker had per tonne capital costs for equivalent technology that were about 44 percent higher than in Europe and as much as 41 percent higher than in Japan.[12] These capital cost differences are probably smaller today, but their pattern is similar to that of 1976. In

[9]Aylen, op. cit., pp. 17 and 21.

[10]Aylen, op. cit., table 1.
[11]Aylen, op. cit.
*Capital costs are discussed more fully inch. 10.
[12]Aylen, op. cit.

Table 34.—Integrated Steel Producers' Capacities in Selected World Areas, 1976

			Raw steel tonnes of capacity			
Area	Number of firms	Plants per firm	Approximate total	Average per firm	Average per plant	Average per plant among 10 largest
Canada	4	1.0	13.0	3.3	3.3	NA
United States	20	2.5	115.0	5.8	2.3	5.9
Japan	8	2.5	120.0	15.0	6.0	11.5
European Coal and Steel Community (six countries)	40a	1.8	135.0	3.1	1.8	6.4

aEstimated
NOTE All numbers are approximate

SOURCES Average for 10 largest plants–H G Mueller, "Structural Change in the International Steel Market, " 1978, all other data—D F Barnett, 'The Canadian Steel Industry in a Competitive World Environ merit," Canadian Government. 1977 contrast to the U.S. capital cost disadvantage, the domestic steel industry has an energy cost advantage—albeit a slowly eroding one—because it is able to use domestic coal.

In conclusion, domestic steelmaker have had less incentive than their international competitors to adopt new technologies to replace open hearth steelmaking, dated-technology blast furnaces, and conventional casting facilities.[13] High capital costs have encouraged the substitution of other factors of production for capital improvements. But with ever-increasing energy and raw materials costs and a rate of productivity improvement insufficient to offset rising employment costs, domestic steel companies cannot expect aging equipment to remain profitable. Investing in new, more efficient, though more expensive equipment may be justified if the new equipment entails sufficiently lower production costs.

Comparative Production Cost Data

Available steel production cost data suffer from two major shortcomings: lack of access to specific confidential industry data and noncomparability among sources. Thus, studies differ in industry cost performance data for similar industry segments and time frames. Even if total cost figures per tonne of steel for materials, labor, and capital are roughly similar, it is not uncommon to find a different breakdown for these inputs in the various studies. The most extensive steel production cost estimates are those prepared by the World Steel Dynamics (WSD) organization.[14] However, that model is based on larger economies of scale for integrated plants than may exist in reality, particularly for U.S. plants. * Thus, total factor productivity may be overestimated somewhat using the WSD data.

In addition to the WSD study, comprehensive steelmaking cost analyses have been made by FTC, the American Iron and Steel Institute (AISI), Mueller and Kawahito, and Thorn.[15] FTC, Thorn, and Mueller and Kawahito took similar approaches by relying on aggregate confidential cost data and/or information supplied by foreign government agencies concerned with steel industries. Only the WSD data are based on models of large integrated plants producing a mix of carbon steel products. The WSD simulation model compares costs in major producing countries (United States, Japan, West Germany, United Kingdom, and France), going back as far as 1969 and projected to 1984.

Available cost studies may differ with respect to both total steelmaking costs and input factors. For instance, the WSD 1974, 1975, and 1976 Japanese cost estimates are higher by 7.6 percent, 10.4 percent, and 13.6 percent, respectively, than those presented by AISI. The WSD data do not include transportation costs, and the same appears to be the case for the AISI data. The AISI estimates also do not include marketing costs, but the WSD data do appear to include them. Both sources deal with average costs for carbon commodity steels only.

The WSD and Thorn data differ in input costs. In comparing 1973 Japanese cost data to those of the United States, the two sources show an almost opposite condition for material and capital costs. There is an even greater dissimilarity between the 1973 West German/U.S. comparisons by WSD and Thorn than between their Japanese/U.S. cost comparisons. The WSD data show an $1 l/tonne West German disadvantage relative to U.S. producers, and the Thorn data show a $33/tonne advantage. Of the major inputs,

[13] Aylen, op. cit.

[14] World Steel Dynamics, Core Report J, September 1979.

*The WSD U.S. and European cost data are associated with a 3-million- to 4-million-tonne/yr integrated plant and the Japanese data are based on a 5-million- to 6-million-tonne/yr integrated plant.

[15] U.S. Federal Trade Commission, ''U.S. Steel Industry and Its International Rivals,'' November 1977; American Iron and Steel institute, "Economics of International Steel Trade," 1977; Hans Mueller and K. Kawahito, "The international Steel Trade Market: Present Crisis and Outlook for the 1980's,"' conference paper No. 46, Middle Tennessee State University, May 1979: and R. S. Thorn, "Changes in the international Cost competitiveness of American Steel, 1966 -197 S," working paper No. 8, University of Pittsburgh, February 1975.

employment and capital costs contribute most to the discrepancies.

Sets of U.S./Japanese data by WSD, FTC, and Mueller and Kawahito for 1976 also illustrate the limitations of developing comparable steelmaking cost estimates. For the United States, WSD shows the lowest total cost estimates, followed by Mueller and Kawahito, and FTC. The Mueller and Kawahito energy cost estimates are about 25 percent lower than those in the other two sources. And finally, WSD shows a different energy-iron cost balance than do the other two sources (table 35).

The methodologies of the various studies differ in several other respects, as well. The WSD data exclude electric furnace production. Thus, scrap costs tend to be underestimated and energy costs overestimated. 'G The FTC and WSD data are based on market prices for raw materials, while Mueller and Kawahito incorporate company-owned materials prices. Less verifiable differences in the studies include possible differences in industry definitions and adjustments for product mix.

The following discussion is in many instances based on WSD cost data. * It should be kept in mind that the WSD total U.S. cost data appear to be underestimated relative to that of other countries—perhaps by as much as 5 to 10 percent in the cases of Western Europe and Japan, respectively. '

[16]George R. St. Pierre, "Impacts of New Technologies and Energy/Raw Materials Changes on the U.S. Steel industry, " Office of Technology Assessment, contractor report, 1979.

*Transportation costs are not included in the discussion in this section. Unless otherwise noted, all references in this section are to U.S. dollars at actual operating rates.

Labor Costs

A significant portion of the cost of producing steel is labor cost. This cost can rise as a result of increases in hourly wage rates and fall as a result of increases in labor productivity.

Declining Employment and Increased Skill Requirements

Domestic steel industry employment has declined by 21.4 percent during the past two decades, from about 550,000 employees in 1960 to about 450,000 in 1978.** From 1962 to 1966, employment levels rose slowly, about 1 percent annually. Since that time, however,

*This conclusion is based on findings such as:

- The Council on Wage and Price Stability found that 1972-77 WSD U.S. cost data were between 1 and 6 percent lower than comparable industry data (Council on Wage and Price Stability, "Prices and Costs in the United States Steel Industry, " 1977, p. 25):
- WSD Japanese 1974-76 cost estimates were between 7 and 13 percent higher than comparable AISI estimates: and
- WSD has lower 1976 U.S. cost estimates than either Mueller and Kawahito or FTC, even though WSD, unlike Mueller and Kawahito, uses higher market prices for raw materials.

**Based on AISI data. Steel industry employment data are typically about 22 percent lower than U.S. Department of Labor, Bureau of Labor Statistics, data. Unlike BLS, AISI does not include smaller establishments primarily engaged in the finishing of purchased iron and steel.

Table 35.—Estimates of U.S. and Japanese Steel making Costs, 1976 (dollars per tonne)

Study	Country	Iron ore and scrap	Input costs: Energy	Input costs: Labor	Total[a]
FTC.	United States	$72.97	$92.80	$157.85	$323.62
	Japan	54.57	68.40	57.98	180.95
WSD	United States	71.84	94.89	115.84	282.57
	Japan	33.51	88.14	59.37	181.03
Mueller.	United States	63.10	71.10	155.54	289.74
	Japan	52.92	73.64	61.16	187.73

[a]Totals exclude miscellaneous materials and supplies, and capital costs.

