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U. S. STEEL IMPORT AND INTERNATIONAL COMPETITIVENESS

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I. INTRODUCTION

Thirty years ago the U. S. steel industry was the largest and most efficient in the world, but its condition has deteriorated while foreign competition has intensified. Steel imports into the United States have increased from practically none before 1959 to over one-fourth of total consumption at pressent. This increase in steel imports has seriously injured U. S. producers by reducing sales and production volume. Up until the end 1950s, Western European countries were the only substantial source of steel imports. In the 1960s Japan entered the market and during te 1970s it took the place of western European countries as the largest supplier to the U. S. market. Now Brazil and South Korea are threatening Japan as suppliers to the United States. Other third world countries such as Taiwan and Mexico are potential competitors in the U. S. steel market.

This paper reviews the dramatic changes of the intervening years, identifying each country's advantages and disadvantages and comparing and identifying the relative importance of technolagical, labor and raw material costs in detertmining national competitiveness. The paper ends with an assessment of the potential viability of the U. S. steel industry. The bottom line is that U. S. steel production costs are still below the production costs plus the transportation costs to U. S. shores of any foreign competitor. It is government, subsidized competitors which are the major factors in the U. S. industry's current competitive difficulties, though higher productivity, lower wages and more advanced technolgy could all help offset those economic and political handicaps. Either a $6 per hour decrease in labor costs or a two hour per ton reduction in labor input would restore the U. S. industry to competitiveness, even considering those foreign subsidies. On the other, trade restrictions will only require the American consumer to subsidize the domestic industry without improvement in its ability to compete. However, even under the best of conditions an integrated basic steel mill would be a low return investmet, unattractive to capital markets. Within this complex picture, policy alternatives ar suggeted for viability without protection for this key industry.

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Ⅱ. THE SOURCES AND DESTINATIONS OF U. S. STEEL

Except for the years surrounding the second world war, exports have never absorbed a substantial portion of U. S. steel production. The importance of the U. S. to the world steel markets is as a consumer, traditionally of its own output and, in recent years, a growing proportion of the output of the rest of the world. The U. S. which had offered no appreciable import market for steel until 1959, by 1967 imported 12. 2 million tons, leadings to the 26. 1 million tons of 1984 (Table 1). Until the 1960s western Europe was the only substantial source of U. S. steel imports. Japan become a significant source by 1965 and outstripped the European Economic Community as a U. S. supplier only in 1983. However, it was South Korea, Brazil and Canada, and the decline in U. S. consumption, not Japanese imports, which were responsibe for displacing the European source (Table 2).

[Table 1] United States Trade in Steel Mill Products
(in thousands of net tons)

	Production	Exports	Imports	Consumption	Import Penetration (%)
1940	45, 966	7, 640	18	38, 344	0. 0
1945	57, 242	4, 354	54	52, 942	0. 1
1950	72, 232	2, 639	1, 014	70, 607	1. 4
1960	71, 149	2, 977	3, 359	71, 531	4. 7
1965	92, 666	2, 496	10, 383	100, 553	10. 3
1970	90, 798	7, 062	13, 364	97, 100	13. 8
1971	87, 038	2, 827	18, 304	102, 515	17. 9
1972	91, 805	2, 873	17, 681	106, 613	16. 6
1973	111, 430	4, 052	15, 150	122, 528	12. 4
1974	109, 472	5, 833	15, 970	119, 609	13. 4
1975	79, 957	2, 953	12, 012	89, 016	13. 5
1976	89, 447	2, 654	14, 285	101, 078	14. 1
1977	91, 147	2, 003	19, 307	108, 451	17. 8
1978	97, 935	2, 422	21, 135	116, 648	18. 1
1979	100, 262	2, 818	17, 518	114, 962	15. 2
1980	83, 853	4, 101	15, 495	95, 247	16. 3
1981	88, 450	2, 904	19, 898	105, 444	18. 9
1982	61, 567	1, 842	16, 663	76, 388	21. 8
1983	67, 584	1, 199	17, 070	83, 455	20. 5
1984	73, 739	980	26, 163	98, 922	26. 4
1985	74, 000	900	23, 000	96, 000	23. 9

Source : 1940 - 84. American Iron and Steel Institute, *Annual Statistical Reports* 1985 estimate by International Trade Administration.

[Table 2] The Sources and Destimation of U. S. Steel in 1967 and 1983

Year	Apparent Consumption	U. S. Shipments	Exports	Imports	% Impor Penetration
1967	93. 6	83. 9	1. 7	11. 4	12. 2

1967	Exports	Destination	Canada	Latin America	E. C. *	Asian Countries	Others
		Quantities :	0. 4	0. 3	0. 2	0. 7	0. 1
	Imports	Origins :	Japan	E. C. *	Canada		Others
		Quantities :	4. 5	5. 9	0. 6		0. 4

Year	Apparent Consumption	U. S. Shipments	Exports	Imports	% Impor Penetration
1983	83. 1	67. 5	1. 2	17. 1	20. 6

1983	Exports	Destination	Canada	Latin America	E. C. *		Asian Countries	Others
		Quantities :	0. 4	0. 3	0. 1		0. 3	0. 1
	Imports	Origins :	Japan	E. C. *	Canada	S. Korea	Brazil	Others
		Quantities :	4. 2	4. 1	2. 4	1. 7	1. 2	3. 5

Sources : American Iron and Steel Institute, *Annual Statistical Report*, 1967 and 1983.
* European Community

Ⅲ. COMPARATIVE COSTS OF STEEL PRODUCTION

The United States, forty years ago steelmaker to the entire world, has become the world's highest cost steelmaker. But the cost differential is not as great as generally assumed. After all, the U. S. is also the world's largest steel market. What determines the prospects of the U. S. steel industry is the relative costs to the U. S. user of various steel products of comparable quality. Looking at only production cost plus transportation from the foreign country to the nearest U. S. port, the U. S. steel industry is potentially competitive on its own turf (Table 3). Only the United Kingdom, South Korea and Brazil of those conutries we use for comparison had production costs sufficiently lower in 1984 to offset their transportation cost to the United States, but the contributions of those countries to U. S. imports were minor.

