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IV Industry: New Protectionism and New Competitors

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7 The Steel Crisis in the United States and the European Community: Causes and Adjustments

David G. Tarr

7.1 Introduction

The years since 1974 have been very difficult ones for the steel industries of the United States and the European Community (EC). Production in both regions has dropped by more than one-third and employment has fallen even more. In recent years there have been either large losses or small profits.[1] Data on these trends are presented in table 7.1. In response to these developments the U.S. government and the Commission of the European Community have adopted rather similar external policy measures but quite different domestic measures. How well are these measures suited to meet the problems affecting the industry and how might they be modified to deal more effectively with these problems?

In order to answer these questions, the fundamental causes of the industry's problems are discussed in section 7.2. The policy responses and their effects in the U.S. and EC are described in section 7.3. The last section of the paper evaluates these policy responses.

7.2 The Causes of the Crisis

7.2.1 New Entrants in the International Steel Market

In the past 30 years there has been a dramatic shift in the pattern of steel production, exports, and imports around the world. The basic

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Table 7.1 **Steel Production, Capacity, and Labor Employed in the U.S., EC, and Member Countries**

	Crude Steel Production (thousands of metric tons)				Capacity (crude) (thousands of metric tons)				Employment (thousands of workers)			
	1974	1977	1980	1984	1974	1977	1980	1984	1974	1977	1980	1984
United States	132,195	113,700	101,455	83,941	na	160,000	153,700	135,300	512,395	452,388	398,829	236,002
EC9	159,881	126,121	127,732	119,316	155,526	200,869	202,536	172,851	794,770	721,619	597,873	445,843
FRG	53,232	38,984	43,838	39,389	53,232	67,701	66,924	51,556	232,037	209,465	197,406	152,467
France	27,021	22,094	23,176	19,000	27,020	33,282	32,512	28,829	157,833	142,992	104,940	85,064
Italy	23,804	23,335	26,501	24,061	23,789	34,168	39,385	37,271	95,656	96,593	99,528	75,611
Netherlands	5,873	4,923	5,264	5,739	5,840	8,230	8,512	7,965	25,077	23,293	21,047	18,748
Belgium	16,227	11,256	12,322	11,305	16,225	19,151	19,659	15,664	63,738	49,752	45,220	37,184
Luxembourg	6,447	4,329	4,618	3,987	6,448	8,200	6,380	6,380	23,503	17,437	14,904	12,713
United Kingdom	26,667	20,467	11,277	15,121	22,318	28,870	27,954	23,991	196,926	178,874	112,120	61,856
Ireland	110	47	2	166	110	91	90	345	na	704	527	657
Denmark	536	686	734	548	535	1,177	1,120	850	na	2,509	2,181	1,543

Sources: International Iron and Steel Institute, *Annual Statistical Report,* various years for production data; Eurostat, *Iron and Steel Yearbook,* various years, for EC capacity and employment data; and American Iron and Steel Institute, *Annual Statistical Report,* various years for U.S. capacity and employment figures.

trends are summarized in table 7.2. In 1950, the United States produced almost half of the world's steel output; by 1984, its share was less than 12 percent of this output. The U.S. became a net importer of steel in 1959 and has imported over 20 percent of its steel throughout most of the 1980s. The European Community tripled its steel production between 1950 and 1970. Its output has been reduced from the peak of the early 1970s, but the EC remains a net exporter of steel products. Japan emerged as a major player in the international steel market during the 1960s and early 1970s, with an increase in production of over 100 million tons between 1960 and 1973 (the peak year for Japanese production). In fact, Japan's increased production capability is underestimated by the production figures because Japan is estimated to have been operating at only about 65 percent of capacity during the last decade (Bradford 1986, 82). As will be shown in the next section, in the last 10 to 15 years some developing nations, especially Brazil and Korea, have also emerged to become important players in the international steel market.

7.2.2 Decline in Demand

In the past 12 years, growth in overall demand for steel has been extremely sluggish; it can essentially be characterized as a period of zero growth. In 1973–74 steel production peaked in the noncentrally planned economies at about 519 million metric tons. After a recession in 1975, steel demand began to recover until it reached its 1973 level in 1979–80. Since 1980, however, steel production has remained at or below 500 million metric tons in the noncentrally planned economies with 1982 and 1983 being especially disastrous years for steel demand. The broad trends are summarized in table 7.3.

The years 1973–74 were very encouraging ones for the future of the world steel industry. Most forecasters of steel demand predicted significant growth in steel demand over the 1975–85 period.[2] As a result, a number of nations undertook major expansion projects for their steel industries. By the early 1980s, however, the optimism of 1974 had turned to pessimism as many companies, especially those in the U.S. and the EC, experienced significant losses.

Overall trends mask an even more ominous trend as far as the United States, the EC, and other industrialized countries (ICs) are concerned. From 1973 to 1984 there was a significant decline in steel consumption in the industrialized countries, from 416 to 322 million metric tons, while consumption in the developing countries (DCs) increased from 100 to 181 million metric tons, a total of 81 percent. Over this period demand in the United States fell by 36 million metric tons (crude steel equivalent) to 113 million tons and by 33 million metric tons (crude steel equivalent) in the EC to 95 million tons. Thus, while steel demand

Table 7.2 **The Changing International Positions of the U.S., EC, and Japanese Steel Industries**

	United States			European Community			Japan			World
	Output[a]	Percent of World Total	Net[b] Exports	Output[a]	Percent of World Total	Net[b] Exports	Output[a]	Percent of World Total	Net[b] Exports	Output[a]
1870	1.8	16.2%	−0.7	7.5	69.2%	1.2	—	—	—	10.8
1900	14.6	34.2	0.9	20.3	49.4	5.0	—	—	—	41.1
1920	49.2	59.8	2.2	27.8	33.7	8.0	0.9	1.1%	—	82.3
1950	96.8	48.4	1.6	53.2	25.6	9.0	5.3	2.6	.4	200.0
1960	99.3	27.6	−0.2	107.8	29.6	9.7	24.4	6.7	2.5	360.3
1970	131.5	21.6	−6.3	151.6	23.8	7.4	102.9	16.1	22.3	637.8
1980	111.8	14.1	−12.4	140.1	17.8	15.0	122.8	15.5	34.7	792.2
1984	91.5	11.7	−22.9	132.5	16.9	11.3	116.4	14.9	31.8	783.0

Source: Adams and Mueller (1986).

[a]In million net (or short) tons of raw steel.

[b]Exports minus imports, in million net tons of steel products. (One product ton is roughly equivalent to 1.25 tons of raw steel.)