SOURCES U S Federal Trade Commision,'U.S. Steel Industry and Its International Rivals,'November 1977, World Steel Dynamics, Core Report J. 1979, H Mueller and K. Kawahito, "The International Steel Market' Present Crisis and Outlook for the 1980' s," Middle Tennessee State University, conference paper No 46, 1979 steel industry employment has dropped steadily, by an average of almost 2 percent per year (table 36). U.S. Bureau of Labor Statistics (BLS) projections for 1985 indicate that steel employment is expected to continue its downward trend, but with a somewhat lower rate of decline—about 0.5 percent annually. [17]

Declining steel industry employment may be attributed to a number of factors, including growing steel import penetration, increased labor productivity, and product substitution. With the exception of France, steel industry employment in other major producer countries also has decreased to varying degrees, beginning at least in the 1960' s.* The U.S. decline has been greater than that generally experienced abroad.

Steel industry job content and occupational requirements also have changed considerably in recent years. These changes, brought about mainly by new technologies, are reflected in the relative employment levels of production and nonproduction workers. The number of production workers employed in steel hit a peak in 1965 and since then has declined steadily; nonproduction worker employment increased continuously from 1964 to 1970 and then dropped sharply. From 1966 until 1978, production worker employment declined almost twice as fast as did nonproduction worker employment. For the entire 1960-78 period, employment of production and nonproduction workers fell, on average, 1.36 and 0,58 percent per year, respectively (see table 36).

Among production workers, craft and related workers have remained about the same in number over the past two decades, and skilled workers have increased relative to operators and laborers, whose part in the production process has been slowly diminishing. The increasingly complex machinery and instruments used in steelmaking require craft and maintenance workers who are more highly skilled and trained than those required

[17] BLS Bulletin No. 1856, footnote 22,

* 1978 West Germany: 205,000 employees, down by 4.5 percent since 1960: 1978 France: 135,800 employees, up by 3.12 percent since 1960; 1978 England: 170,000 employees, down by 14.01 percent since 1974; 1978 Japan: 302,487 employees, down by 5.48 percent since 1965. (U. S. Department of Labor, unpublished data.)

Table 36.—U.S. Steel Industry Employment, Productivity, and Compensation, 1960-78

Year	Average number of employees: Total	Product ion	Non production	Output per employee-hour (annual rate of change)	Compensation per employee-hour (annual rate of change): Actual	Inflation adjusted
1960	571,552	449,888	121,664	-5.2	1.1	–0.1
1961	523,305	405,924	117,381	2.6	3.3	2.5
1962	520,538	402,662	117,876	4.3	3.2	2.6
1963	520,289	405,536	114,753	4.0	1.7	0.6
1964	553,555	434,654	118,901	4.0	0.6	– 0.7
1965	583,851	458,539	125,312	3.9	1.4	– 0.1
1966	575,457	446,712	128,835		3.5	0.8
1967	555,193	424,153	130,990	- 3'2'	3.1	0.4
1968	551,557	420,684	130,873	3.5	4.7	0.5
1969	554,019	415,301	128,718	1.5	7.9	2.1
1970	531,196	403,115	128,081	-2.7	5.4	– 1.1
1971	487,269	403,115	120,287	4.9	10.6	4.5
1972	478,368	364,074	114,294	6.5	16.3	9.6
1973 , ...	508,614	392,851	115,763	10.8	13.8	3.6
1974	512,395	393,212	119,183	0	22.6	3.5
1975	457,162	339,945	117,217	-15.9	28.3	7.3
1976	454,128	339,021	115,107	6.9	19.5	4.4
1977	452,388	337,396	114,992	1.1	18.0	1.7
1978	449,197	339,155	110,042	5.1	30.0	5.8
Average rate of change 1960-78				1.90	10.82	2.62

SOURCES: 1%0-77-American Iron and Steel Institute. Annual Statistical Reports 1969; 1978—Department of Labor, Bureau of Statistics, Steel SIC 331, May 1979, unit labor costs, October 1979 (unpublished) for simpler equipment. However, complexity does not necessarily increase the number of workers required, For instance, the more advanced oxygen furnace takes one-fifth as much labor to process heat as is required by the open hearth process.

The proportion of nonproduction (white collar) workers in steel employment also has increased somewhat since 1960, Nonproduction workers now make up nearly 25 percent of the entire steel industry work force. In general, the need for technically trained personnel is growing as more advanced instrumentation, computer controls, and pollution control devices come into use. These personnel include control engineers, programmers, laboratory testers, and R&D specialists, The number of managerial, administrative, and sales personnel also has increased substantially during the past decade.

Productivity

Labor is only one of several input factors of production. Labor productivity, measured by employee hours required to produce a tonne of steel, reflects the joint effects of many influences, including new technology, capital investment, capacity utilization, energy use, managerial skills, and the skills and efforts of the work force. When operating rates are low, labor productivity measures understate the technological capability of steelmaking equipment. Nevertheless, labor productivity at actual operating rates is a reasonable approximation of the technological competitiveness of the domestic steel industry on the international market.

Both BLS and WSD have developed data on international steel labor productivity. * It appears that BLS slightly underestimates U.S. steel industry labor productivity relative to that of foreign steel industries, while Marcus slightly overestimates U.S. productivity levels, The BLS unpublished steel productivity series are based on a 1967 product mix and have not incorporated the U.S. shift toward producing more lightweight and specialty steels since that time. The Marcus data assume larger economies of scale than exist in reality, particularly in the United States.

The domestic steel industry frequently is singled out for its low productivity improvement rate (see table 36), which has been well below that of other U.S. industries since at least the late 1940's. As overall industrial labor productivity and capital investment have declined since the mid-1960's, the gap between steel industry labor productivity improvement rates and those of other industries has narrowed somewhat. During the 1965-70 period, productivity growth rates for manufacturing and for the total private economy both slipped to 2 percent, but that for steel fell more sharply, averaging a minimal 0.2 percent annually. In 1971, when wages began increasing substantially productivity also moved upward. From 1971 to 1978 the average annual increase was 2.4 percent. Benefiting from high operating rates in 1978, U.S. steel labor productivity improved 5 percent.

The wide gap between U.S. and Japanese steel industry productivity improvement rates is of particular significance. During the past two decades, Japanese steelmaking labor productivity has improved faster than that in the United States, and it appears that their productivity level exceeded that of the domestic steel industry for the first time in about 1973. * According to WSD data for integrated plants, U.S. steel labor productivity growth since the early 1960's has been only about half that of the Japanese, although it is still double the West German rate. BLS data, which appear to be valid, show sizable labor productivity improvements for West Germany, as well as Japan, relative to domestic steelmaking (see table 37). The favorable labor productivity improvement rates for Japan and West Germany have substantially reduced or eliminated the output-per-employee-

*International comparisons are difficult because of the different use of contract labor, level of fixed annual employment, level of capacity use, and product mix.

*BLS data suggest that Japanese steel labor productivity levels exceeded domestic levels in 1973. WSD data indicate that this would not occur until 1984. The 1977 FTC report accepts the BLS findings.

Table 37.—Labor Productivity at Actual operating Rates, Selected Countries, 1969-84
(employee hours required per tonne of carbon steel shipped)

Year	United States	Japan	West Germany	United Kingdom	France
1969	10.53	14.69	12.76	22.73	19.38
1970	10.39	13.67	13.85	21.49	18.03
1971	10.50	13.75	15.05	23.60	18.06
1972	9.76	12.82	12.76	22.82	16.62
1973	9.25	10.13	11.59	20.06	16.20
1974	9.16	9.60	10.82	21.99	15.51
1975	9.57	10.29	12.90	25.62	17.79
1976	9.08	9.91	12.48	21.47	16.27
1977	9.34	10.01	12.88	23.74	15.41
1978	8.63	9.79	11.82	23.21	14.12
1979	8.56	9.20	—	—	—
1980a	8.37	8.54	—	—	—
1985a	7.19	6.48	—	—	—
Average annual change 1969-79	–1.8770	–3.7370	–0.90%	0.23%	–3.010/o

[a]Estimate

SOURCE World Steel Dynamics, Core Report J,1979.

hour advantage long held by U.S. steel producers.