Since all but South Korea were operating well below their most efficient capacity levels, costs would have been lower at higher rates of output. Since U. S. mills were operating further below capacity than any of the others (48. 4 percent in 1982), the U. S. industry had the most to gain in cost advantages from higher levels of output. More than low demand was involved in the endemic overcapacity. Most of the steel producing countries had gone on adding to their capacity long after it was obvious that the supply was sufficient to outstrip any conceivable growth in demand (Table 4). Continued government investment in the wholly or partly government-owned industries was responsible for these

[Table 3] Costs Per Net Ton Shipped for Major Countries
Based on 1984 Exchange Rates
(at actual operating rates)

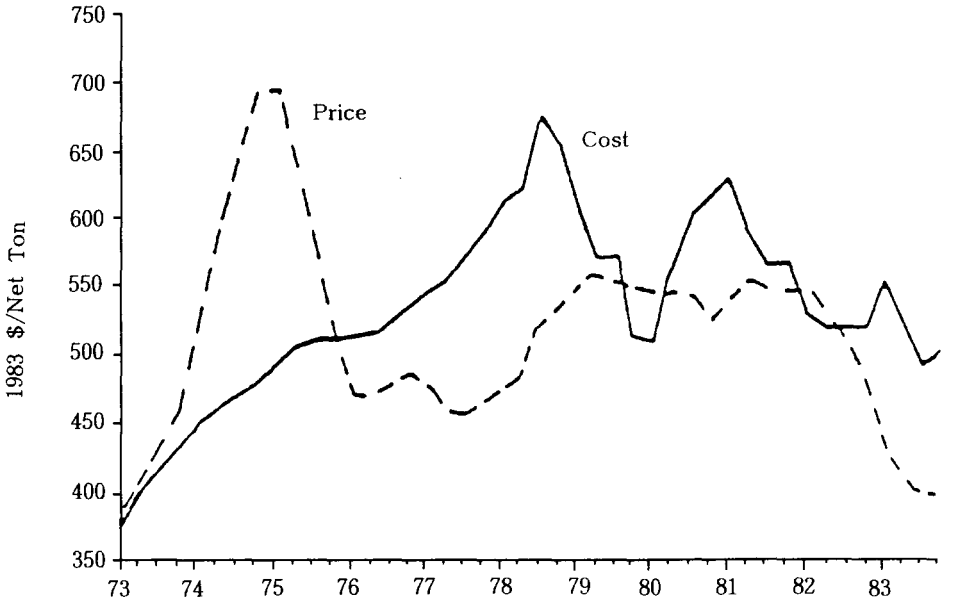
	U. S.	Japan	F. R. G	France	U. K.	S. Korea	Brazil
Labor Costs	$137. 61	$95. 98	$124. 28	$126. 74	$90. 33	$31. 86	$80. 00
Raw Material Costs	301. 69	255. 33	242. 62	251. 18	255. 33	224. 28	160. 00
Financial Costs	38. 76	96. 35	49. 73	75. 19	51. 67	41. 72	N. A.
Total	$478. 06	$447. 66	$416. 63	$423. 11	$397. 33	$297. 86	$240. 00
Dec. 1983 entry costs into U. S. market (duty, freight, handing)		$74. 61	$70. 76	$70. 76	$70. 76	$74. 61	N. A.
Landed costs in U. S. before profit	$478. 06	$522. 27	$487. 39	$493. 97	$468. 09	$372. 47	N. A.

Sources : The U. S., Japan, F. R. G, France, and the U. K. — *World Steel Dynamics, Steel Strategist #9*, Feb. 1984 ; South Korea — unpublished data from Korean Iron and Steel Federation ; Brazil — data are for 1982 from Hans Mueller (1984), p. 41.

[Table 4] Capacity vs. Consumption for Major Countries
(millions of metric tons)

	Crude Steel Capacity			Apparent Steel Consumption (crude steel equivalent)		
	1969	1983	annual rate of growth (%)	annual rate of growth (%)	1969	1983
Belg. Lux.	19. 9	27. 9	2. 8	-2. 8	4. 6	2. 9
France	25. 2	32. 1	1. 9	-2. 5	23. 0	15. 0
Germany	49. 7	66. 2	2. 4	-1. 9	40. 9	29. 8
Italy	19. 5	42. 7	8. 4	-0. 7	20. 2	18. 1
U. K.	29. 1	26. 7	-0. 5	-3. 1	24. 9	14. 0
Japan	81. 0	175. 6	8. 3	-0. 2	67. 1	65. 6
U. S.	140. 5	149. 9	0. 5	-2. 1	132. 9	94. 5
Korea	0. 7	13. 5	130. 6	41. 7	1. 3	8. 9
Brazil	4. 6	22. 2	27. 3	3. 4	5. 5	8. 1

Sources : 1669 data — U. N. statistics for capacity, OECD statistics for apparent consumption. 1969 data for Korea and Brazil — Korean Iron and Steel Federation, *Statistical Yearbook*, 1976. Capacity for 1983 — Chase Econometrics, *The World Steel Outlook to 1995*, Vol. 1, July 1983 ; Consumption for 1983 — Korean Iron and Steel Federation, *Statistical Yearbook*, 1986.



[Figure 1] Graph of Real Import Prices and Full Japanese Costs for Carbon Steel 1973-1983

perverse decisions. Only the privately-owned U. S. Industry and that of financially-strapped United Kingdom reacted with market-oriented ratonality-and for that the U. S. industry has suffered considerable criticism. Of course, the result was increased pressure to export with the U. S. as the prime target. Had the U. S. industry gone against the market, as did so many others, by creating new capacity when there was no potential demand, it would have upgrade its capacity with new-technology, but would have done so at the cost of even greater losses.

1. Subsidies

The competitive disadvantages of the U. S. steel industry in 1984, therefore, had a primary source : below cost sales of international competitors.

Investing in more efficient technology, would not eliminate the basic threat to U. S. competitiveness. A large portion of the steel capacity of every major producer except the United States is owned or heavily regulated by its government. Figure 1 illustrates the extent to which Japan has been willing to subsidize its steel exports to keep its mills humming. Total European operating subsidies for the 1975-85 period have been estimated at $30 billion, even at present exchange rates, in addition to an estimated $34 billion in governmental capital investment.[1] Yet the flip side of that is willigness of Japanese

1) U. S., Congress, Senate, Committee on Foreign Relations, *The Steel Industry, Hearing before a Subcommittee of the Senate Committee on Foreign Relations on S. hrg. 98-1002* 98th Cong., 2nd sess., 1984, p. 162.

and European taxpayer to subsidize the U. S. steel consumer, as well as steel consumers in other countries. Some notion of the trade-off between producer and consumer welfare can be gained from the Congressional Budget Office estimate that the Reagan Administration's restraints on steel imports for the last half of the 1980s will result in a 7 percent increase in U. S. steel prices over what they would otherwise have been.[2] Additions to total capacity have ceased in Europe and Japan and restructuring with retirement of the most obsolete capacity is underway there as in the U. S. Yet Brazil, South Korea and Taiwan continue to add capacity.

2. Raw Material and Energy Costs

The United States is far better-endowed with the raw materials and energy required to produce steel than any of its cmpetitors. Yet its per unit cost for raw materials and energy is above them all. The problem is not the endowment of raw materials and energy but the inefficient manner in wich they are used and the delivery costs. The U. S. has the lowest ratio of dependence on imports of iron ore, though its remaining are bodies are no longer as rich as those of the past and land transportation is more expensive than water. The United States has ben called the Saudi Arabia of coal and that is true of coke as well. The U. S. is also the world's greatest supplier of steel scrap. Energy costs per ton of steel are lower for the U. S. than for its major competitors, but they should be because it is more nearly energy indepedndent than any of them. Nevertheless, Americon total raw material and energy costs per ton of steel produced, the lowest among all steel producing nations in 1968, were substantially above those of all U. S. competitors in 1984 (Table 5). Every cmpetitor has experienced a more rapid rise in energy and raw material cost than U. S., but they hve been more effective in offsetting those costs, Japan

[Table 5] Unit Raw Material and Energy Cost for Major Countries in 1968 and 1984 (U. S. dollars per net ton)

Country	1968	1984	% Increase
United States	36. 0	301. 7	908%
Japan	44. 4	255. 3	475%
United Kingdom	38. 5	255. 3	563%
France	N. A.	221. 2	N. A.
West Germany	43. 5	242. 6	457%
South Korea	N. A.	224. 3	N. A.
Brazil	N. A.	(160. 0)*	N. A.