Table 7.3 World Steel Production Trends

	Levels (millions of metric tons of crude steel equivalent)					Growth (% per annum)		
	1960	1973	1980	1982	1984	1960–73	1973–80	1980–84
ICs	233	463	407	338	376	5.4	−1.8	−2.0
DCs[a]	20	57	94	97	113	8.4	7.4	4.7
Subtotal	253	520	501	435	489	5.7	−0.5	−0.6
CPEs	87	179	215	210	221	5.7	2.7	0.7
Total	340	699	716	645	710	5.7	0.3	0.0

Source: Compiled from data available in International Iron and Steel Institute, *Annual Statistical Report*, various issues.

[a]China is included in the DCs.

in the developing world has been increasing, the opposite trend is apparent for the industrialized world. These trends are summarized in table 7.4.

Most forecasts of demand for the 1985–95 decade predict continued slow aggregate growth of about 1 percent annually for the noncentrally planned economies. Again, however, there is a sharp contrast in the expected growth patterns of the industrialized countries and the developing world. For the next decade, the International Iron and Steel Institute (IISI) forecasts annual growth of 0.1 percent in the industrialized countries, but 3 percent in the developing countries.

The growth of steel demand in the developing world and not in the industrialized countries is explained by the IISI's intensity-of-steel-demand curve. The curve is based on data that this organization has collected showing that per capita consumption of steel increases (at a decreasing rate) with national per capita income up to a maximum and then begins to decline.[3] There are a number of reasons why the steel intensity curve has the observed shape. First, infrastructure expendi-

Table 7.4 World Steel Consumption Trends

	Levels (millions of metric tons of crude steel equivalent)					Growth (% per annum)		
	1960	1973	1980	1982	1984	1960–73	1973–80	1980–84
ICs	218	427	360	298	339	5.3	−2.4	−1.5
DCs[a]	39	87	147	144	163	6.4	7.8	2.6
Subtotal	257	514	507	442	502	5.5	−0.2	−0.2
CPEs	89	181	214	209	218	5.6	0.0	0.5
Total	346	695	721	651	720	5.5	0.5	0.0

Source: Same as Table 7.3 except for 1960 data, which are taken from the World Bank data base.

tures tend to be significantly reduced after a given level of development is reached. Second, the share of service industries has been rising in most Organization for Economic Cooperation and Development (OECD) countries since 1974. As economies shift into banking, financial services, and insurance, and away from traditional smokestack industries, there is a decline in the demand for steel. Third, there is a saturation level for some consumer durables, such as refrigerators; once reached, this results in slower growth. A fourth reason is that manufacturers of products such as automobiles and cans have substituted alternative materials, and fifth, technological advances have reduced the demand for steel. For example, it is estimated by IISI that continuous casting reduces the demand for raw steel by 15 percent. In the decade from 1974 to 1984, the industrialized countries' production of steel by continuous casting went from 15 percent to 64 percent, while that of the developing nations went from 15 percent to 36 percent. Also, the development of stronger, thinner gauge steel has reduced the demand for final steel products.[4]

Table 7.5 **Unit Cost for Inputs: U.S. and Japan (dollars per metric ton of steel produced)**

	Total		Labor		Iron ore		Scrap		Coking coal	
Year	U.S.	Japan	U.S	Japan	U.S.	Japan	U.S.	Japan	U.S.	Japan
1976	294.65	161.93	143.55	49.64	44.51	26.87	21.82	22.72	53.73	41.38
1975	270.27	159.26	132.87	49.93	37.58	27.85	18.98	17.23	52.40	43.18
1974	215.55	147.30	100.91	42.60	29.66	21.65	34.10	33.65	29.20	29.84
1973	161.21	100.97	87.31	35.32	24.42	17.62	17.08	23.38	17.44	15.18
1972	155.11	83.56	89.52	31.97	23.84	16.97	11.26	12.04	16.08	14.65
1971	145.98	81.28	85.03	27.98	22.85	19.43	8.53	9.06	15.15	16.76
1970	137.23	78.05	80.81	23.22	21.54	17.47	10.05	16.05	12.80	14.65
1969	125.25	69.93	75.18	21.20	20.34	16.66	8.60	14.00	10.29	11.72
1968	119.40	67.78	70.35	20.83	20.65	16.99	6.71	12.16	10.69	10.91
1967	117.70	69.53	69.88	19.93	20.10	16.68	6.73	15.73	10.83	10.27
1966	113.21	71.86	65.93	20.68	19.95	18.14	7.72	14.88	9.99	10.84
1965	112.99	76.38	65.06	22.11	19.92	18.63	8.56	16.75	9.78	10.94
1964	114.97	75.20	67.00	20.97	20.41	16.73	8.25	19.27	9.74	10.05
1963	116.01	79.03	69.62	23.76	19.60	17.80	7.39	18.12	9.16	10.99
1962	118.74	81.56	71.36	24.10	19.93	18.97	6.83	17.43	10.17	12.33
1961	122.50	91.59	72.36	21.94	20.58	18.54	9.45	30.09	10.21	11.85
1960	120.18	85.08	71.83	23.01	19.47	17.91	8.24	23.16	11.48	11.50
1959	113.98	90.04	66.67	25.02	17.25	18.08	10.87	24.59	10.93	13.03
1958	122.18	98.65	70.09	30.12	19.75	21.20	9.94	19.37	13.09	16.75
1957	110.00	133.21	60.24	26.79	18.17	31.55	10.95	37.98	12.73	23.03
1956	110.84	119.83	54.67	26.66	17.51	25.78	17.78	35.15	12.15	20.01

Source: Federal Trade Commission Staff Report (1977, pp. 113–14).

Change in Relative Costs

Emergence of Japan and the Developing Countries

In a study that has come to be known as the Federal Trade Commission Staff Steel Report (1977), my colleagues and I investigated the causes of the changing patterns of steel trade flows over the period 1956–76. We concluded that the changing production pattern was primarily explained by changes in relative costs. Incorporated in table 7.5 is the summary table from the study, reporting the changes in variable steel costs between the United States and Japan. U.S. costs relative to Japan's went from being slightly lower at the beginning of the period to over $100 per ton greater than Japan's at the end of the period. Whereas Japan was considered to be the low-cost producer of steel in the world in the mid-1970s, the Republic of Korea (Korea) is now considered to enjoy that position. The data of table 7.6 reveal that as of 1984, Korea enjoyed a cost advantage of about $166 per ton over the U.S. and $77 per ton over the EC. While the table exaggerates the

Table 7.5 (continued)