This shift in the U.S./Japanese labor productivity relationship may be attributed in part to continuing U.S. dependence on relatively small, old, and poorly laid-out plants. Such plants do not use labor efficiently.[18] Furthermore, expansion of existing plants (typical among domestic steelmakers) offers lower productivity growth potential than does new plant construction. Relatively old facilities cannot handle the higher workload that a new facility in the same plant can. Thus, bottlenecks develop. Labor-management attitudes about productivity improvement and employment security also can affect growth rates. For instance, occasional delays in setting incentive rates can constrain potential productivity improvements associated with the use of new equipment.

Wages and Unit Labor Costs

Both here and abroad, steel industry wages are often higher than the all-manufacturing average.[19] In the United States, the gap between steel industry and manufacturing industry average wages narrowed during the late 1960's in response to increased import competition and reduced profitability in the steel industry; but in the 1970's and particularly since 1974, the lead held by steel industry wages again increased significantly.[20] Hourly earnings in 1977 in the steel industry were estimated to be 55 percent higher than the all-manufacturing average.[21] U.S. hourly employment costs in the steel industry have increased by 10 to 15 percent since 1960, with higher than average increases during recent years.* The 1979 total yearly increase in steel industry wages appears to have been about 11 percent. [22]

Employment cost data for companies in the three segments of the domestic industry are given in table 38. There is clearly a large employment cost difference among integrated producers, generally about a $55/tonne difference between the high and low labor cost companies. (The very low value for the McLouth Co. is related to its 100-percent use

[18]Aylen, op. cit., p. 17.

[19]Employees of the major Japanese steel companies receive about 33 percent more in wages than the average for all industrial companies in Japan (WSD, p. J-1-14, 1979).

[20]The substantial increases in the 1974 steel labor settlements were granted in exchange for the union's support of the Experimental Negotiating Agreement (ENA). This agreement was negotiated in an environment of declining U.S. imports, booming demand for U.S. steel products, and sharply escalating world steel prices. In such a situation, management was eager to avoid disruption of production. Cost of living clauses are a part of the Agreement. (Council on Wage and Price Stability, "Prices and Costs in the U.S. Steel Industry," 1977.)

*'Ibid.

*AISI data show a 15-percent annual increase since 1960. BLS data show a 10-percent annual increase since 1960.

"Bradford, op. cit., p. 14.

Table 38.—Employment Costs for Domestic Steel Companies, 1978

Company	Net income as a percent of investment	Employment costs as a percent of sales	Employment costs dollars per tonne shipped	Capacity utilization (percent)
Integrated				
U.S. Steel Corp.	5.3	40.6	$238	76.1
Bethlehem Steel. .,	9.3	41.2	214	84.8
National,	8.2	30.2	152	82.4
Inland.	9.7	**30.0**	**172**	**95.0**
Wheeling-Pittsburgh	6.3	36.5	160	92.4
Kaiser	1.6	49.4	243	65.2
McLouth	5.2	25.0	116	79.3
CF&l.	6.6	44.7	214	82.2
Interlake	3.7	33.1	386	82.0
Republic [a].,	10.4	33.8	180	76.3
Armco [a]	10.4	28.3	226	81.6
Nonintegrated				
Northwestern	13.9	34.2	117	65.5
Nucor.	25.0	18.7	51	96.0
Florida.	13.8	19.7	58	73.5
Keystone.	2.3	42.4	306	90.8
Lacledo.	9.4	39.8	177	91.9
Atlantic ...,	9.6	28.3	114	78.0
Alloy/specialty				
Sharon.	15.3	26.3	122	90.5
Cyclops	10.3	29.4	258	87.1
Allegheny-Ludlum	8.5	33.3	619	73.5
Cooperweld.	8.4	32.3	385	82.6
Washington	11.6	22.1	497	66.0
CarpenterTechnology.	16.9	32.6	NA	NA
Likens	9.6	41.4	NA	81,9

NA = not available
aBoth of these flrms make substantial amountsofalloy/specialty steels.

SOURCES Income. employment. and production data from *Iron Age,* May 1979; capaclty data from International Iron and Steel institute Commentary, January-February 1979, data for Nucor from company

of continuous casting.) A considerable spread in employment costs also exists among the nonintegrated steelmaker and, as might be expected because of major product differences, among the alloy/specialty steelmaker. The nonintegrated producers have a lower employment cost than the integrated steelmaker, an average of $144 versus $210, respectively, per tonne of steel shipped.* Although a relationship between profitability and employment costs might be expected, none is found. For the integrated producers, there is also no relationship between employment costs and capacity utilization, although there is a strong correlation (a coefficient of 0.772) between profitability and capacity utilization.

‘The nonintegrated segment of the steel industry generally does not have contracts with the United Steelworkers of America. Their labor costs are reported to be about one-third less than for unionized companies.

A major reason for the rise in labor costs per tonne of steel is that wage increases have only to a small degree been offset by labor productivity gains or other efficiency improvements in total unit production costs. In the U.S. steel industry, real and nominal compensation increased annually between 1.5 and 5.5 times faster, respectively, than labor productivity (table **36).** Foreign steel industry unit labor costs increased at an even faster rate than in the domestic industry during the 1969-78 period because of currency changes and because of wage increases that exceeded those in the United States. *

From 1969 to 1978, West German and Japanese employment costs increased 345 and 299 percent, respectively, compared with 117 percent in the United States (table 39). Never-

*Foreign producers, particularly the British and French, probably also experienced labor productivity y gains insufficient to offset increased hourly employment costs.

Table 39.—Carbon Steel Production Costs, Five Countries, 1969 and 1978

Country and year	Total Dollars/ tonne	Employment Dollars/ tonne	Employment Percent	Financial Dollars/ tonne	Financial Percent	Materials Dollars/ tonne	Materials Percent
United States							
1969	$169.39	$ 48.33	34.43%	$ 17.46	10.30%	$ 93.60	55.25%
1978	395.65	127.18	32.11	30.91	7.81	237.66	60.06
Percent change, 1969-78	133.57	117.86		77.03		153.91	
Japan							
1969	$124.95	$ 25.41	20.41	$ 18.93	15.21	$ 80.11	64.37
1978	410.51	101.60	24.74	81.87	19.94	227.03	55.30
Percent change 1969-78	229.85	229.84		332.48		183.39	
West Germany							
1969	$126.48	$ 30.10	23.79	$ 21.37	16.89	$ 75.01	59.30
1978	438.12	134.23	30.63	60.02	13.09	243.87	55.66
Percent change, 1969-78	246.38	245.94		180.86		225.11	
United Kingdom							
1969	$146.37	$ 37.87	25.87	$ 21.42	14.63	$ 87.09	59.49
1978	460.64	135.28	29.36	58.36	12.66	267.00	57.96
Percent change, 1969-78	214.70	257.22		172.45		206.57	
France							
1969	$152.22	$ 42.45	27.88	$ 25.86	16.98	$ 83.91	55.12
1978	456.33	143.10	31.35	71.77	15.72	241.47	52.92
Percent change, 1969-78	199.78	237.10		177.53		187.77	

SOURCE World Steel Dynamics,Core Report J. 1979

theless, in 1978, U.S. hourly costs were still 30 percent higher than West German costs and 40 percent higher than Japanese costs (table 40), but it can be seen that annual employment cost increases in local currencies were much lower than in dollars. Thus, the rapid foreign labor cost increases of the past decade have not yet eliminated the unit cost advantage held by foreign steelmaker (see table 27). 0nly 1978 was unexceptional year, with relatively low U.S. unit labor costs because of very favorable operating rates.