Sources : Japan, W. Germany, France, the U. S. and the U. K. — Paine Webber, Inc., *World Steel Dynamics*, *Steel Strategist #9*, Feb. 1984 ; South Korea — unpublished data from Korean Iron and Steel Federation.

* Brazil — data are for 1982 from Hans Mueller (1984), p. 41.

2) "U. S. Consumer is Seen as Big Loser in New Restraints on Imported-Steel", *The Wall Street Journal*, 7 January 1985, p. 5.

and South Korea by minimizing tranportation costs to plants located on their seacoasts and by aggressive programs of technological change. It is in the latter area that United States has lagged furthest behind.

3. Labor Cost and Productivity

The hourly employment cost for the U. S. steel industry is nearly double its nearest competitor (Table 6) U. S. steel wages have always been above those of other steel producing countries but U. S. productivity was adequate to offset the wage differential until the 1970s. The U. S. wage increases during the 1970s were primarily political and accidental. The industry was not expanding and there was no need to attract additional labor. However, the industry's labor market was totally organized within one collective bargaining system. In the years immediately following the World War II, the steel industry had a particularly gloomy labor relations record. A national steel strike occured at one-half of the contract openings from 1945 through 1959. When the 1959 strike went on for 116 days, the Secretary of Labor put together a study team to find out why. The blame was placed upon a corrupt form of tripartism.[3] Each party bargained with an eye on government. The union was convinced that government would not allow a national steel strike to continue over any substantial period of time. Therefore, they could demand more and hang tough waiting for the government to force a settlement at a compromise level above what the union could expect to gain from a bilateral negotiation. Guessing the union's policy and the government's likely response, the companies held back part of what

[Table 6] Hourly Employment Costs for All Steel Industry Employees for Major Countrys (U. S. dollars per hour)

Country	1966	1982	Percentage Increase 1966-82	1985*	Percentage Increase 1982-85
United States	12. 50	24. 67	97	23. 00	-7
Japan	2. 31	10. 89	371	11. 00	1
United Kingdom	4. 12	9. 14	121	5. 50	-40
France	4. 53	12. 14	167	10. 00	-18
West Germany	4. 70	13. 27	182	10. 00	-25
Brazil	na	4. 00	na	na	na
South Korea	0. 30	1. 84	513	3. 00	68

Sources : U. S., Japan, W. Germany, France, and U. K. — Paine Webber, Inc., *World Steel Dynamics*, March 11, 1985 and March 11, 1986 ; South Korea — Korean Iron and Steel Federation, *Statistical Yearbook*, 1982, pp. 301-331 and 1985, pp. 305-337 ; Brazil — Hans Mueller (1984), p. 41.

* : Approximate na : not available

3) E. Robert Livernash, et al., *Collective Bargaining in the Basic Steel Industry* (Washington, D. C. : U. S. Department of Labor, 1961), p. 18.

[Table 9] Labor Productivity for All Steel Industry Employees for Major Countries (manhours per net ton at actual operating rates)

Country	1966	1982	Percentage Increase 1966-82	1985*	Percentage Increase 1982-85
United States	12.1	7.8	35	6.5	17
Japan	22.4	8.0	64	7.2	11
United Kingdom	25.8	13.4	48	na	na
France	23.8	10.8	51	na	na
West Germany	22.5	11.1	51	9.5	14
Brazil	na	27.9	na	na	na
South Korea	na	15.0	na	13.2	12

Source : U.S., Japan, West Germany, France, and U.K. — Paine Webber, Inc., *World Steel Dynamics*, March 11, 1985 and March 11, 1986 ; South Korea — Korean Iron and Steel Federation, *Statistical Yearbook*, 1982, pp. 301-331 and 1986, pp. 305-37 ; Brazil — Hans Mueller (1984), p. 41.

* : Approximate na : not available

[Talbe 10] Unit Labor Costs for Major Countries in 1966, 1982, and 1985 (U.S. dollars per net ton)

Country	1966	1982	Percentage Increase 1966-82	1985*	Percentage Increase 1982-85
United States	149.94	194.64	30	149.5	-23.0
Japan	51.93	87.99	69	79.2	-0.9
United Kingdom	106.16	122.42	15	na	na
France	107.59	132.53	23	na	na
West Germany	105.67	147.04	3	95.0	-35.4
Brazil	na	54.96	na	na	na
South Korea	na	31.86	na	39.6	24.2

Source : U.S., Japan, West Germany, France, and U.K. — Paine Webber, Inc., *World Steel Dynamics*, March 11, 1985 and March 11, 1986 ; South Korea — Korean Iron and Steel Federation, *Statistical Yearbook*, 1982, pp. 301-331 and 1986, pp. 305-37 ; Brazil — Hans Mueller (1984), p. 41.

* : Approximate na : not available

The accidental head start given the steel workers in attaining a generous COLA did accelerate their wages more rapidly in comparison to the average manufacturing wage in U. S. than was true of any competing country. Yet, with the exception of South Korea, steel workers in each country enjoyed a substantial increment over their manufacturing counterparts (Table 8). Without a meaningful labor movement, Korean workers are wage takers rather than wage bargainers, and they receive no fringe benefits to leverage their hourly labor costs upward. There is only a quarterly bonus which can be withheld if the quarter has not been a profitable one. Brazil's wages are lowered in terms of world standards by its extreme exchange rate.

As recently as the mid-1960s, the U. S. steelworker was by far the most productive in the world, using about one-half as much labor per net ton of steel in comparison to the others. But during the years following, productivity progress was far lower in the U. S. than among its competitors, wiping out its advantage vis-a-vis Japan and narrowing it vis-a-vis others. The combination of rapidly rising wages and slowing rate of productivity increase placed U. S. unit labor costs far above those of its competitors (Tables 9 and 10). However, after 1982 the unit labor costs for the developed countries, Japan, the U. S. and West Germany, have declined, whereas the Korean unit labor costs have increased steadily. The primary reason for the slower produtivity increase in the U. S. appears to have been failure to take advantage of some the newer technologies. The 1982-85 turnaround does not indicate a change in investment policies and technological adoption but piecemeal though persistent attention to managemet practices and work rules. A saving factor in international competition has been that U. S. hourly employment costs have been rising at a slower pace than in competing countries, but the gap will take a substantial time to close. A troublesome wage development was the jump that the wages of U. S. steelworkers took between 1975 and 1982 in comparison with the average of all manufacturing workers in the country, a phenomenon that the other nations did not experience.

[Table 8] Hourly Labor Costs for Production Workers in Iron and Steel Compared with Total Manufacturing Labor Costs for Major Countries (Ave. Mfg. Wage=100 in each country)

Country	1975	1980	1982
United States	161	177	195
Japan	172	173	174
United Kingdom	120	115	120
France	128	119	125
W. Germany	115	112	111
South Korea	109	107	105

Sources : U. S., Japan, Germany, France, and U. K. — U. S. Bureau of Labor Statistics ; South Korea — Korean Iron and Steel Federation, *Statistical Yearbook*, various years.