	Fuel oil		Electric power		Noncoking Coal		Natural gas
Year	U.S.	Japan	U.S	Japan	U.S.	Japan	U.S.
1976	5.05	6.84	15.84	14.47	0.85	0.00	9.31
1975	4.95	8.66	14.03	12.41	0.85	0.00	8.60
1974	5.02	9.01	10.21	10.54	0.76	0.00	5.67
1973	1.91	3.43	8.09	6.04	0.54	0.00	4.40
1972	1.60	2.47	7.60	5.45	0.54	0.00	4.64
1971	1.54	2.73	7.70	5.31	0.62	0.00	4.55
1970	1.23	1.81	6.49	4.74	0.56	0.11	3.74
1969	0.94	1.44	5.83	4.80	0.51	0.10	3.54
1968	1.09	1.74	5.74	5.02	0.61	0.10	3.56
1967	1.05	1.87	5.30	4.92	0.63	0.13	3.16
1966	1.14	1.75	4.90	5.33	0.63	0.24	2.93
1965	1.28	1.93	4.64	5.70	0.63	0.31	3.09
1964	1.41	1.92	4.48	5.88	0.63	0.37	3.01
1963	1.58	2.04	4.73	5.87	0.73	0.45	3.19
1962	1.59	1.92	4.71	6.28	0.83	0.54	3.29
1961	1.74	2.04	4.27	6.50	0.89	0.63	2.99
1960	1.80	2.30	3.92	6.44	0.85	0.75	2.59
1959	1.78	2.09	3.47	6.61	0.80	0.61	2.19
1958	1.99	2.54	3.96	6.72	1.07	1.94	2.28
1957	1.97	4.27	3.73	6.29	0.75	3.31	1.46
1956	2.26	2.85	4.15	6.07	0.74	3.31	1.58

Table 7.6 **An International Comparison of Major Input Costs, 1984 (in dollars per net ton shipped)**

	Labor	Coal & Ore	Energy	Capital	Total	Difference from U.S. Cost
U.S.	170	102	76	55	403	0
EC	97	102	48	67	314	−89
Japan	82	97	46	77	302	−101
Brazil	44	86	50	114	296	−126
South Korea	24	97	48	85	256	−166

Source: Adams and Mueller (1986, 107).

Note: Product mix of steel output, i.e., the proportion of high and low value steel products is similar for the steel industries of the U.S., the European Community, and Japan. The steel industries of Brazil and South Korea produce a higher proportion of less sophisticated products, which causes the differential between their cost and that of the U.S. industry to be overstated by $15 to $25 per net ton shipped.

cost advantage enjoyed by Brazil and Korea by about $20 per ton because these two countries produce a product mix that is somewhat less finished than that of the other countries, the data suggest that at least these particular countries are not simply building "monuments." Rather, the technology of steel is no longer progressing rapidly and, therefore, in a world of free trade, production might well shift, gradually and in the long run, toward the developing world.[5]

Raw Materials and Transportation Costs.

When one examines the data on the cost estimates in the tables, it is apparent that the main explanation of the cost differences is the difference in labor costs. Raw material costs are not a major factor in the overall comparisons, although they can make a difference in the case of particular plants.

Steel and the raw materials used in making steel are relatively heavy products for their value. Transportation costs can loom large in total value if it is necessary to ship large distances by rail or truck. Having deepwater ports, with the resulting access to other's raw materials and the ability to ship their output at relatively low transportation charges, is an advantage enjoyed by Japan, Korea, and some other countries that compensates for their lack of domestic raw materials.

Access to low-cost water transport should be borne in mind in observing the pattern of closures among U.S. steel plants as well as in considering what to expect from a market-oriented closure pattern in the EC. Plants located on the Great Lakes with access to Mesabi range iron ore via water transportation (and the high-quality Appalachian coking coal) and proximity to the markets of Cleveland, Detroit, and

Chicago, are in relatively good condition. The inland plants in places like Pennsylvania and Ohio, however, will find it very difficult to survive.[6]

Labor Costs

The increase in the relative labor costs of the U.S. is the result of a combination of two factors: improved relative productivity of its competitors and an increase in its labor-compensation costs. To a lesser extent, these factors have also been important for the EC. In the mid-1960s, an average U.S. steelworker produced roughly twice as much steel per hour as his Japanese, German, French, or British counterpart (with the German worker producing slightly more than the other three). By 1982, if the output per U.S. worker is indexed at 100, the Japanese worker's productivity is at 141, the German worker's at 108, the French worker's at 100, and the British worker's at 71.[7] Data underlying table 7.6 suggest that the productivity of Korean workers is comparable to that of British workers (Adams and Mueller 1986, 107). Thus, the U.S. no longer has a significant productivity advantage, and the Japanese have surpassed both the U.S. and the EC.

Steelworkers around the world typically earn wages above those earned by the average manufacturing worker in their country. During the 1960s and early 1970s hourly labor costs had been less than 50 percent above the average for U.S. manufacturing workers. During the late 1970s, however, they soared to the point where, by 1982, U.S. steelworkers were earning 93 percent more than the U.S. average.[8] In Europe, steelworkers' premium over other manufacturing workers is much lower—between 7 and 32 percent. Only in Japan do steelworkers earn a premium comparable to that earned in the U.S., a premium which, in the Japanese case, appears to be productivity-based. These data are presented as table 7.7.

The combined productivity and wage trends explain the significant shift in relative costs against U.S. integrated producers. The trends are not as dramatic for the European producers, but the Japanese have also surpassed them in productivity, and they are faced with the emergence of steel producers in the developing world that have hourly labor costs less than one-quarter of theirs. The wage data for 1984 are presented in table 7.8.

Exchange Rates

Clearly, shifts in exchange rates over the last decade are very important in explaining changes in relative competitiveness. The real, multilateral trade-weighted value of the U.S. dollar rose 50 percent from 1980 to 1984, although in the past year it has fallen significantly. Thus the relative position of the United States has improved since the calculations underlying tables 7.6 and 7.8 were made. The relative

Table 7.7 **Hourly Compensation for Production Workers in the Steel Industry as Percentage of Hourly Compensation for Production Workers in Manufacturing in the Same Country**

	1975	1976	1977	1978	1979	1980	1981	1982
United States	161.26	162.05	162.19	163.37	167.03	176.19	173.72	192.88
Japan	172.68	169.56	168.35	169.26	168.39	173.54	175.83	174.95
Germany	115.00	113.67	111.21	111.32	112.40	112.32	110.19	110.39
France	127.83	128.23	129.82	122.73	120.82	116.93	116.45	112.72
Italy	127.08	121.42	118.08	120.64	119.46	117.53	118.00	118.12
Belgium	123.74	124.92	127.80	128.28	129.89	131.31	131.31	131.70
Luxembourg	112.53	111.17	112.00	111.77	111.20	109.29	109.38	107.47
Netherlands	124.79	123.35	120.31	117.86	122.04	126.04	126.04	125.24
England	119.73	120.81	120.83	126.46	123.17	112.78	116.48	123.82
Sweden	114.43	112.50	111.24	110.76	111.37	111.09	111.28	109.17
Korea	146.59	152.40	155.88	156.49	146.91	141.95	143.53	140.11
Mexico	118.33	116.32	121.29	121.65	128.28	126.49	125.48	120.21