Raw Materials and Energy

Key raw materials for steelmaking are: iron ore, scrap, coal and other sources of energy, limestone and other fluxes, alloy additives, refractories, and oxygen. Raw materials comprise more than half of all input costs for steelmaking (table 39). During the past decade, the cost per tonne of raw materials for domestic steel has increased by 5 percent annually and now represents 60 percent of all input costs.

Within the materials component, direct energy costs have risen most (275 percent) and now account for almost 40 percent of raw materials costs (table 41) or 24 percent of total steelmaking costs for integrated operations. About two-thirds of the energy used to make steel from ore comes from coal. Of the major producing countries, Japan has made

Table 40.—Steel Industry Hourly Employment Costs, Five Countries, 1969 and 1978

Country	1969 Dollars	1969 Local currencies	1978 Dollars	1978 Local currencies	Average annual percent increase Dollars	Average annual percent increase Local currencies
United States	$5.54	$5.54	$14.73	$14.73	18.43%	18.43%
Japan	1.73	625.00 yen	10.42	2,169.00 yen	55.81	27.44
West Germany	2.36	9.25 DM	11.34	22.73 DM	42.27	16.19
United Kingdom	1.66	LO.70	5.83	L3.04	27.91	33.71
France	2.18	fr11.32	10.09	fr45.44	40.31	33.49

SOURCE World Steel Dynamlcs, Core Report J. September 1979

Table 41 .—Unit Costs for Inputs, United States and Japan, 1956-76 (dollars per tonne of steel produced)

Year	Total		Iron ore		Scrap		Coking coal	
	United States	Japan	United States	Japan	'United States	Japan	United States	Japan
1956 ......, ., ...	$110.84	$119.83	$17.51	$25.78		$35.15	$12.15	$20.01
1957, ...	110.00	133.21	18.17	31.55	10.95	37.98	12.73	23.03
1958, ...	122.18	98.65	19.75	21.20	9.94	19.37	13.09	16.75
1959	113.98	90.04	17.25	18.08	10.87	24.59	10.93	13.03
1960 ....., ...	120.18	85,08	19.47	17.91	8.24	23.16	11.48	11.50
1961	122.50	91.59	20.58	18.54	9.45	30.09	10.21	11.85
1962	118.74	81.56	19.93	18.97	6.83	17,43	10.17	12.33
1963	116,01	79,03	19.60	17.80	7.39	18.12	9.16	10.99
1964	114.97	75.20	20.41	16.73	8.25	19.27	9.74	10.05
1965..	112.99	76.38	19,92	18.63	9.56	16.75	9.78	10.94
1966, ...	113.21	71.86	19.95	18.14	7.72	14.88	9.99	10.84
1967	117.70	69.53	20.10	16.68	6.73	15.73	10.83	10.27
1968	119.40	67.78	20.65	16.99	6,71	12.16	10.69	10,91
1969 . . ., ..., ..,...,,	125.25	69.93	20.34	16.66	8.60	14.00	10.29	11.72
1970 . ., ., ., ...,.,.,	137.23	78.05	21.54	17.47	10.05	16.05	12.80	14.65
1971	145.98	81.28	22.85	19.43	8,53	9.06	15.15	16.76
1972, ...,..,.	155.11	83.56	23.84	16.97	11.26	12.04	16.08	14.65
1973	161.21	100.97	24.42	17.62	17.08	23,38	17,44	15.18
1974	215.55	147.30	29.66	21.65	34.10	33.65	29.20	29.84
1975	270.27	159.26	37.58	27.85	18.98	17.23	52.40	43.18
1976 ......, ...	294.65	161.93	44.51	26.87	21.82	22.72	53.73	41.38

Year	Fuel oil		Electric power		Noncoking coal		Natural gas
	United States	Japan	United States	Japan	United States	Japan	United States
1956 ....,	$2.26	$2.85	$4.15	$6.07	$0.74	$3.31	$1.58
1957	1,97	4.27	3.73	6.29	0.75	3.31	1.46
1958, .,.,...	1.99	2.54	3.96	6.72	1.07	1.94	2.28
1959 ..,...,..	1.78	2.09	3.47	6.61	0.80	0.61	2.19
1960 . . ,	1.80	2.30	3.92	6.44	0.85	0.75	2.59
1961 ., ...	1.74	2.04	4.27	6.50	0.89	0.63	2.99
1962	1.59	1.92	4.71	6.28	0.83	0.54	3.29
1963	1.58	2.04	4.73	5.87	0.73	0.45	3.19
1964	1,41	1,92	4.48	5.88	0.63	0.37	3.01
1965., . .	1.28	1.93	4.64	5.70	0.63	0.31	3.09
1966	1.14	1.75	4.90	5.33	0.63	0.24	2.93
1967	1,05	1,87	5.30	4.92	0.63	0.13	3.16
1968, ...	1.09	1.74	5.74	5.02	0.61	0.10	3.56
1969	0.94	1.44	5.83	4.80	0.51	0.10	3.54
1970 ......,	1,23	1,81	6.49	4.74	0.56	0.11	3.74
1971 .	1.54	2.73	7.70	5.31	0.62	0.00	4.55
1972 ..,...,..	1.60	2.47	7.60	5.45	0.54	0.00	4.64
1973 .,. . .	1.91	3.43	8.09	6.04	0.54	0,00	4.40
1974	5.02	9.01	10.21	10.54	0.76	0.00	5.67
1975. . .	4.95	8.66	14.03	12.41	0.85	0.00	8.60
1976	5.05	6.84	15.84	14.47	0.85	0.00	9.31

SOURCE US Federal Trade Commission Staff Report on the United States Steel industry and its Internatlonal Rivals," 1977.p 113

the greatest improvements in energy-efficient steelmaking. Coke rates in Japan are presently 25 percent more efficient than those in the United States'[1] (table 42)

The cost of iron ore and scrap metal went up by about 120 percent during the past decade and is now 26 percent of raw materials costs, according to WSD.[24] Ore costs, since 1974, have been pushed up at an annual rate of nearly 10 percent as a result of large increases in energy and labor costs in mining, a decline in the quality of ore obtained, and

[1]In Japan the average coke rate is now about 420 kg/tonne of pig iron, with only about 40 liters of oil injected. In the United States, the coke rate was 585 kg'tonne last year, with only slightly less oil used. Only the Bethlehem Steel "L" blast furnace at Sparrows Point has achieved a coke rate similar to that in Japan. (Bradford, op. cit., p. 17.)

*WSD,op.cit.,p.J-l-49,

Table 42.–Coke Consumption per Tonne of Pig Iron Produced, 11 Countries, Selected Years, 1958-78
(kilograms/tonne)

Year	West Germany	France	Italy	The Nether-lands	Belgium	Luxem-bourg	United Kingdom	Japan	United States	Canada	Sweden
1958	922	1,023	750	839	890	1,100	880	667	780	—	675
1960	834	980	680	787	852	1,092	820	619	720	—	650
1965	672	780	633	559	658	860	680	507	650	585	555
1970	559	629	524	484	586	730	610	478	636	544	545
1971	521	595	526	475	569	683	604	451	629	495	550
1972	487	563	509	456	559	645	590	442	610	486	540
1973	494	558	518	475	557	601	576	432	599	486	550
1974	517	551	500	465	564	538	597	442	608	484	—
1975	497	531	479	467	545	525	609	443	610	491	
1976	482	—	—	—	—	—	—	432	592	475	—
1977	484	—	—	—	—	—	—	434	595	451	
1978	486	—	—	—	—	—	—	429	597	432	

SOURCES: Statistical Office of the European Community, *Iron and Steel Yearbook,* 1976, for the six original EEC countries for all years and the United Kingdom for 1973-75; data for United States and Canada, for 1958-70 forward, were calculated from data available in various issues of the *Annual Statistical Report* of the American Iron and Steel Institute; for Japan, Japan Iron and Steel Federation, Tekko *Tokei Yoran,* various issues; Bo Carlsson, "Scale and Performance of Blast Furnaces in Five Countries—A Study of Best Practice Technology," Stockholm mimeo, March 1975; Statistiches Bundesamt, West Germany, U.S. Bureau of Mines

sharply higher costs for ore-processing capital equipment. Increased steel demand and limited coking capacity encouraged producers during the 1970's to substitute scrap for virgin metallics. Following the elimination of general price controls in 1974, scrap prices increased rapidly as domestic producers competed with potential foreign scrap buyers in a strong worldwide market. [25]

During the past decade, the United States was the only major steel-producing country in which raw materials price increases exceeded the average increase in total production costs. As a result, it was also the only major producing country where raw materials costs became a larger proportion, by 5 percentage points between 1969 and 1978, of total production costs. In other countries, raw materials became a smaller element of production costs by 2 to 9 percent (see table 39). It is noteworthy that the materials cost differential between the United States and Japan widened sharply from 1975 to 1977, when very large increases in the costs of coking coal and iron ore were recorded.