Continuous casting has been accepted more slowly but is now advancing rapidly, again with the U. S. as the laggard (Table 12). A continuous cast eliminates ingot cooling and soaking pit reheating, resulting in both energy conservation and reduced capital cost. It has been estimated that, had the U. S. industry adopted continuous casting at the same rate as Japaness did, it would have saved over $5 billion between 1971 and 1983.[7]

The newest of the technologies is direct reduction which replaces the traditional blast furnace by removing oxygen from iron ore. It is currently most attractive for nations such as Mexio with an abundance of natural gas. However, coal using methods are being developed which, if successful, can make its availability almost universal. In all of these techniques the U. S. lags behind, both because it is the only traditional steelmaker which did not need structural rebuilding after having its capacity destroyed in the World War Ⅱ, and because there has been no significant investment in the intergrated basic steel industry in the last 30 years.

The one notable exception to an almost total absence of investment in the U. S. steel industry in recent years is advent of minimill. The term arises not so much from size as from the fact that this mill encompasses only a part of the traditional steelmaking process. The integrated mill burns coke with iron ore in blast furnaces to produce iron, remelts iron ingots in open hearth or basic oxygen furnaces, combining iron with other ingredients for steel, then remelts the steel in order to process it into plates, sheets, rods, pipe, structual shapes and other products. The minimill bypasses the coke ovens, blast furnaces and open hearths to melt scrap and continuously cast it into low quality steel products such as rods, bars and light shapes.

[Table 12] Continuous Casting in Selected Steel-Producting Countries : Share of Total Production and Growth Rates of Share, 1979-85 (percentage)

Country	1979	1981	1983	1985	1979-85 growth Rates
United States	16. 9	21. 1	26. 3	43. 6	157%
Japan	52. 0	70. 7	66. 3	91. 1	75%
United Kingdom	16. 9	31. 8	35. 1	54. 8	224%
France	30. 0	51. 3	51. 4	80. 6	168%
Germany	39. 0	53. 6	55. 8	79. 5	103%
Brazil	28. 0	36. 4	40. 3	43. 7	56%
South Korea	30. 6	44. 3	42. 5	63. 3	106%

Source : Data for 1979-83 — U. S., Congress, House, Committe on Science and Technology, *New Technology and The Future of Steel, Hearings before the subcommittee on Investigations and Oversight and the subcommittee on Science, Research and Technology of the House Committee on Science and Technology on Hrg. 99-33.* 99th Cong., 1st sess., 1985, p. 47 ; Data for 1985 — Korean Iron and Steel Federation, *Statistical Yearbook*, 1986, pp. 42-44.

7) Hans G. Mueller, "Trends in Steel Production and Trade", paper presented at Annual Conference of Eastern Economic Association (Paper No. 92), New York, 14-18 March 1984, p. 124.

The damage done in the 1970s to the competitiveness of the U. S. steel industry was substantial, but the gap, though still wide, was narrowing again in the 1980s. Steel worker wages rose only 43 percent between 1978 and 1983 compared to an average of 50 percent for other durable goods industries. For the first time in nearly 50 years, the pay of unionized steel workers was cut by $1.31 an hour during the 1983 negotiations. Even more substantial wage cuts were emerged from the 1986 negotiation.

At the same time, the emerging minimill sector of the industry (discussed below) was based upon nonunion employees with substantially lower wages and benefits whose productity pace was substantially higher. All was not hopeless on the productivity and pay front. If the U. S. industry overall could cut its labor requirements by an average of two manhours per ton or its hourly labor costs by $6.00, thus reducing its unit labor costs by $50.00, international competitveness could be restored, regardless of exchange rates or dumping practices.[5] There has been little likelihood of such an industry-wide concession on wages and work rules but at least the break up of industy-wide bargaining prior to the 1986 negotiation made it possible to approach those goals on company-by-company basis.[6]

4. Technical Change

The four major technologicl changes in steelmaking during the past 35 years have been the basic oxygen furnace, the electric furnace, continuous casting and direct iron reduction. All have the major advantage of using less raw materials and energy per ton of steel produced. The basic oxygen furnace can melt down heats of up to 300 tons of iron in 45 minutes compared to 6 hours in the traditional open hearth. The electric furnace melts down scrap, bypassing the iron-making stage. The use of both has increased rapidly with the United States lagging in the use of the basic oxygen furnace (Table 11).

[Table 11] Percentage of Crude Steel Produced by Various Processes for Major Countries

Country	Open Hearth		Basic Oxygen		Electric Furnace	
	1967	1984	1967	1984	1967	1984
U. S.	55.6	.0	32.6	57.1	11.6	33.9
Japan	14.6	0	67.2	72.3	18.3	27.7
West Germany	37.0	0	31.5	80.6	8.5	19.4
France	21.8	0	16.7	80.4	9.7	19.6
U. K.	57.1	0	27.8	68.1	14.3	31.9
South Korea	36.3	0	0	70.5	63.7	29.5
Brazil	N. A.	4.4	N. A.	69.7	N. A.	25.9

Source : International Iron and Steel Institute, *Steel Statistical Yearbook*, various years.

5) Athor's calculations based on relative pay and production levels.

6) George Ruben, "Developments in Industrial Relations", *Monthly Labor Review* 108 (July 1985) : 56.

they would otherwise have offered to use as "caving in" money when the government applied pressure.

The 116-day 1959 strike occurred when the government changed its script and did not intervene. That strike changed the perceptions of the parties and made them anxious to avoid a repeat performance. However, it also taught steel users that there were emerging international sources of supply. With trade relations established and a newly-equipped steel industry emerging in previously war devastated Europe and Japan, imports rose inexorably.

But that did not end tripartism; it only brought government inside the bargain. The parties' determination to aviod further mass strikes led ultimately to the Experimental Negotiating Agreement (ENA) in 1973. In essence, the union agreed to a no-strike pledge in exchange for regular wage increases tied to productivity plus inflation.[4] The government sealed the agreement with an implied promise to limit import competition and not to oppose cost pass-throughs. No one promised to work to keep the industry competitive. The year 1973 was the worst moment in history for such an agreement. The emergence of Organization of Petroleum Exporting Countries (OPEC) strengh that winter brought on a decade of high and often double-digit inflation and cost of living adjustment (COLA) ran away with steel wages.

Competing countries were hit even harder by rising energy costs. Some were rapidly expanding and recruiting and training labor at the same time. Others had their own collective bargaining systems with cost of living adjustments. Only the newly emerging South Korea and Brazil industries were shielded by government policy from collective bargaining pressures. Thus, the wage gap between the U. S. and its steel competitors actually narrowed in relative terms during the period between 1964 ad 1980 (Table 7).

[Table 7] Indices of Labor Cost, Productivity and Unit Labor Cost in Iron and Steel and All Manufacturing for Five Countries (1964=100) in 1980

	Hourly Labor Cost		Output per Hour		Unit Labor Cost	
Country	Iron & Steel	All Mfg.	Iron & Steel	All Mfg.	Iron & Steel	All Mfg.
U. S.	382	316	119	141	321	224
Japan	725	807	352	394	206	205
Germany	448	461	227	217	197	212
U. K.	827	898	217	197	689	538
France	754	632	221	233	341	271

Sources : M. E. Kreinin, "Wage Competitiveness in the U. S. Auto and Steel Industries", *Contemporary Policy Issues* 4 (January 1984) : 44.