Source: Bureau of Labor Statistics, "Hourly Compensation Costs for Production Workers in Manufacturing, 34 Countries, 1975–1982."

improvement of the U.S. position is, however, less than the percentage decrease in the value of the U.S. dollar. Raw materials are purchased on world markets, usually in U.S. dollar-denominated amounts so that, for example, Japanese raw materials costs are lower after the appreciation of the yen against the dollar. Nonetheless, although the gap in relative costs between the United States and its competitors has not been eliminated, it has been considerably narrowed.[9]

Mini-Mills

The pessimistic comparisons of the U.S. steel industry's cost position with that of other countries does not extend to U.S. "mini-mills." These are small, nonintegrated plants that recycle scrap into certain rolled steel products such as bars and rods. Mini-mills often reap high profits from a combination of modern technology, good location (in growing southern and western markets overlooked by the majors), and a work force unencumbered by restrictive work rules. Since 1960, these operations have increased their share of U.S. steel production from about 3 percent to 20 percent. Interestingly, some of this ground was recaptured market-share from imports.

The mini-mills are likely to make further inroads into the sales of the major domestic producers. If they succeed in developing continuous casters that allow them to produce flat-rolled products at a lower minimum efficient size, the inroads could be dramatic.[10] This development may also be dependent on whether producers can turn direct reduction (a process that renders iron ore usable as a raw material in mini-mill

Table 7.8 **Hourly Compensation Costs for Production Workers in Iron and Steel Manufacturing (US SIC 331), 1984**

Country	Exchange Rate: National Currency Unit	Exchange Rate: National Currency Units per U.S. Dollar	Average Hourly Earnings in National Currency	Ratio of Additional Compensation to Hourly Earnings	Hourly Compensation: National Currency	Hourly Compensation: U.S. Dollars	Hourly Compensation: Index US = 100
United States	Dollar	—	12.99	56.1	20.28	20.28	100
Canada	Dollar	1.295	14.91	33.2	19.86	15.34	76
Brazil	Cruzeiro	1848	2231	38.5	3090	1.67	8
Japan	Yen	237.4	2168	19.9	2599	10.95	54
Korea	Won	806.0	1478	13.0	1670	2.07	10
Austria	Shilling	20.00	78.87	94.1	153.09	7.65	38
Belgium	Franc	57.75	358.53	94.6	697.70	12.08	60
France	Franc	8.736	39.16	103.7	79.77	9.13	45
Germany	Mark	2.845	16.34	83.4	29.97	10.53	52
Italy	Lira	1756	8886	99.3	17710	10.09	50
Netherlands	Guilder	3.208	19.73	84.1	36.32	11.32	56
United Kingdom	Pound	.7482	3.97	36.6	5.42	7.25	36

Source: U.S. Bureau of Labor Statistics, August 1985 (provisional estimates).

furnaces and thereby dramatically reduces scrap requirements) into an economically viable option. Otherwise scrap prices may be bid up, cutting into the mini-mills' profitability.

The large integrated producers, unfortunately, appear incapable of emulating the mini-mills. Armco is closing its mini-mill in Houston, and Bethlehem is selling its two mini-mills in Los Angeles and Seattle. These companies are encumbered by their contracts with the United Steelworkers union; thus, they face higher wages and, possibly more important, more restrictive work rules.

The mini-mills in the EC are also regarded as relatively efficient producers that have exerted competitive pressure on the integrated producers. The most notable examples are the "Bresciani," a group of about 80 steel producers near the city of Brescia in northern Italy.[11]

7.3 Adjustment in the United States and the European Community

7.3.1 The United States

Recent Protection History

The U.S. steel industry has enjoyed significant levels of trade protection since 1969. To the extent that it has perceived a crisis, the U.S. government has responded with intermittent periods of trade protection.

The first major action was the "voluntary restraint agreements" (VRAs) with the EC and Japan that were in effect from 1969 to 1974. Because of the worldwide boom in steel demand during 1973 and 1974, however, these restraints were not binding in these last two years.[12]

The next major episode of protection was the initiation of the trigger price mechanism (TPM) in 1978. The TPM was, in principle, designed to establish a minimum price for imports below which imports could not enter without being subjected to an expedited antidumping investigation. It has been estimated that the TPM induced an increase in import prices of approximately 9 percent (Crandall 1981).[13]

In 1982 a major effort was undertaken by the majority of the integrated U.S. steel producers to obtain antidumping and countervailing duties on the products of the EC and a number of other countries. This effort led to the signing of the VRA with the EC, which will be discussed in more detail below.

In early 1984 the United Steelworkers of America and Bethlehem Steel Corporation petitioned the United States International Trade Commission (ITC) for relief from imports under section 201 of the Trade Act of 1974; this section allows exclusion of fairly traded imports if they are assessed to be a substantial cause of serious injury. Although the ITC recommended that quotas be imposed, the president rejected

formal quotas. Instead, he directed his trade representative to negotiate VRAs with virtually all major foreign suppliers of steel to the United States, in the hopes of reducing imports from about 25–26 percent to 18.5 percent of domestic consumption excluding semifinished steel.

Costs of the Existing Quotas

Tarr and Morkre (1984) have estimated the annual costs to U.S. consumers of the 18.5 percent quota to be $1.1 billion in 1983 U.S. dollars. Of this, $779 million consists of inefficiency costs to the U.S. economy and the remainder constitutes a transfer from U.S. consumers to U.S. producers. The estimates also reveal that non-U.S. producers are expected to earn $557 million in quota rents compared with $428 million in additional profits for U.S. producers. Over the five-year scheduled life of the VRAs, they are estimated to cost U.S consumers $4.8 billion and the economy $3.4 billion in present value terms.

To obtain some perspective on the costs of the quotas, Tarr and Morkre estimated the costs in terms of the number of jobs protected and earnings losses saved. The quota is expected to protect temporarily 9,951 jobs. This means that the costs to consumers are $114 thousand per job per year, and the costs to the economy are $81 thousand per job per year. For every dollar of earnings losses saved by otherwise displaced steelworkers, consumers lose $35 and the economy loses $25. These estimates are summarized in tables 7.9, 7.10, and 7.11.