Capital **Investment and Financing Costs**

A number of factors influence steel industry investment decisions; some are quantifiable and others more speculative. Market size and rates of growth; the relative costs of capital, labor, and fuel; the absolute cost of capital; and Government taxation and subsidy policies all influence the potential profitability of investment projects. Other factors, such as attitudes towards risk, time horizons, and time preferences, also influence investment in less conspicuous ways.

There are considerable differences between the capital-attracting abilities of the U.S. steel industry and foreign industries. Domestic steel companies rely heavily on internal sources, namely aftertax profits, for investment funds and can only attract outside capital if they are reasonably profitable. Foreign companies, often with the assistance of their governments, have easier access to external capital sources.

The U.S. industry's aftertax profits depend in part on the depreciation rate the Internal Revenue Service (IRS) allows on capital expenditures. The faster capital assets can be depreciated, the greater the deduction from the gross profits, the lower the tax burden, and hence the higher the level of aftertax profits. The IRS has, for many years, required that capital investment in steel be depreciated over 18 or more years, although most other U.S. industries are allowed to write off their capital investments much faster, e.g.,

[25]Council on wage arid Price Stability, op. cit.

plastics in 9 years and aerospace in 7 years. By comparison, the Canadian steel industry is able to write off capital investments in 3 years. This puts the U.S. industry at a disadvantage in attracting capital on the basis of profitability.

During the 1970's, real capital spending by the U.S. steel industry was 20 percent lower than during the preceding decade (table 25). * On a per tonne basis, U.S. capital expenditures also lagged behind that of foreign producers. From 1972 to 1977, domestic steel industry capital spending was, according to industry estimates, about 73 and 79 percent, respectively, of Japanese and West German steel industry investment levels (table 43).

Table 43.—Capital Expenditures per Net Tonne of Raw Steel Production, Five Countries, 1972-77 (dollars)

Country	Expenditures
United States	$19
Japan	26
West Germany	24
United Kingdom	35
France (1972-76)	28

SOURCE International Iron and Steel Institute

The reliance of the U.S. steel industry on internal financing does leave it with a lower financial cost burden than some foreign industries have. As a percentage of total production costs, the U.S. industry's direct financial costs were about 9 percent during most of the decade. In Europe, they hovered between 13 and 17 percent of total production costs. Japan had a higher financial cost component than any of its international competitors, at 20 percent of total production costs. It was the only major producing country with faster rates of increase in financial costs than either employment or raw material costs (see table 38). These higher Japanese financial costs are the result of higher debt-equity ratios and higher investment levels than are found elsewhere.

*Required environmental capital expenditures (10 to 16 percent of total U.S. steel industry capital investment during the past few years) have had a downward effect on the productivity-improving potential of new capital investment. Other major producing nations have had similar experiences.

Though financial expenditures are generally a low fraction of direct production costs, the capital expenditures they represent have important effects on improving equipment, labor, and energy productivity. Improved total productivity plays an important role in determining total steel production costs per tonne of output. Thus, though financial costs may directly increase total costs, they may indirectly reduce unit costs, so their influence is much greater than their share of total production costs would indicate.

Macroeconomic Changes

Two major external factors influence steel industry production costs considerably—changes in operating rates and changes in currency values. Operating rates tend to change cyclically, but often currency values change abruptly. Both are strongly affected by general economic conditions such as GNP growth rates and inflation.

Operating Rates.— High operating rates increase the efficiency of steelmaking equipment with respect to raw materials and labor, particularly in integrated plants. U.S. steelmaker have enjoyed higher capacity utilization rates than their international competitors during recent years. During 6 of the past 10 years, U.S. operating rates were more than 85 percent—a high level.[26] Depressed operating rates for integrated plants have been a severe handicap for Japanese and other foreign producers, whose operating rates have been below U.S. levels for 7 of the past 10 years.[27]

Even at comparable operating rates, domestic producers have one advantage not enjoyed by most foreign producers—that is, more flexibility in employment levels. European unit labor costs increase significantly during periods of low demand because of their industries' limited ability to lay off

[26]WSD, op. cit.

[27]Ibid. For example, in 1977 when the Japanese rate was 69 percent and the U.S. rate 78 percent, U.S. production costs were 12 percent greater than the Japanese; but in 1978, with the Japanese rate at 66 percent and the U.S. rate at 86 percent, U.S. costs were 3 percent less than the Japanese.

workers during those times. * The Japanese steel industry is relying more and more on contractors. However, the Japanese lifetime employment system does have an upward effect on unit labor costs at low operating rates because of the difficulty of laying off workers during a slowdown.

Currency Values.—Recent dollar devaluations have had a favorable effect on the international competitiveness of the domestic steel industry. Monetary changes have made most foreign steel production costs more expensive than domestic costs. For instance, during the past decade, U.S. steelmaking costs increased at a higher rate than Japanese and West German costs in home currencies, but at a much lower rate in dollars (table 44).

*The European disadvantage has been offset somewhat during the past few years because of government transfer payments.

Table 44.—Production Costs per Tonne of Carbon Steel Shipped: Percentage Increase 1969-78

Country	Home currencies	U.S. dollar
United States	133%	133%
Japan	92	229
West Germany	72	246
United Kingdom	291	214
France	160	199

SOURCE World Steel Dynamics, Core Report J 1979

Shifts in Cost Competitiveness

From 1946 to 1959, the international steel market was dominated by U.S. exports. In the 1960's, however, several European countries and Japan became lower cost producers of steel.[28] Two additional competitive shifts have taken place since about 1973. The Japanese have lost some of their cost advantage relative to the United States, * and European producers lost their advantage altogether. Compared to other major steelmaking nations, U.S. raw material and employment costs per tonne of steel are somewhat high and capital costs somewhat low (see table 38).

U.S. steelmaking costs increased by 133 percent between 1969 and 1978, largely as a result of rapidly rising purchased energy costs and wage rates.[29] Japanese steelmaking costs increased by as much as 230 percent during this period as a result of dollar-priced raw materials, devaluations of the U.S. dollar, and the greater impact of rising energy prices on Japanese producers. Nevertheless, WSD data show that major Japanese producers have had a cost advantage of about 15 percent over U.S. steel firms for a decade or more. The Japanese cost advantage decreased from about 27 to 12 percent between 1969 and 1977 (see table 38). For the U.S. steelmaker, 1978 was a unique year: total production costs were roughly similar to those in Japan because of the unusually favorable U.S. operating rate compared to Japan. In 1979, U.S. steel production declined by about 10 percent because of reduced demand for steel plates and structural steel products,[30] and by the first quarter of 1979, Japanese steelmaker again had lower costs. Although their operating rate was still far below that of the United States, Japanese producers benefited from a weakening of the yen combined with a lower inflation rate than the United States.[31]

At the present time, the EEC steel industry is characterized by far greater diversity in structure and performance than those of Japan and the United States. The West German industry does well, on average, with respect to technology and productivity; but newer, larger, and better located steelworks can be found in Italy, France, and England. Most of the individual EEC steel industries have pock-

[28] Mueller and Kawahito, op. cit., p. 4.
*only Mueller and Kawahito suggest that Japan recently has been able to increase its cost advantage over the United States to pre-1973 levels.
[29] Bradford, op. cit., p. 14.