4) Jack Stieber, "Steel", in *Collective Bargaining : Contemporary American Experiences*, ed. Gerald G. Somers (Madison, Wisconsin : Industrial Relations Research Association, 1980), pp. 181-90.

U. S. minimill shipments have risen from 16. 3 percent of the U. S. total in 1980 to 18. 3 percent in 1983 and are expected to double the 1983 percentage by the end of the century (Table 13). So far, the minimills have been primarily nonunion, unimpeded by work rules, paying lower base wages but adding to earnings possibilities through more extensive use of wage incentives production bonuses than is customary in the intergrated mills.

The saving in labor costs where the U. S. is at a disadvantage combined with the use of scrap where the U. S. is at advantage puts the U. S. minimill on an equal production cost footage with its international competitors (Table 14). Not only are international transportation costs saved but the minimills can locate near any market which also has a source of scrap, saving domestic trasportation costs. Scarcity of domestic sources of scrap and high electricity costs deter Japan and Third world steel-makers from competing with U. S. minimills. Should scrap prices rise too high, the direct reduction development will have to be accelerated. The limited range of steel products to which the minimill technique is applied is the major factor in limiting the projection of minimill production. That range of product can be broadened. But for that one-third of industry or more, there is no obvious reason for the U. S. to be at a competitive disadvantage.

[Table 13] Comparisons Between Minimills and Integrated Producers in U. S. Trend Projections for The 1980s and 1990s

Years		1983	1985	1990	2000
	Minimills	18. 0	20. 5	25. 0	35. 5
Capacity*	Integrated	118. 5	105. 5	92. 0	75. 5
Raw Steel	Minimills	14. 4	18. 5	22. 4	31. 7
Production*	Integrated	72. 5	83. 7	77. 0	65. 2
	Minimills	12. 4	15. 9	20. 2	29. 8
Shipments*	Integrated	55. 1	63. 6	60. 8	56. 7
Share of Total	Minimills	18. 3	20. 0	25. 0	34. 5
Shipment (%)	Integrated	81. 7	80. 0	75. 0	65. 5
	Minills	86. 0	86. 0	80. 0	94. 0
Yield (%)	Integrated	55. 1	63. 6	60. 8	56. 7
	Minimills	3. 3	3. 0	2. 3	1. 5
Productivity**	Integrated	8. 4	7. 8	6. 7	4. 8

Source : U. S. Congress, Senate, Committee on Labor and Human Resources, *Employment and Productivity Trends in the Steel Industry Hearings before a Subcommittee of the House Committee on Labor and Human Resources on S. Hrg. 98-816*, 98th Cog., 2d sess., 1984, p. 156.

* : millions of metric tons ** : manhours per ton

[Table 14] Comparative Production Costs of Wire Rods for The U. S., West Germany, and Japan in 1980
(dollars per net shopped)

	Integrated			Minimill		
Country	U. S.	F. R. G	Japan	U. S.	F. R. G	Japan
Labor	131	84	51	60	45	37
Iron ore	62	50	49	—	—	—
Purchased Scrap	15	5	3	93	96	96
Coal or coke	52	75	59	—	—	—
Other energy	46	37	40	45	52	51
Other costs	60	61	64	65	69	68
Operating costs	372	312	266	263	262	252
Depreciation	12	14	16	11	12	11
Interest	5	8	18	7	8	10
Misc. taxes	5	2	4	3	1	2
Total Costs	393	336	304	284	283	275

Source : Donald F. Barnett and Louis Schorsch, *Steel : Upheaval in a Basic Industry* (Cambridge, Massachusetts : Ballinger Publishing Company, 1983), p. 95.

Ⅳ. THE U. S. STEEL INDUSTRY'S PROSPECTS

During the past 20 years, steel has become a truly international industry and one characterized by substantial overcapacity. The long-run prospects for the U. S. portion of that industry depend upon perceiving and achieving a role which makes economic sense within a rationalized world steel market. Who is going to produce and who is going to consume what steel products? What is the U. S. wiling to invest in its steel industry? In which products and technologies can it compete?

There has not been in the industrial world a nation with economic power a international influence without a viable steel industry. But that does not mean there cannot be in the future. Steel has long been a bellweather of employment and pay. Those employment opportunities can be replaced but not likely at the same rates of pay for people of the same levels of education and skill.

There are also adequate sources of steel supply to meet all of the nation's needs–as long as access is not denied by war. Some level of domestic steel production is essential to national defense; how much depends upon the nature of any potential conflict.

We consider here the prospects for investment in the U. S. steel indusry, the products and technologies in which successful competition is most likely and the resulting employment and pay consequences.

1. Prospects for Steel Investment

The U. S was historically a labor-short nation with wags rates substantially above its older industrial competitors. The population explosion in the less developed countries

accentuated the U. S. wage disadvantage. However, capital intensive production methods and rapid rate of productivity increases offset the wage disadvantage. Trouble developed as the pace of productivity improvement slowed after 1965, investment incentives diminished in some industries and investment was diverted into avenues which did not reduce unit labor costs.

The Office of Technology Assessment (OTA) of the U. S. Congress estimated in 1980 that an investment of $5.3 billion per year for 10 years would be necessary to modernize the existing U. S. steel-making capacity.[8] The American Iron and Steel Institute fixes at $7.0 billion the annual investment need of the industry, including new facilities.[9] The industry has spent an average of $3.4 billion per year since 1980 and shows little sign of substantially increasing that pace (Table 15). The OTA estimate that the $5.3 billion investment would produce cost saving of 2 percent is hardly encouraging.[10] The reluctance to invest in integrated mills is adequately

[Table 15] Annual Investment Expenditure in Relation to Crude Steel Production in The Main Steel-Production Countries
(Units : $Million ; U. S. Dollars per ton)

		1962	1970	1974	1976	1980	1981	1982	1983
West	$mill.	418	627	581	701	722	763	717	597
Germany	US$/ton	12.8	13.9	10.9	18.7	16.5	18.3	19.9	16.7
	$mill.	437	369	630	460	347	380	401	540
France	US$/ton	25.3	15.5	23.3	19.8	15.0	17.9	21.8	30.7
	$mill.	476	269	500	938	299	332	233	253
U. K.	US$/ton	22.9	9.7	22.3	42.1	26.6	19.0	17.0	16.9
	$mill.	106	175	403	442	487	698	490	165
Canada	US$/ton	16.3	15.7	29.7	34.1	31.1	40.9	41.7	13.0
	$mill.	911	2,000	2,115	3,400	3,400	3,365	4,219	3,235
U. S.	US$/ton	10.1	16.8	16.0	29.3	33.4	31.5	62.4	42.1
	$mill.	615	1,889	2,844	3,509	2,865	3,830	3,720	
Japan	US$/ton	20.8	20.2	24.3	32.7	25.7	35.4	38.5	38.3

Source : Organization for Economic Cooperation and Development, *The Iron and Steel Industry*, various years.