Impact of the Quotas on Adjustment

Each of the three episodes of protection described above has been initiated by respective administrations with the hope that the industry would use the breathing room offered by the protection to modernize and become competitive with its foreign rivals. Indeed, the current

Table 7.9 **Estimates of Relevant Costs and Gains as a Result of an 18.5 Percent Quota on Carbon and Alloy Steel Products (excluding semi-finished)[a]**

	Annual Costs (base-year[b] dollars)	Annual Costs (1983 dollars)	Present Value of Costs over Four Years (1983 dollars)
Consumers' losses	1,131	1,098	3,981
Losses to the U.S. economy	803	780	2,827
Gains to U.S. producers	441	428	1,552
Quota rents to foreigners	573	557	2,018

Source: Tarr and Morkre (1984, 130).

[a]In millions of dollars.

[b]The base year is September 1983 through August 1984.

Table 7.10 **Annual Costs to Consumers and Inefficiency Costs to the United States Economy for Each Job Saved by the Quota**

	(in base-year[a] dollars)
Losses to consumers	113,622
Losses to the economy	80,682

Source: Tarr and Morkre (1984, 130).

[a]The base year is September 1983 through August 1984.

Table 7.11 **Costs, Benefits, and Cost-Benefit Ratios for Each Dollar of Earnings Losses Saved by the 18.5 Percent Quota**

Costs: Present Value of Costs over Five Years[a]	Benefits: Earnings Losses Saved[a]	Cost-Benefit Ratios
4,960.422 (to consumers)	$143.334	$34.60
$3,522.344 (to the economy)	$143.334	$24.57

Source: Tarr and Morkre (1984).

[a]Figures shown as millions of base-year dollars, where the base year is September 1983 through August 1984.

protection was authorized by Congress through the Trade and Tariff Act of 1984, which included the requirement that continuation of the trade relief in any year is contingent on the major steel producers' reinvesting substantially all of their net cash flow from steel operations into modernization of their steel operations.[14]

As the trends in labor productivity would suggest, previous efforts in this regard have been unsuccessful. For example, there has not been a new integrated steel plant built in the United States since Bethlehem's Burns Harbor facility was constructed in 1962. Indeed, given the above international cost comparisons and trends in demand, it is not surprising to learn that calculations of the profitability of such investments (Crandall 1981) indicate that they are very unprofitable at current prices.

More serious than the fact that the quota program is not likely to achieve its goal of promoting a modern, efficient U.S. steel industry, is the fact that protection may hurt the integrated steel producers in the long run. The major problems of the U.S. integrated producers are their labor costs, the decline in demand, and the rise of the mini-mills. How will protection affect each of these areas?

With protection in place it may become more difficult to obtain the further wage concessions and work rule modifications required to lower labor costs and make the integrated producers more competitive. This will exacerbate the integrated producers problems not only with inter-

national competition, once the quotas are removed, but also with the mini-mills.

The industry has suffered a decline in demand in part because of a switch to alternative materials and in part because more steel is being brought into the country in the form of manufactured products. The amount of steel imported indirectly as manufactured products rose from 1.2 million tons in 1962 to 5.2 million tons in 1973. By causing U.S. prices to rise, the quotas will promote the use of alternative materials further and encourage research and development into new materials. Moreover, manufacturers of products that use steel will have a greater incentive to locate their plants out of the United States where they can benefit from the lower world prices. Once investments are made in alternative technologies or production sites, it will be difficult for the U.S. steel industry to win back these markets. Thus, rather than helping the industry in the long run, the protection can be expected to result in a less competitive integrated steel sector.

7.3.2 The European Community

Domestic Controls

A plan, which came to be known as the "Davignon" plan (after the Commissioner of Industrial Affairs, Etienne Davignon), was instituted in the EC in May 1977. Besides import controls, it called for mandatory "minimum" prices on reinforcing bars, a product under stiff competition, and also called for "reference" or "guidance" prices for six other steel products. The price restraints were combined with voluntary production quotas.

This effort at a voluntary cartel proved unsuccessful when the market deteriorated in 1980. In response, a "manifest crisis" was declared. The most important immediate consequence was the introduction on 31 October 1980 of mandatory production quotas for producers of steel within the EC. When the market further deteriorated, mandatory minimum prices were extended to other products besides the six products mentioned. Eventually, minimum prices were established for most strip products, cold-rolled sheet, some hot-rolled sheet, and heavy sections and beams.

Finally, a code on national subsidies was adopted in August 1981. In principle, subsidies were supposed to be tied to a program of rationalization and restructuring of the steel industry. All national subsidies were to be terminated by the end of 1985.

The most strenuous objections to the production quotas and minimum prices have come from the most efficient producers, the most notable example being the aforementioned "Bresciani." Being efficient mini-mills, they were very unhappy with the minimum prices for reinforcing rods which they contended deprived them of their competitive advantage. The

Bresciani proved to be a major enforcement problem for the Commission since, despite threats of major penalties, complaints kept coming in of sales below the minimum price. Eventually, an agreement was reached whereby in return for compliance with the Commission's price schedule, the Bresciani received, in effect, an export quota to other countries within the EC (Lowenfeld 1979, 299–300).

The large German producers also objected to the production quotas. These producers are regarded as being the most efficient of the EC's integrated producers, as well as having the greatest proportion of their plants at minimum efficient size.[15] The quotas had the effect of shifting production away from these firms that could produce at the lowest cost.

Import Protection

In 1977 the EC also initiated an import control program, along with a gradually escalating program of EC controls on domestic production, prices, investment, and subsidies. The import control program employs a system of basic import prices. These basic prices are like the U.S. trigger-price mechanism; in principle they represent the cost of supplying steel to the EC from the world's low-cost suppliers. Imports below these prices are deemed to be dumped without any prior inquiry into the question of injury (Lowenfeld 1979, 289).[16] If a country negotiates a VRA with the EC, however, it is then exempt from the basic import price system. Fifteen countries (Bulgaria, Hungary, Romania, Czechoslovakia, Poland, South Africa, Australia, Brazil, South Korea, Japan, Spain, Norway, Finland, Austria, and Sweden), providing about 75 percent of the EC's imports, agreed to a VRA as of 1 January 1978, and these VRAs have been renewed annually. With respect to the European Free Trade Association (EFTA) countries, the VRAs were concluded rather amicably. In the cases of Hungary, Romania, Australia, Poland, and South Korea, VRAs were not concluded until definitive antidumping duties were threatened (Jones 1986).[17] These countries agreed to a VRA because the basic prices were set so high that they would otherwise have been excluded from the market.