[30] Bradford, op. cit., p. 6
[31] WSD, op. cit., p. J-l-5.

ets of less-than-average efficiency, and these affect adversely the average performance of those industries and of the EEC steel industry as a whole.[32] From 1969 to 1972, U.S. production costs were generally 5 to 15 percent higher than European costs, but the European advantage evaporated in about 1973-74 because of currency changes, increased labor costs, and insufficient offsetting improvements in 1abor productivity. From 1972 to 1977, U.S. costs were about 5 to 15 percent lower than European costs, and they were about 9 to 22 percent lower during the early part of 1979. West German steelmaker are among the most efficient European producers. In 1978, their costs were 1 to 7 percent higher than U.S. costs, while French costs were 10 to 15 percent higher (see table 38).

On the international market, raw materials, labor, and capital costs only partly determine competitiveness. The costs of exporting, including transportation costs, warehousing, sales, and marketing, are also relevant. Japanese steelmaker have made impressive efficiency gains in transportation costs. Nevertheless, ocean freight costs increased during 1978 by as much as 55 percent because of skyrocketing oil prices. Total export cost for 1979 added about 25 percent to the cost of Japanese steel products—up by 5 percentage points from 1978.

[32] Mueller and Kawahito, op. cit., p. 34.

[33] WSD, report A, p. A-3-8, 1979.

Future Trends in Competitiveness, Supply-Demand, and Trade

The cost factors that favored domestic producers in the 1970's, along with changes in demand and investment activity, will continue to affect future steelmaking costs, but in uncertain ways. High operating rates throughout the world are likely by the mid-1980's, and Japan is expected to continue as the world's lowest cost producer of steel, The United States has a potential for the selective export of high-technology domestic steels, but its cyclical import dependence may grow in importance.

Steel Shortages in the Mid-1980's

There are major problems in forecasting both future steel demand and future capacity. Rates of economic growth, actual new plant construction, and capacity utilization rates are major uncertainties. A low-demand-growth scenario could create a favorable U.S. cost position, because fixed-cost obligations affect domestic steelmaker less than they affect foreign competitors. Rapid demand growth and the associated high operating rates could benefit foreign steelmaker more than U.S. firms. In the immediate future, from 1980 to 1983, there probably will be excess steel-producing capacity in most countries of the world and for the United States, even assuming improved economic conditions and the continued closing (rationalization) of older European facilities. But after 1983, there could be a worldwide shortage of steel products. By shortage is meant a very close matching of supply to demand in major areas of the world that causes substantial increases in export prices.

The domestic industry is aware that a shortage could occur, and that its comparative cost position would be vulnerable in that case. According to George Stinson, Chairman of National Steel:

> We are not crying wolf, nor are these scare tactics to gain public or government support . . . Our analysis concludes that there is a good possibility that the world will face a steel shortage beginning in the mid-1980's . . .

The industry view has also been supported by a majority of steel experts in Government and financial communities, who have been noting the steady decline in U.S. capacity as older plants are closed. * However, some experts claim that a steel shortage is not likely. David G. Tarr, senior economist of FTC, for example, states that:

> The imminent (steel) shortage has been predicted by industry spokesmen for at least five years. Every year or two the onset of the shortage is pushed back by a year or two. The projections of shortage are wrong, I believe. The industry is cyclical, and if a simultaneous worldwide boom occurs there will be a shortage. But it will be temporary not secular .34

Most forecasts indicate that by the mid-1980's capacity utilization would have to reach 85 percent to satisfy demand, and this would represent the production level at which pricing reflects a shortage condition. Table 45 summarizes some of the major demand-supply forecasts.

*Almost all steel specialists in the financial community see the possibility of worldwide steel shortages after 1982. See, e.g., any of the current industry analyses by Peter F. Marcus from Paine, Webber, Mitchell, and Hutchins, Inc.; Joseph C. Wyman of Shearson Hayden Stone, inc.: and Father Hogan of Fordham University.

"Correspondence between David G. Tarr and Bernard L. Weinstein, Special Study on Economic Change, U.S. Congress, Joint Economic Committee, July 30,1979.

Potential for Exports

If worldwide steel shortages do develop there may be opportunities for the U.S. producers to export steel. However, this possibility raises a number of issues. The United States does not possess a clear production cost advantage in commodity carbon steels; additional shipping costs also will constrain successful competition in foreign markets with commodity carbon steels. Domestic producers may be able to expand their exports of high-technology steels in which the United States is clearly cost and technologically competitive. However, several factors are likely to mitigate against this expansion. Among these are a lack of international trade experience among many domestic producers,

Table 45.—World Raw Steel Supply-Demand Forecasts, 1980-2000 (millions of tonnes)

		Capacity		Demand	
Source of data	Year	Western	Total	Western	Total
Chase[a]	1977	625	—	430	—
Marcus[b]	1977	637	—	—	—
Hogan[c]	1977	—	815	—	—
Marcus	1979	652	—	—	—
IISI[d]	1979	—	—	484	755
IISI	1980	—	—	480	760
AISI[e]	1980	613	926	608	—
Marcus	1983	698	—	—	—
Chase	1985	715	—	588	—
IISI	1985	675	—	—	—
AISI	1985	696	926	691	—
Hogan	1985	—	890	—	900[f]
Bureau of Mines[g]	1985	730	—	—	840
Chase	1986	730	—	614	—
Chase	1990	794	—	—	—
AISI	1990	781	1,200	776	—
Marcus	2000	791[h]	—	—	—
Bureau of Mines	2000	—	—	—	1,350

aMichael F Elliott-Jones (Chase Econometrics), "Iron and Steel in the 1980's: The Crucial Decade," speech at George Washington University Steel Seminar, Apr. 19, 1979.
bWorld Steel Dynamics, Apr. 25, 1979.
cW.T. Hogan, "Steel Supply and Demand in the Mid-1980's," *Center Lines,* May 1979.
dInternational Iron and Steel Institute, 33 *Metal Producing,* December 1979, p. 38.
eAmerican Iron and Steel Institute, "Steel at the Crossroads: The American Steel Industry in the 1980' s," 1980: assuming operating rate = 0.85.
fHogan has given the following summary for total world steel demand in 1985:

	Date of forecast	Millions of tonnes
AMAX	3178	919
Citibank	6178	890
Cleveland Cliffs	7/78	920
Metals Society (United Kingdom).	5178	1,015
Stanford Research .,	4179	970
Wharton. . .	10/77	896

9Bureau of Mines, *Iron and Steel,* MCP-15, 1978
hExtrapolated fro m 1983 using given growth rate of 1.8 Percent Per Year

and tariff and nontariff trade restrictions by many countries.

There is a growing shift of strategy among steel companies in industrialized nations, which may result in a growing cyclical dependence on steel imports. Industrialized nations appear to be aiming at higher average capacity utilization by scaling capacity to meet normal steel demand rather than cyclical peak demands and to supply domestic rather than export demand. Future exports may emphasize technology rather than steel, including the export of high-price, technology-intensive steels, rather than commodity carbon steels. The net result of these changes could be that in future periods of high domestic demand, domestic capacity would be inadequate and the United States would be more dependent than at present on steel from LDCs, which have distinct energy and labor cost advantages,

The role of LDCs in the world steel supply and demand situation is critical. Their rates of growth in steel consumption are very high (figure 15). Depending on their rates of economic growth and of new steel plant construction, their impact on world exports could be substantial (table 46). Specific LDCs are likely to develop increasing capability to export semifinished steel and direct reduced iron to industrialized nations if these industrialized nations make major capital investments in LDCs. For the United States, energy- and iron-ore-rich Latin America presents singular uncertainties.