8) U. S. Congress, Office of Technology Assessment, *Technology and Steel Industry Competitiveness* (Washington, D. C. : O. T. A., 1980), p. 309.

9) American Iron and Steel Institute, *Steel at the Crossroads : The American Steel Industry in the 1980s* (Washington, D. C. : AISI, 1980), pp. 43-54.

10) U. S. Congress, Office of Technology Assessment, *Technology and Steel Industry Competitiveness* (Washington, D. C. : O. T. A., 1980), p. 309.

explained by Table 16. The U. S. industry has actually experienced a greater rate of return than steel industries of any other nation except Canada, but government ownership and subsidization dampens this advantage.

Minimill investment was sparked by a rate of return at least equal to the average for all manufacturing though that return suffered during the recession of the early 1980s (Table 17). That is also true of specialty steel firms. However, the specialty steel industry complained bitterly of its exclusion from the trigger price mechanism (TPM) established during the 1970s to protect the U. S. steel industry from the suspected dumping proclivities of competing governments.[11] Imports have been cited as an explanation of the reluctance to invest in the industry.[12] Given the rate of

[Table 16] Profit Rates on Steel Sales for Major Countries : Net Income/Sales (%)

Country	1975	1977	1979	1980	1981	1982	1983	1984
U. S.	4. 3	0. 4	2. 1	3. 0	3. 9	-6. 8	-9. 1	-0. 1
Japan	0. 6	0. 6	3. 3	2. 9	1. 9	1. 5	-0. 3	N. A.
W. Germany	1. 4	0. 1	0. 4	0. 6	N. A.	N. A.	-1. 0	N. A.
France	-15. 9	-23. 5	-10. 1	-11. 5	N. A.	N. A.	N. A.	N. A.
U. K.	-10. 8	-14. 1	-17. 6	-22. 6	N. A.	N. A.	-7. 2	N. A.
Canada	6. 0	4. 9	7. 1	7. 4	N. A.	N. A.	N. A.	N. A.
S. Korea	N. A.	N. A.	N. A.	N. A.	2. 6	4. 5	1. 5	1. 3

Sources : U. S. Congress, Senate, Committee on Labor and Human Resources, *Employment and Productivity Trends in the Steel Industy, Hearings before a Subcommittee of Senate Committee on Labor and Human Resources on S. Hrg. 98-816* 98th Cog., 2nd sess, 1984, p. 91 ; Korean Iron and Steel Federation, *Statistical Yearbook*, various years.

[Table 17] U. S. Comparative Return (Loss) as A Percent of Equity for Integrated Mill, Minimill, and All Manufacturing

	Integrated Steel	Mini Mill	Manufacturing
1972-76	9. 1	15. 8	14. 0
1977-81	5. 1	17. 0	16. 2
1982	(25. 2)	0. 8	11. 0
1983	(16. 5)	3. 2	10. 6

Sources : U. S. Congress, Congressional Budget Office, *The Effects of Import Quotas on the Steel Industry* (Washington, D. C. : CBO, 1984), p. 31 ; Council of Economic Advisers, *Economic Report of the President*, February 1986, Table B-88.

11) U. S. Congress, House, Committe on Energy and Commerce, *Capital Formation and Industrial Policy, Hearing before a Subcommittee of the House Committee on Energy and Commerce on H. R. 97-174*. 97th Cong., 2nd sess., 1982, pp. 201-9.

12) U. S. Congress, House, Committee on Ways and Means, *Problems of the U. S. Steel Industry, Hearing before a subcommittee of the House Committee on Ways and Means on H. R. 98-93*. 98th Cong., 2nd sess., 1984, p. 423.

return to the basic integrated mills, reluctance to upgrade them is understandable. As an investment decision, U. S. Steel's purchase of Marathon oil was faulty only in its assumption about the future profitability of the oil industry. A private enterprise economy cannot attract private capital to an essential but low-profit industry without its own less direct forms of subsidization and incentive. As its chairman has been quoted as saying, "U. S. steel is not in the business of making steel. It is in the business of making money."[13] It is doing progressively less of either.

2. Semifinished Products Importation

One promise on the horizon is alliance between U. S. and foreign industry servicing the U. S. market by finishing here semifinished products imported from abroad. The technological advances which have outstripped U. S. investment are primarily at the ironmaking and steelmaking stages. Those at the finishing stage have been less dramatic and the U. S. has experienced less lag in those which have occurred. Since iron and steelmaking are more labor intensive than the finishing activities, the U. S. is at less of a disadvantage in the latter.

The proposal of U. S. Steel in 1978 to finish British Steel slab in its Fairless, New Jersey plant created considerable consternation in the country but did get the issue explored before it fell through. The company's argument was that it could not afford the investment necessary to bring the plant's steelmaking capacity up to date but that its finishing capacity was still efficient.[14]

Despite the furor which greeted that proposal, semifinished product importation has increased persistently with little public notice (Table 18). Several Japanese and U. S. steel companies have discussed Japanese investment in U. S. mills. South Korea's Pohang Iron and Steel Company has offered to deliver its slabs, blooms and billets to the Fairless plant for as little as $200 per ton whereas it costs Fairless $275 to produce its own semifinished product.[15] Already California Steel, which purchased the Kaiser Steel Fontana Plant, is importing Brazilian slabs and finishing it in its California mill.[16]

[Table 18] U. S. Import Trends for Semifinished Products

	1977	1979	1981	1983	1984
Imports (thousan tons)	270	313	717	746	1516
Semiproducts Imports					
(%) Total Imports	1. 5	2. 0	4. 0	4. 8	5. 7

Sources : American Iron and Steel Institute, *Annual Statistical Report*, various years and author calculation.

13) Jack Metzgar, "Would Wage Concessions Help the Steel Industry?" *Labor Research Review* 1 (Winter 1983) : 26.

14) "Talks on Importing BSC SLab to Continue", *American Metal Market*, v. 91., 20 April 1983. p. 1.

15) U. S. Steel Corporation Discussing Link to Korean Firm", *Wall Street Journal*, 4 June 1984, p. 1.

16) International Efforts Revive A Steel Factory Kaiser had Shut Down. *Wall Street Journal* 4 June 1985, p. 1.

The western component of the U. S. steel industry was jarred in December 1985 when U. S. Steel started a joint venture with Pohang Steel to import semifinished products for refinishing in U. S. Steel's Pittsburg, California plant. The joint venture cheered the 1, 100 employees of the Pittsburg plant but angered the 2, 400 employees of the Geneva, Utah plant who had been supplying steel for that purpose. The intermountain market is inadequate to support the continued operation of the Utah plant without the California outlet.[17] The Utah community was convinced that, had U. S. Steel invested in the modernization of the Utah plant, it could have met the competitive challenge. The corporation had been unwilling to keep the plant up to date even though the local management and employees had managed to keep the productivity rate for the obsolescing plant well above the industry average. U. S. Steel had left the plant's technology basically unchanged from its 1942 construction by the Government Defense Plant Corporation. U. S. steel had tried to interest the Koreans in buying into the Utah Plant. Having built plants only at the water's edge, Pohang Steel was unwilling to put money in an inland plant with the freight cost handicaps. Instead, they offered to invest $400 million in the California plant, as long as it imported Korean steel for finishing.