The VRAs control both quantity and price. For non-EFTA countries, specific quantity limitations are mentioned in the agreements, whereas for EFTA countries, export amounts are merely required to reflect traditional trade patterns. Imports are not permitted to be sold at less than the lowest delivered price to a location, less a penetration margin.[18] The penetration margin is 3 percent for ordinary steel from EFTA producers and 6 percent from non-EFTA producers. In addition, the price must exceed the EC's "minimum" or "guidance" prices, whichever applies.

The minimum-price restraints of the VRAs appear to be much more binding than the quantity restraints. Jondrow, Chase, and Gamble (1982) have shown that imported steel must sell at a discount relative to

domestic steel to be competitive. This is because there are greater costs associated with the purchase of imported steel due to factors such as higher inventory and warehousing costs and greater lag times in awaiting delivery. There is evidence, however, that the VRAs have achieved their intended effect of increasing the relative price of imports from countries subject to VRAs.[19] Thus, we find that Brazil and Korea, that are among the lowest cost producers in the world, are falling far short of meeting their quotas. For example, South Korea shipped less than 3 percent of its allowed quota in 1984 (European Community Commission, 1986). The experience of the Bresciani suggests, however, that it is profitable for the most efficient producers to sell at prices less than the minimum prices. Thus, if imports were permitted at lower prices, they would likely capture a larger share of the market.

7.3.3 The US-EC Steel Arrangement

An especially interesting episode, from the perspective of both US-EC trade relations and antidumping and countervailing duty law, began in early 1982. A massive antidumping and countervailing duty investigation was launched by the U.S. Department of Commerce (DOC) and the ITC, after complaints were filed by the major U.S. integrated steel producers. Initially 132 complaints, charging very substantial subsidization and dumping, were filed against producers from Belgium, France, West Germany, Italy, Luxembourg, the Netherlands, and the United Kingdom, as well as from Brazil, Romania, South Africa, and Spain. The DOC is charged with the determination of the subsidy or dumping margin, and the ITC is charged with the question of whether the industry is materially injured by virtue of the subsidized or dumped imports.

With respect to the EC, the DOC found a very diverse pattern of subsidies. While a number of the EC producers were found to be subsidized by substantial margins, a large portion of the EC capacity was determined to be unsubsidized or subsidized by only a small amount. The large French producers, Usinor and Sacilor, were found to be subsidized at between 11 and 21 percent; the Italian firm, Italsider, was found to be subsidized at 26 percent; the Belgian firm, Cockerill-Sambre, was found to be subsidized at a rate of 13 percent; and the British Steel Corporation was found to be subsidized at a rate of 20 percent. In contrast, seven of the eight large German firms were found to be unsubsidized and the eighth was found to be subsidized at only 1 percent.[20] The large Dutch firm of Estel Hoogovens, 13 small British firms, and the Belgian firm of Clabecq were also found to be unsubsidized; in addition, the Luxembourg firms of Arbed and MMR-A were found to be subsidized at the low rates of 0.5 percent and 1.5 percent, respectively. A complete list of the DOC determinations in these cases is found in table 7.12.[21]

Table 7.12 **Summary of Final Subsidy Rates[a] Found by the U.S. DOC on 24 August 1982**

Country	Producer	Product(s)	Subsidy Rate
Belgium	Cockerill-Sambre	Structurals	13.255%
		Plate	13.255%
		Hot-rolled sheet & strip	13.411%
	Fabrique de Fer de Charleroi	Plate	2.165%
	Forges de Clabecq	Plate	Affirmative
		Hot-rolled sheet & strip	(0.348%, *de minimis*)
	Siderurgie Maritime (Sidmar)	Plate	4.640%
		Hot-rolled sheet & strip	4.640%
Federal Republic of Germany	AG de Dillinger Huttenwerk	Plate	Negative (0.150%, *de minimis*)
	Hoesch	Structurals	Negative (0.039%,
		Cold-rolled sheet & strip	*de minimis*)
	Klockner-Werke AG	Plate	Negative (0.032%,
		Hot-rolled sheet & strip	*de minimis*)
		Cold-rolled sheet & strip	
	Fried Krupp Huttenwerke AG	Hot-rolled sheet & strip	Negative (0.051%, *de minimis*)
	Otto Wolf	Cold-rolled sheet & strip	Negative (0.015%, *de minimis*)
	Stahlwerke Peine-Salzgitter AG	Structurals	Affirmative
		Hot-rolled sheet & strip	(0.235%, *de*
		Cold-rolled sheet & strip	*minimis*)
	Stahlwerke Rochling-Burbach GmbH	Structurals	1.131%
	Thyssen	Plate	Negative (0.035%,
		Hot-rolled sheet & strip	*de minimis*)
		Cold-rolled sheet & strip	
France	Dilling	Hot-rolled sheet & strip	4.038%
		Cold-rolled sheet & strip	3.702%
	Sacilor	Structurals	14.223%
		Hot-rolled sheet & strip	21.416%
		Cold-rolled sheet & strip	19.494%
	Usinor	Structurals	11.300%
		Hot-rolled sheet & strip	17.980%
		Cold-rolled sheet & strip	11.300%
Italy	Italsider	Hot-rolled sheet & strip	26.050%
		Cold-rolled sheet & strip	26.050%
	A.F.L. Falck	Hot-rolled sheet & strip	17.810%
		Cold-rolled sheet & strip	17.810%
Luxembourg	Arbed	Structurals	0.539%
	MMR-A	Structurals	1.523%

Table 7.12
(continued)

Country	Producer	Product(s)	Subsidy Rate
Netherlands	Estel Hoogovens B.V.	Hot-rolled sheet & strip Cold-rolled sheet	Negative (0.183%, *de minimis*)
United Kingdom	Bar Bright-Usam	Cold-formed carbon steel bar	Negative (0.050%, *de minimis*)
	Bedford Steels, Ltd.	Hot-rolled carbon steel bar Cold-formed carbon steel bar	Negative
	Brasway Bright Bar	Cold-formed carbon steel bar	Negative
	Bright Steels, Ltd.	Cold-formed carbon steel bar	Negative (0.260%, *de minimis*)
	British Steel Corp. (BSC)	Structurals Plate Hot-rolled carbon steel bar	20.330% 20.330% 20.330%
	Brymbo Steelworkers, Ltd.	Hot-rolled carbon steel bar	1.880%
	Darlington & Simpson Rolling Mills, Ltd.	Structurals	Negative (0.040%, *de minimis*)
	The Dudley Port Rolling Mills, Ltd.	Structurals Hot-rolled carbon steel bar	Negative
	Eaton & Booth, Ltd.	Structurals Hot-rolled carbon steel bar	Negative (0.120%, *de minimis*)
	Flather Bright Steel, Ltd.	Cold-formed carbon steel bar	Negative
	Glynwed Steels, Ltd.	Hot-rolled carbon steel bar	Negative (0.020%, *de minimis*)
	Kiveton Park Steel and Wireworks, Ltd.	Cold-formed carbon steel bar	Negative
	Lee Bright Bars, Ltd.	Cold-formed carbon steel bar	Negative (0.090%, *de minimis*)
	London Works Steel Co., Ltd.	Hot-rolled carbon steel bar	Negative
	Round Oak Steel Work, Ltd.	Hot-rolled carbon steel bar Cold-formed carbon steel bar	Negative
	Spencer Clark Metal Industries	Hot-rolled carbon steel bar Structurals	Negative (0.070%, *de minimis*)

Source: U.S. Department of Commerce, Press Release, 25 August 1982.