Future Costs and Productivity*

In home currencies and at high operating rates, U. S., French, and British steelmaking costs are expected to increase by about 8 percent, while Japanese and West German costs may increase by less than 4 percent, from 1980 to 1984. '5 Depending on operating rates, Japanese steelmaking costs may be about 14 to 17 percent lower, and West German costs may be 2 to 6 percent higher than domestic steelmaking costs.

During the mid-1980's, West German and especially Japanese steelmaker are expected to continue as leaders in making further improvements in the efficient use of raw materials, and their costs would then increase at only about half the U.S. rate. Furthermore, materials costs in these countries are expected to remain a smaller proportion of total steelmaking costs than those in the United States. It is expected that by 1985 the cost to domestic steelmaker of oil and coking coal will reach world market levels. The combined U.S. unit cost for oil and coal is expected to be $3/tonne higher than in Japan but about the same as in the EEC. Higher American unit costs for iron-bearing materials would be approximately offset by lower electricity costs.[36]

It appears that U.S. producers did not experience any improvements in labor productivity during 1979 because of increased repair and maintenance requirements caused by bringing old equipment back into the production stream. As a result of anticipated reductions in the work force, gains in U.S. productivity into the mid-1980's should be around 2.5 percent annually. This is higher than recent domestic labor productivity growth rates but lower than those expected for major producers abroad. As a result of major cost reduction efforts, the largest labor productivity gains are projected for Europe [4.5 percent annually), followed by Japan (3.5 percent). Thus, barring major technological improvements in the United States, Japan will increase its lead over the domestic industry in having lower man-hour requirements during the mid-1980's. Of the major European producers, only West Germany is likely to approach U.S. labor productivity levels.

It is projected that unit labor cost differences will widen, and by the mid-1980's domestic cost levels may be 8 to 10 percent higher than Japanese unit labor costs.[37] This

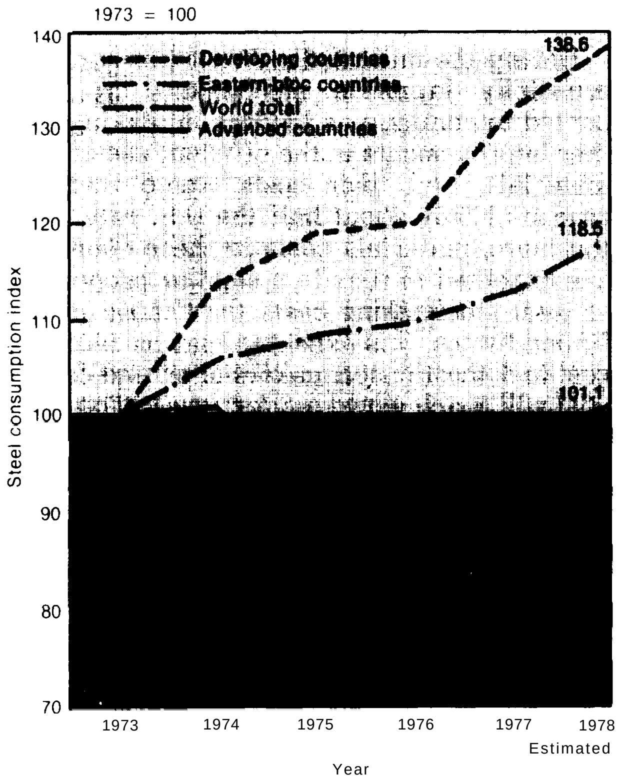
*Cost projections in this section are based on WSD cost data, adjusted by 5 to 10 percent for methodological reasons. They are limited to raw material, labor, and capital costs, and should be viewed as indicators of trends rather than specific developments.

[35]WSD, op. cit., p. J-l-25

"Mueller and Kawahito, op. cit., pp. 29-30.

[37]WSD, 1979.

Figure 15.—Apparent Steel Consumption Indexes by Region, 1973”-8



NOTE. Eastern-bloc countries include North Korea and China.

SOURCE International Iron and Steel Institute

deterioration in the U.S. unit labor cost position is expected for several reasons, including declining U.S. productivity growth rates and increasing hourly employment costs. At the same time, anticipated increases in the operating rates of Japanese and European steel producers will increase their labor productivity and restrain upward pressures on unit employment costs. The U.S. industry, operating at close to full capacity now, has already exhausted these economies.[38]

Whereas the U.S. steel industry’s present capacity is almost the same as it was in 1967, one-third of steelmaking capacity in the EEC and two-thirds of that in Japan has been put in place since that year. Thus, a considerably larger portion of steelmaking capacity in the United States will need to be replaced by 1985 or soon thereafter than in Japan or in the EEC. Maintenance costs can also be expected to be higher in the United States than in the EEC or Japan because of the difference in average age of plant and equipment.

Domestic steelmaker are expected to add a number of continuous casting facilities and new electric furnaces, thus bringing onstream new and efficient capacity. * In general, the scrap-based producers have modern, highly automated facilities and use continuous casting extensively. These factors should enable the scrap-based producers to cope with rising labor and energy costs more effectively than can the integrated producers.[39] However, limited scrap availability could reduce the growth potential of this low-

[38]Mueller and Kawahito, op. cit.. pp. 28-29: Bradford, op. cit., p. 16.

*These and other components of modernization are discussed in ch. 10.

[39]Bradford, op. cit., p. 5.

Table 46.—Potential Impact on World Steel Supply by Less Developed Countries (in crude steel equivalents)

Year and growth assumption	Steel capacity (million tonnes)	Steel production (million tonnes)	Steel production (percent of consumption)	Net Imports (million tonnes)	Net Imports (percent of consumption)	Apparent consumption (million tonnes)	Degree of self-sufficiency (percent)
1960	100	8.7	414	12,3	58.6	21.0	41.4
1965	200	16.1	50.2	16.0	49.8	32.1	50.2
1970	28.0	21,6	53.2	19.0	46,8	40.6	53.2
1977	58.0	41 7	609	26.8	39.1	68.5	60.9
1985 projected at:							
30% GNP growth	110-115	92	92	8	8	100	92
4% GNP growth	110-115	93	86	15	14	108	86
5% GNP growth	110-115	95	79	25	21	120	79
6% GNP growth	110-115	95	73	35	27	130	73
7% GNP growth	110-115	98	68	47	32	145	68

SOURCE: Central Intelligence Agency. "The Burgeonlng LDC Steel Industry More Problems for Major Steel Producers 1979 cost segment of the U.S. steel industry, unless direct reduced iron becomes available. This cannot happen before 1983 at the earliest. Partly as a result of the shift to electric furnace steelmaking, integrated producers are expected to reduce costs by consuming 15 percent less coke in 1980 than in 1979. '()

Japanese producers are likely to derive long-term benefits from their decision to put most of their investment funds into the construction of modern greenfield plants. These benefits include low-cost production and stabilizing capital costs in the 1980's for replacement and pollution control." Japanese and to some extent European steel companies now have sufficient modern infrastructure to add 9 million to 14 million tonnes of capacity at a relatively moderate cost. Nevertheless, Japan is expected to continue its current strategy of slowing down its steel industry plant construction program while continuing to introduce more energy-saving equipment.[42]

The Japanese steel industry is very dependent on raw material and energy imports (table 47), which has caused many of the raw material and energy prices in Japan to be somewhat higher than in the United States. The only raw material the U.S. steel industry imports in substantial amounts is iron ore—about one-third of iron ore is imported. Nevertheless, unit costs per tonne of steel produced in Japan have been markedly lower than those for most plants in the United States (see table 41). This is a consequence of the newer facilities and more modern technology in Japan,

During the next several years, Japan is expected to continue as the world's lowest cost steel producer. Some developing nations with lower labor cost and modern plants are now becoming almost as competitive as the Japanese. Indeed, they now pose a threat to the Japanese market; this is especially true of South Korea.