Under the Reagan Administration's steel import restraint program, a maximum of 1. 5million tons of semifinished steel can be imported at current tariff level. The policy issue will have to be faced when rising imports reach that level.

3. The Outlook for Employment

Whatever the prospects for the U. S. steel industry, a return to employment levels of even the recent past will not be among them. From its peaks of 652, 300 in 1953 and 644, 000 in 1969, steel industry employment fell to 343, 100 in 1983 (Table 24). The steel industry's hopes for the future must be based on accelerating productivity, either through increased investment in integrated mills or a shift to those portions of the industry such as minimills, which already have higher productivity. It is not possible to have rapidly rising productivity and rising employment without extraordinary growth in output.

The Bureau of Labor Statistics (BLS) in 1983 Projected steel industry employment of 435, 000 in 1990 and 447, 000 in 1995 (Table 19). The elongated clearance process within BLS makes it likely that projections published in 1983 were completed as much as two years earlier. Failure of industry employment to recover after the 1981—82 recession might have dampened BLS optimism. In what is probably a more realistic projection, Barnett[18] expects steel employment of 238, 700 in 1990. Employment recovery is not among the alternatives available to the steel industry. The options are to (1) preserve what is preservable of the industry, including the jobs which remain after strong productivity improvement, (2) cut wages drastically, or (3) let the industry decline into oblivion.

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17) Garth Mangum and Sae-Young Kim, "Geneva Steel in the Utah Economy : Retrospect and Prospect", *Utah Economic and Business Review* 45-12 December 1985, 1-21.

18) See U. S. Congress, Senate, Committee on Labor and Human Resources, *Employment and Productivity Trends in the Steel Industry, Hearings before a Subcommittee of Senate Committee on Labor and Human Resources on S. Hrg. 98-816*. 98th Cog., 2d sess, 1984, p. 156.

[Table 19] Employment in The United States Steel Industry and Projections (1973-1995)

Year	Industry Employment	Percent Change
1973	604, 600	+6. 4
1974	609, 500	+0. 8
1975	548, 200	-10. 1
1976	549, 400	+0. 2
1977	554, 300	+0. 9
1978	560, 500	+1. 1
1979	570, 500	+1. 8
1980	511, 900	-10. 3
1981	506, 100	-1. 1
1982	394, 300	-22. 1
1983	343, 100	-14. 7
1984	334, 000	-2. 7
1985	237, 500	-28. 9
1990	435, 000	+12. 1*
1995	447, 000	+0. 5*

Sources : Bureau of Labor Statistics and Valerie Personick, "The Job Outlook Through 1995 : Industry Output and Employment Projections", *Monthly Labor Review*, November, 1983 : 24-36;Data for 1984 and 1985 — from U. S. Bureau of Labor Statistics, *Employment and Earnings*, Monthly. * Annual change rate.

V. WHAT TO DO ?

The problems of the U. S. steel industry are but a piece of the overall problem of the world steel industry : overcapacity and underconsumption. There is ample need for all the steel the world industry can produce. But the international distribution of income is such that the needs of the Third World cannot be transformed into effective demand. Yet until the problems of feeding the world are solved, the problems of providing automobiles, machinery, railroads, steel-skeletoned skyscrapers and other steel products are of lesser priority. Hence, overcapacity is the operational problem.

Steel is one of the way stations on the trail of economic development. Countries tire of the captive position of raw materials suppliers to industrial nations. Export of labor-intensive production combined with import of capital intensive goods from abroad condemn them to low wages and fluctuating demand. Since what the less-developed country typically has plenty of is labor and what it lacks is capital, labor-intensive industry is its best resort. But the less developed nation seldom sees it that way.

Since the high wage imports are the most obvious evidence of its disadvantages, import substitution is the usual objective. Textiles, clothing and shoes begin the industrialization process because capital requirements are relatively low, the demand is obvious and the

domestic markets are accessible. However, the domestic market soon proves inadequate and foreign outlets must be sought.

Unless foreign capital flows in to tap the surplus labor supply for the export of more sophisticated consumer goods, the next target of economic developers becomes industries processing basic raw materials, notably steel, to supply the intermediate product for more advanced industries. The economies of scale in steelmaking are such that mass markets are necessary. Since these are never adequate in the developing country, it must export its steel to achieve efficient levels of operation. In a private enterprise-oriented economy, steel would not be an attractive outlet for private investment under these circumstances. However, emerging economies do not develop their steel industries and only afterward face the issue of finding markets. Hence an inherent tendency to overcapacity and goverment subsidized production. As the world's largest market as well as the world's largest steel producer, the U. S. is the inevitable target and opponent industrial battles.

As earlier sections of this paper have detailed, there are three bases for the competitive difficulties of the U. S. steel industry :

1. subsidies provided to their steel industries by foreign governments;
2. inadequate U. S. investment in new technologies; and
3. relatively high U. S. labor costs.

Foreign subsidies are a source of ambivalence. As noted, they are subsidies to the American consumer as well as to the foreign producer. "Importing" is estimated to have cost the U. S. steel industry $2.6 billion in lost profits and steel workers $2.4 billion in lost wages during 1977–83. On the other hand, the Congressional Budget Office estimates the cost to U. S. consumers of the relatively mild Reagan Administration steel import restrictions at over $6 billion per year.

The Office of Technology Assessment calculates that $5.5 billion per year in investment is needed to modernize the U. S. industry in order to make it competitive. The American Iron and Steel Institute puts a $6.5 billion price tag on the same objective, this compared to the current average annual investment of $3.4 billion. However, as long as the rate of return on steel investment is substantially below the economy wide average, investment funds will not voluntarily make their way to the industry.

The mini-mill and specialty steel sectors give promise of substantial expansion. The importation of semifinished iron and steel products for finishing in the United States is a trend to be encouraged. It has emerged from normal economic forces without favoritism or subsidy. It preserves for U. S. mills what they can do best, rationalizing the industry around traditional principles of comparative advantage. Where the comparative advantages of foreign mills emerges from subsidization, U. S. public policy must pay attention to the long-term tradeoffs between the interests of U. S. consumers and U. S. producers. If destruction of the U. S. industry now would result in higher prices later, heavier pressure on foreign governments to leave their industries to compete on equal grounds are justified.

U. S. steel wages have always exceeded those of the rest of the world. The transition from coordinated to firm by firm bargaining should promote better adaptation of wage levels and work rules to the conditions and markets of each company and perhaps each

facility. Reasserting the historical pace of productivity growth alone would not be sufficient in the current environment. To overcome the dual handicaps of extraordinary U. S. wage increases during the 1970s and the rapid pace of productivity growth in some competing nations, the U. S. would require productivity growth far above its historical trend.

With company by company and plant by plant emphasis in employer-employee relations, it should be possible to reduce the mutual suspicion which has historically characterized the industry. Survival is a strong incentive on the employee side. Whether it is among the employers remains to be seen. Past experience in which funds saved through employee concessions has been siphoned into industries of high rates of return has not reinforced the steelworkers willingness to sacrifice.