[a]This table shows the rates of subsidy (as a percentage of f.o.b. value) found in the DOC's determinations.

This diverse pattern of subsidy determinations by the DOC proved very troublesome on both sides of the Atlantic and set the stage for a negotiated settlement. From the perspective of U.S. producers, countervailing duties in an amount equal to the subsidy margins and limited to those producers who were found to be subsidized would not accomplish very much in the way of protection. The four nations from which the United States imports the most steel are Japan, Canada, West Germany, and South Korea. There were no cases brought against Japan or Canada; West Germany was exonerated by the DOC proceedings; and South Korea in subsequent proceedings would have only negligible duties assessed against it. Even if the duties were implemented against the EC producers found to be subsidized, other unsubsidized producers in the EC or elsewhere could take their place.

From the perspective of the EC, firms such as Usinor, Sacilor, the British Steel Corporation, Italsider, and Cockerill-Sambre were quite concerned that the United States might actually apply rates of countervailing duties that would probably exclude them from the U.S. market. In contrast, EC member states who were found not to be subsidized resisted an agreement negotiated by the EC that would restrain their exports to the U.S. The German firms, in particular, were well known for their long-standing opposition to subsidies to steel producers in other EC member countries with which they had to compete. They saw their access to the U.S. market being limited because of these subsidies. The Commission, however, wanted a solution that would "share the burden" among member states. Ultimately, on 21 October 1982, as the deadline for a negotiated settlement neared, the German producers agreed to go along with a VRA for the EC as a whole, when pipe and tube products (a product line in which the Germans were the largest suppliers) were deleted from the explicit agreement.[22] The U.S. Customs Service was charged with monitoring the agreement through a system of export licensing tied to projected apparent consumption in the U.S. Once again, as with the efforts to enforce the cartel domestically, the Commission's cartel or burden-sharing approach resulted in less output going to the most efficient European producers.

7.4 Policy Conclusions

7.4.1 Impact of Domestic Policies

The main difference in the policy response of the United States and the EC has been in the domestic area. The U.S. government has not intervened directly in the domestic market. It has permitted the large losses suffered by its domestic firms to be the market guide for plant closures. This has resulted in significant reductions in the least efficient

capacity of the integrated producers (almost 25 percent in the last eight years) and, at the same time, in significant additions to capacity in the efficient mini-mill sector. This trend is likely to continue.

The EC, in contrast, has administered an elaborate domestic cartel. It first imposed production quotas and minimum prices and in later years attempted to restrain subsidies and investment as well as reduce capacity. How well has this program worked in bringing about adjustment in the EC compared to the market-oriented adjustments in the U.S.? Although reliable capacity estimates are difficult to obtain, the estimates of table 7.1, as well as others that are available,[23] indicate that EC capacity reductions have been considerably less than those in the U.S. In this fundamental regard, the EC program has not been as successful as that of the U.S.[24]

One must also recognize that the production quotas, minimum prices, and "burden sharing" have tended to shift production to the less efficient producers in the EC, enabling them to stay in business longer than in the absence of assigned production quotas and the higher cartel prices. This causes the efficient producers to earn lower profits or incur greater losses, thereby discouraging them from making the limited kinds of investments necessary for long-run survival. U.S. and EC integrated producers have been able to compete effectively in markets for higher-quality products, and because of technological progress in finishing mills, limited investments will be necessary by these producers to continue to compete successfully in these markets. Thus, if production quotas were the only aspect of the Commission's program, it should clearly be regarded as counterproductive.

The Commission's program, however, also included limitations on the use of subsidies by the national governments. Subsidies were to be granted only as part of a rationalization or restructuring effort and were to be eliminated entirely by the end of 1985. Without restraints on subsidies many of the adverse effects of the cartel effort would have been worse, since subsidies to inefficient producers prolong their existence, drive down prices, and, thereby, discourage investment by efficient producers.[25] Thus, the Commission should be commended for its effort to reduce the subsidies. The problem is in assessing the extent to which the Commission was responsible for the reduced subsidies. Because of budgetary constraints, the national governments might have reduced the subsidies in any event.[26] Given the political difficulties of reducing subsidies, however, pressure from the Commission may have helped this effort.

7.4.2 Impact of Trade Protection Policies

This paper has explained that in the last 10 to 12 years there has been a fundamental shift in the international steel industry. The indus-

trialized countries have seen a decrease in their demand while the developing countries have seen an increase in demand. Observers expect this pattern to continue through the next 15 years. Also during the last 10 to 12 years, some key developing countries have become the world's low-cost producers and have captured market shares from the EC in third markets. Finally the established integrated producers in the United States have been losing market shares to mini-mills within their own country.

In response to significant dislocations of labor and reduced profits and capital losses, the United States and the EC have acted to protect their markets through nontariff barriers. The estimates provided in this paper document the expected result that the resource misallocation and rent transfer effects of these nontariff barriers considerably exceed the saved adjustment costs. This paper has also argued that protection may aggravate the causes of the injury to the industry in the long run. Protection simply cannot solve the problem of declining domestic demand and loss of competitiveness in third markets. By increasing the cost of steel to domestic consumers of steel, protection will in fact accelerate the shift to alternative materials and to sites outside the protected regions by manufacturers of products for which steel is an important input. Moreover, especially in the United States, it is likely to slow the cost-reducing effort of those firms that have the potential for surviving in the long run.

7.4.3 Future Policy Choices

Regarding domestic policy in the future, the above assessment of the effects of recent Commission policy clearly indicates that the Commission would contribute to a more viable, efficient steel industry in the EC by eliminating its domestic controls on prices, output, and investment as soon as possible. These controls become more costly and create more distortions over time, since companies who need to shift their products lines are impeded from doing so because of the lack of quota. The Commission's efforts at eliminating subsidies, however, will, if effective, help produce a more efficient and viable steel industry in the EC.