The largest European production cost improvements will result from programs designed to make the industry more efficient. Apparently West Germany will be most likely to succeed in cutting back its share of the 27-million-tonne capacity reduction planned for Common Market producers. Capacity reduction may be accelerated if foreign governments adopt implementing legislation for the Multilateral Trade Agreement subsidy code, which limits governmental aid to ailing producers and boosts payments to terminated workers.[43]

World Steel Trade

The domestic steel industry periodically states that the U.S. competitive position in home markets is eroded by the below-cost pricing of exports by Japan, as well as by European countries.[44] However, steel industry

"Ibid., p. 18.
'Mueller and Kawahito, op. cit., pp. 30-31.
"Ibid., pp. 34-35, Moreover, it is predictable that at some point in the future the Japanese steel industry will face many of the same difficulties as those currently confronting the U.S. steel industry. At some future time (probably beyond 1990-2000), Japan will face substantial capital replacement. These replacement needs will place a considerable burden on Japanese steel producers, especially because some of the important advantages the Japanese presently enjoy will no longer be operative.

"WSD.
"Putnam, Hayes and Bartlett, Inc., The *Economic Implications of Foreign Steel Pricing Practices in the U.S. Market*, prepared for American Iron and Steel Institute. Newton, Mass., 1978.

Table 47.—import Dependence of the Japanese Steel Industry, Selected Years, 1955.78 (percent imported)

Industry	1955	1960	1965	1970	1974	1976	1977
Iron ore	84.7	92.0	97.1	99.2	99.4	98.7	98.8
Coking coal	22.0	35.9	55.1	79.2	86.1	88.6	89.7
Iron and steel scrap	19.5	28.6	15.5	13,4	12.9	4.4	3.9

SOURCE: Japan's *Iron and Steel Industry,* Tokyo, Kawata Publicity, Inc. 1973 Edition, pp. 249, 250, 1975 Edition, p. 35: and 1978 Edition. p 48 findings of below-cost pricing have been disputed by many analysts, including FTC.[45]

There is a consensus that at the present time most U.S. steel companies are price competitive for comparable steel qualities in the domestic market. Nevertheless, Japanese steel producers have been able to secure a significant share of the U.S. steel market. Some analysts claim that Japanese steel producers rely on agressive, even countercyclical, export programs to stabilize their highly leveraged positions. Others correctly dispute this allegation.[46] Some analysts and consumers believe that Japanese steel—made in more modern plants—is of high quality and is for this reason more competitive than other steels in the domestic market. There may have been times at which some Japanese steel was sold in the United States at below-cost prices, but most available data support the basic cost advantage of the Japanese. Although Japanese producers' profits may be small and their financial structure difficult to comprehend, the dumping of Japanese steel does not appear to be a valid issue.

As the amount of Japanese imports in the U.S. market declined in 1978 and early 1979, EEC and LDC exports to the United States increased. European producers have lost their cost competitiveness during the past several years. WSD cost data suggest that many European producers may have been selling in the American market below cost, because their costs are higher than U.S. costs but their prices are equal to or below U.S. prices.

[45]FTC criticized a major AISI-sponsored study as follows: "Thus (Putnam, Hayes and Bartlett) have estimated the costs of making all steel and compared these costs with the price of carbon steel alone. Ignoring special steels in the price series results in a series bias in favor of finding below-cost pricing. Since PHB have not removed this bias from their data and estimates, one cannot conclude from their estimates that below-cost pricing has occurred. " (FTC, "Staff Report on the United States Steel Industry and Its International Rivals: Trends and Factors Determining Competitiveness, " 1977, p. 244.)

[46]A study undertaken by the Council on Wage and Price Stability, "Prices and Costs in the United States Steel Industry," October 1977, states: "We conclude that a major reason for the success of the Japanese steel industry cannot be found in a countercyclical dual-pricing approach to domestic and world markets. Japanese exports have grown at phenomenal rates during good times and bad for the home economy." (p. 90).

LDC finished products have also, to some extent, replaced Japanese steel imports. EEC countries, exceptionally sensitive to imports, established a policy in 1977 to cut imports from developing countries like Mexico, South Africa, and South Korea. Japan traditionally has resisted significant imports of steel products. Thus, the United States provides the most accessible market for steel exports from all foreign countries. Exports of semifinished steel and direct reduced iron to the United States also could become significant in the future.

The trigger-price mechanism has been the Government's method of monitoring unfairly traded imports. According to the Treasury Department, the trigger-price mechanism has achieved its twin objectives of reducing steel imports and preventing dumping. * It has also led to price increases. However, the domestic iron and steel industry and some Government analysts do not share the Treasury Department's enthusiasm. The net effect of the system has been 1) to allow the least profitable, highest cost foreign steelmaker, especially the Europeans, to obtain higher export prices and to reduce, but not eliminate, their losses; and 2) to give the Japanese greater profits. At the same time, any benefits the United States realizes from low import prices have been largely eliminated, because the mechanism acts to set price levels. For example, during 1978, every tonne of finished steel imported from Europe that could have been produced in the United States would have generated a domestic profit of more than $22/tonne. Instead, European exports to the United States under the trigger-price mechanism reduced European losses by $3/tonne.

*For example, steel imports were discussed extensively in the 2 days of steel talks on Feb. 7 and 8, 1979, which opened with Treasury Undersecretary Anthony Solomon's report to the Senate steel group on improved industry performance since the inception of the trigger-price mechanism. Import penetration dropped from 20 to 17 percent in the final 8 months of 1978, when the plan was in effect, and in December it dropped to 14 percent.

The situation has been summed up by Roger E. Alcaly, senior economist with the Council on Wage and Price Stability:

> In short, the major impact . . . was on import prices, with most of the gain accruing to foreign producers, while the effects on the domestic steel industry were too small to reverse the long-term trends.[47]

Over the 2 years of the trigger-price mechanism, carbon steel import prices rose 39 percent, while the domestic producer price index for steel mill products rose 21 percent.[48]

Because of the industry's skepticism about the trigger-price mechanism, it has made a considerable effort to have the new Multilateral Trade Agreement vigorously enforced, particularly its provisions against direct export subsidies. The domestic steel industry also feels that the Government's handling of the existing trade laws has been "less than vigorous" and that enforcement powers should be transferred to another Government agency.* Further, the domestic industry would like to have the burden of initiating unfair trade practice agreements lifted from industry and handled by the responsible Federal agency.

The steel industry feels that Government decisions regarding the enforcement of trade laws should allow for more trade association and labor union input. Also of importance to the industry is a new definition of injury to an industry that would extend and codify the limits within which dumping can be prohibited. Given active foreign government participation in their steel industries, effective implementation of the subsidy code will also grow in importance.

The new Multilateral Trade Agreement includes many of the industry's objectives, but the details and specifics of the agreement remain to be implemented. Its actual impact on the domestic iron and steel industry cannot be precisely determined at this time, A definite possibility exists that selected, high-technology U.S. steels would be more easily exported under a well-enforced Multilateral Trade Agreement and some domestic alloy/specialty steel producers might be able to capitalize on this opportunity.* It is clear, therefore, that Government policies within the context of the Multilateral Trade Agreement are of paramount importance to the domestic iron and steel industry, both for preventing unfairly priced imports and for obtaining fair trade in export markets.

[47] *American Metal Market,* Dec. 24, 1979.

[48] C. A. Bradford, "Steel Industry Quarterly Review," Merrill, Lynch, Pierce, Fenner & Smith, Inc., February 1980.

*In July 1978 the Treasury Department was stripped of most of its international trade responsibilities. The Undersecretary for Trade at the Commerce Department now administers international trade programs such as the trigger-price mechanism.

*Discussed more fully in ch. 8.