There are seldom any answers to solve the current problems which the U. S. steel industry has faced. But encouragement of the minimill and specialty steel components of the industry, placing no obstacles in the way of semifinished importations, improved labor-management cooperation in pursuit of productivity betterment, acceptance by steelworkers of a lessened premium over the rest of manufacturing and greater management commitment to its own future could, all together, maintain a viable but reduced U. S. steel industry.

Immediate demand of every threatened steel community is the worst possible solution : import protection. Foreign competition is estimated to have cost the U. S. steel industry $2. 4 billion in lost profits and the steel workers $2. 6 billion in lost wages during 1977—83. Yet the Congressional Budget Office estimates that the relatively mild Reagan Administration's steel import restrictions are currently costing the U. S. consumer over $6 billion per year.[19] Policies must be directed toward identifying those components of the industry which can survive against unrestricted international competition and encourage public and private policies to support that "leaner and meaner" industry.

REFERENCES

[1] AMERICAN IRON and STEEL INSTITUTE. *Annual Statistical Report*. Washington, D. C. : AISI., various years.

[2] AMERICAN IRON and STEEL INSTITUTE (1980). *Steel at the Crossroads : The American Steel Industry in the 1980s.* Washington, D. C. : AISI

[3] "Talks on Importing BSC Slab to Continue." *American Metal Market*. v. 91, 20 April 1983, p. 1.

[4] AULT, DAVID E. (1974). "The Development of Continuous Casting in the U. S. Steel Industry : Reply." *Economic Inouiry* 12 (June), 271—77.

[5] BALDWIN, C. Y., TRIBENDIS, J. J., and CLARK, J. P. (1984) "The Evolution of Market Risk in the U. S. Steel Industry and Implications for the Required Rate of Return." *Journal of Industrial Economics* 33 (September), 73—9.

[6] BARNETT, D. F. and CRANDALL, ROBERT W. (1986) *Up from the Ashes : The Rise of the Steel Minimill in the United States.* Washington, D. C. : The Brookings Institution,

19) Marshall's Statement (1984, p. 468) and U. S. Congressional Budget Office (1984, pp. 44-47)

[7] BARNETT, D. F. and SCHORSCH, L. (1983) *Steel : Upheaval in a Basic Industry.* Cambridge, Mass. : Ballinger Publishing Co.

[8] BHAGWATI, JAGDISH N. and SRINIVASN, T. N. (1983) *Lectures on International Trade.* Cambridge, Mass. : The MIT Press.

[9] CIMA, LAWRENCE R. (1982) *Japanese Steel Exports to The United States : A Theoretical and Empirical Anglysis.* Ph. D. dissertation, West virginia University.

[10] CLARK, T. B. (1984) "When Demand is Down, Competition Up, That Spells Trouble for American Steel." *National Journal* 16−1 (January)

[11] CRANDALL, ROBERT W. (1981) *The U. S. Steel Industry in Recurrent Crisis.* Washington, D. C. : The Brookings Institution.

[12] HOGEN WILLIAM T. (1983) *World Steel in the 1980s : A Case of Survival.* Lexington, Mass. : Lexington Press.

[13] _____(1984) *Steel in the United States : Restructuring to Compete.* Lexington, Mass. : Lexington Press,

[14] INTERNATIONAL IRON and STEEL INSTITUTE, Committee on Statistics. *Steel Statistical Yearbook.* Brussels, Belgium : IISI, various years.

[15] KIM, SAE-YOUNG (1983). "The Effects of Labor Productivity on the Determination of Wage in the Korean Steel Industry." *Journal of Gyeong Sang National University* 22 (Winter) 75−8.

[16] _____(1987). *The Determinants of International Market Share in the U. S. Steel Market : An Application of Seemingly Unrelated Regression.* Ph. D. dissertation, University of Utah.

[17] KIM, Y. H. (1976) *The Growth of Korean Steel Industry.* Seoul : Korea Development Institute.

[18] KOREAN IRON and STEEL FEDERATION. *Statistical Yearbook.* Seoul, Korea : KISF, various years.

[19] KREININ, M. E. (1984) "Wage Competitiveness in the U. S. Auto and Steel Industries." *Contemoorary Policy Issues* 4 (January) 39−50.

[20] LIVERNASH, E. ROBERT. et al. (1961) *Collective Bargaining in the Basic Steel Industry.* Washington, D. C. : U. S Department of Labor.

[21] MANGUM, GARTH and KIM, SAE-YOUNG (1985). "Geneva Steel in the Utah Economy : Retrospect and Prospect." *Utah Economic and Business Review*

[22] _____(1986). "Survival of the U. S. Steel Industry In a Changing World Economy." *Economic Forum* 16 (Summer) 45−12 (December) : 1−21.

[23] MANGUM, GARTH ; MANGUM, STEPHEN ; and KIM, S AE-YOUNG (1986). "The High Cost of Peace in Steel." *Challenge* (July-August) 47−50.

[24] _____. "Steel on the Industrial Staircase : A Conceptual Model for early Warning to other Industries and Nations." *Economic development Quarterly* (Forthcoming).

[25] MARCUS, PETER F. *World Steel Dyngmics.* New York : Mitchell, Hutchins, various issues.

[26] MARSHALL BARTLETT INC., Analysis of Injury to the Domestic Steel Industry Caused by Imports (Report to international Trade Commission), May 3, 1984

[27] MCADAMS, A. K. (1967) "Big Steel, Invention and Innovation, : Reconsidered." *Quarterly Journal of Economics* 81 (August). 457—74.

[28] METZGAR, JACK (1983). "Would Wage Concessions Help the Steel Industry?" *Labor Research Review 1* (Winter) 26—37.

[29] MUELLER, H. G. (1984) "Trends in Steel Production and Trade", paper presented at Annual Conference of Eastern Economic Association (Paper No. 92), New York, 14—18 (March).

[30] _____ (1985). "The Changing U. S. Position in the International Steel Market" In *Revitalizing the American Industry*, pp. 213—262. Edited by Milton Hochmuth & William Davidson. Cambridge, Mass. : Ballinger Publishing Co.

[31] NAM, JONG-HYUN (1979). "An Analysis of Demand and Supply Structure in Korean Steel Industry." *Korean Development Review* (March) : 125—143.

[32] OFFICE of the PRESIDENT. Council on Wage and Price Stability (1975). *A Study of Steel Prices.* Washington, D. C. : Government Printing Office.

[33] _____ (1975). *Report to the President on Prices and Costs in the U. S. Steel Inustry.* Washington, D. C. : Govenment Printing Office, 1977.

[34] ORGANIZATION for ECONOMIC COOPERATION and DEVELOPMENT. *The Iron and Steel Industry.* Paris : OECD, various years.

[35] STEEL PANEL COMMITTEE on TECHNOLOGY and INTERNATIONAL ECONOMIC and TRADE ISSUES. (1985). *The Competitive Status of the U. S. Steel Industry.* Washington, D. C. : National Academy Press,

[36] STIBER, JACK (1980). "Steel". In *Collective Bargaining : Contemporary American Experiences*, 188—90. Edited by Gerald G. Somers. Madison, Wisconsin : Industrial Relations Research Association,

[37] THORN, RICHERD S. (1968). "Steel Imports, Labor Productivity, and Cost Competitiveness." *Western Economic Journal* 6 (December) 375—84.