Regarding the protectionist external policies of the U.S. and the EC, their continuation will impose significant costs on their economies and consumers each year they are in place. Moreover, the longer they are in place, the less likely their industries are to be competitive in the long run. Thus, a policy of eliminating, as soon as possible, the nontariff barriers to trade erected by the United States and the EC will result in the lowest costs to the economies involved as well as more efficient steel industries.

Notes

1. Profits in 1974 for the U.S. steel firms were $2.5 billion. In 1982, 1983, and 1984, however, these companies lost $3.4 billion, $2.2 billion, and $0.2 billion, respectively, on their steel operations (American Iron and Steel Institute, *Annual Statistical Report,* 1984).

2. A very influential document in this regard was *Projection 85* by the International Iron and Steel Institute.

3. Prior to the experience of the last decade, the curve was thought merely to increase at a decreasing rate throughout, without actually achieving a maximum and then declining. That is, if y equals per capita income, and $f(y)$ equals per capita consumption of steel, then it was previously believed that $f'(y) > 0$ and $f''(y) < 0$ for all y. The data of the last decade, however, appear to contradict the hypothesis that per capita consumption of steel is monotonically increasing in per capita income. Thus, while it is still believed that per capita consumption of steel increases at a decreasing rate with per capita income, i.e., $f''(y) < 0$ (for levels of y that we have observed), there appears to be a level of income, y_o, that varies across nations after which f decreases, i.e., $f'(y) < 0$ for $y > y_o$.

4. Slow rates of growth in the economies as a whole clearly contributed to the decline in demand for steel in the industrial countries. If lower energy prices are here to stay, this may stimulate economy-wide growth, which will give an impetus to steel demand.

5. This should not be construed as an argument for subsidies for steel development. Rather, it suggests that, in the long run, market opportunities may present themselves.

6. For a similar view, see Crandall (1986).

7. Unpublished data obtained from the Office of Productivity and Technology, Bureau of Labor Statistics, U.S. Department of Labor.

8. See Tarr (1985a) for an explanation of why this occurred.

9. See Bradford (1986) for some up-to-date cost comparisons.

10. The minimum efficient size for producing flat-rolled products is currently over 3 million tons per year, whereas mini-mills typically produce about one-half of a million tons per year. See Tarr (1984) for a discussion of the minimum efficient size steel plant.

11. Contrary to what some authors have claimed, I do not believe that inefficient management decisions regarding technology adoption have been the cause of the relative decline of the integrated U.S. steel producers (Tarr 1985b).

12. For an analysis of the effects of the VRAs see Jondrow (1978) or Crandall (1981).

13. See my analysis in the FTC staff steel report (1977) for the distributional and efficiency consequences of the TPM, and see Barnett and Schorsch (1983, 239–42) for an evaluation of the TPM's role in the public policy debate on steel.

14. Since most firms are already exceeding this requirement, it is not considered an onerous restraint. See *New York Times,* 15 Oct. 1984, pp. D1, D6.

15. See Tarr (1984) for an explanation of the minimum efficient size steel plant.

16. Provision was made for normal value, for the purpose of a dumping investigation, to be determined by the usual Commission standards, if that would produce a significantly different result. See Official Journal of the European Communities (1984).

17. The VRAs with Bulgaria and Brazil were initiated in 1979. Tsoukalis and Strauss (1985, 217) argue that countries agreed to VRAs because otherwise they would have been excluded from the market. In view of the provision mentioned in the previous note, however, it may have been only that the basic price system allowed the antidumping authorities greater harassment power.

18. The EC has maintained since the 1950s an elaborate system of delivered list prices, known as the *prix de base*. All producers must publish their basing point and prices, including extra charges. From this, a delivered price to any point in the EC can be calculated for any producer. A seller is permitted to sell below his own list price if he is matching a competitor's list price, a practice known as alignment. In the case of a competitor within the EC, alignment would be based on the list price, but historically, alignment has also been allowed on imported products. Alignment privileges were suspended for imports from countries with a VRA and, therefore, who had a penetration margin in effect. An in-depth study of the effects of the *prix de base* system is in Stegemann (1977).

19. Let p equal a ratio defined as the average unit value of imports into the EC from countries subject to a VRA divided by the average unit value of intra-EC trade. This ratio has risen from .94 in 1977 to 1.01 in 1984. These calculations were performed by Andrzej Olechowski as background for the Finger and Olechowski (1986) paper. Moreover, Messerlin (1986) reports estimates that the Davignon plan had the effect of raising prices in the EC.

20. We characterize the situation as unsubsidized when the DOC finding is that the rate of subsidy is too small to assess a countervailing duty. In fact, the subsidy rates for these German producers ranged from 0.015 percent to 0.15 percent, a situation characterized by the DOC as "*de minimus*."

21. For comments on the appropriate methodology that the DOC should have employed in these cases, see my analysis in the Federal Trade Commission's Bureaus' Comments (1982). For an evaluation of whether the DOC did in fact follow these principles, see Mueller and van der Ven (1982) and the reply by Horlick (1983).

Prior to the DOC estimate of subsidies, the only systematic effort to estimate subsidies in the steel industry was by my coauthors in my FTC Staff Report (1977). We found that subsidies were too small to affect trade flows with the possible exception of that to the British Steel Corporation, which was subsidized at a rate of about 3 percent. Since the publication of our report, however, a number of European governments have made large infusions of capital into some of their steel firms. These infusions have often taken the form of equity acquisitions by the government at a price for the equity that exceeded the market value. It is generally true that the DOC found little or no subsidization unless such a capital infusion was present.

Mutti (1984) has also estimated the rate of subsidies to the EC producers and has come to similar conclusions on the importance of these large capital infusions in the subsidy calculations. Still another estimate of the subsidies is by Lamm in *Les Echos*, 22 Nov. 1984.

22. There was a nonbinding agreement by EC producers to limit their exports of pipe and tube to the U.S. market, but since there was no mechanism to enforce the restraint, competition among EC producers for customers resulted in the agreement being violated. This is a standard cartel problem. See Jones (1986) for a discussion of this point and Benyon and Bourgeois (1984) for further details of the overall agreement.

23. See Peter Marcus and Karlos Kirsis (1984) for additional capacity estimates.

24. The data of table 7.1 reveal that overall capacity reductions in the EC have been comparable to those in the U.S. since 1980. Since the decline in demand began in 1974, however, 1974 is the appropriate base year with which to make comparisons of capacity reductions. Moreover, the overall U.S. capacity figures underestimate the reduction in integrated mill capacity because they include the increased capacity of the efficient mini-mill sector. See Crandall (1986) for a similar view of US-EC relative capacity reduction.

25. See Mutti (1984) for a formal derivaton of this result and estimation of the effects of the subsidies on the unsubsidized German and U.S. producers.

26. See Messerlin (1983 and 1986) for a similar view.

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