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Restructuring of the steel industry in Northeast Asia

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1

Issues Raised by Restructuring of the Steel Industry in Northeast Asia

Hiro Lee, Eric D. Ramstetter, and Oleksandr Movshuk

1.1 The dimensions of restructuring

In the 1990s Northeast Asia's steel industry went through a remarkable restructuring process. The objective of this book is to investigate various aspects of this process, whereas the purpose of this introductory chapter is to outline the issues involved, how economists have attempted to address these issues, and how the following chapters contribute to these discussions. This section first introduces the issues by summarizing important dimensions of the restructuring process. Section 1.2 then identifies some of the major issues raised by the restructuring process and explains how economic principles can be used to analyze the issues at hand. Sections 1.3 and 1.4 outline the chapters in Parts II and III of this book, respectively, and how they contribute to the existing economic literature on the subjects examined in this volume.

Perhaps the best indicator of restructuring in Northeast Asian steel was the large decline of employment in the region's steel industry. Combined the region's steel industry lost over 1 million jobs between the early 1990s and 2001, or a little over one quarter of the total in the early 1990s (Table 1.1). Job losses began early in Japan and Korea, where average steel employment fell 10 percent and 4 percent, respectively, between 1990–92 and 1993–96. Since these declines were more than offset by growth in China and Taiwan (5 percent each), the regional total rose slightly. However, the declines then accelerated in Japan and Korea, to 26 percent and 14 percent, respectively, between 1993–96 and 2001. China's attempts to reform the state-owned sector also led to an even

Table 1.1 Production and employment in Northeast Asian steel

Indicator	1990-92	1993-96	1997	1998	1999	2000	2001
<i>Employment of steel plants or firms in Northeast Asia (thousands)</i>							
Northeast Asia	3,720.05	3,844.67	na	na	na	na	2,709.12
Japan (plants, 4+)	335.97	302.79	273.84	261.02	242.62	236.53	223.82
China (firms)	3,218.17	3,374.73	3,171.71	2,880.50	2,725.22	2,515.90	2,315.31
Korea (plants, 5+)	77.96	74.95	70.68	64.87	67.31	64.82	64.35
Taiwan (plants, 91, 96, 01)	87.96	92.21	na	na	na	na	105.65
<i>Crude steel production (thousand metric tons)</i>							
World	741,243	738,732	798,932	777,311	788,995	847,426	850,040
Asia	244,071	274,745	308,633	297,873	308,799	331,845	353,799
Northeast Asia	215,004	241,768	272,066	264,997	274,626	293,683	314,845
Japan	106,040	99,590	104,545	93,548	94,192	106,444	102,866
China	72,762	94,687	108,911	114,588	123,954	127,236	150,866
Korea	25,727	35,612	42,554	39,896	41,042	43,107	43,852
Taiwan	10,475	11,880	16,056	16,965	15,438	16,896	17,261
Europe	333,038	279,540	291,483	281,810	283,991	308,891	304,694
North America	106,710	119,102	129,462	129,940	130,069	135,137	119,657
United States	84,445	92,691	98,485	98,658	97,427	101,803	90,104
Other regions	301,495	340,090	377,987	365,561	374,935	403,398	425,689

Gross output or shipments of steel plants or firms in Northeast Asia (current US\$ millions)

Northeast Asia	192,229	229,364	na	na	na	na	201,932
Japan (plants, 4+)	131,818	136,098	120,364	98,864	99,394	110,679	92,174
China (firms)	30,045	48,823	40,107	40,598	41,901	57,161	68,953
Korea (plants, 5+)	18,346	26,314	27,564	21,137	24,609	29,245	25,737
Taiwan (plants, 91, 96, 01)	12,019	18,129	na	na	na	na	15,067

Value added of steel plants or firms in Northeast Asia (current US\$ millions)

Northeast Asia	71,005	85,488	na	na	na	na	70,495
Japan (plants, 4+)	53,118	57,270	50,978	41,340	42,393	47,308	39,336
China (firms)	7,633	14,597	10,688	10,932	11,414	15,692	18,487
Korea (plants, 5+)	6,847	9,368	9,217	7,391	8,681	9,456	8,802
Taiwan (firms, 91, 96, 01)	3,406	4,253	na	na	na	na	3,871

Notes: The figures for 1990–92 and 1993–96 are annual averages. North America includes Mexico.

Sources: International Iron and Steel Institute (various years) and Tables 2.1, 3.2, 4.2, and 5.3.

larger rate of decline, 29 percent, in this latter period. Because China's industry was by far the largest in terms of employment, China also accounted for the vast majority of the absolute number of jobs lost. In contrast, Taiwan's steel employment continued to rise throughout the period.

In the latter part of the decade, the current value of production (measured either as gross output, which includes the value of intermediate consumption, or value added, which excludes intermediate consumption) also fell markedly in Japan, more moderately in Taiwan, and slightly in Korea (Table 1.1). These declines came after strong increases in Korea and Taiwan and mild increases in Japan early in the decade. In contrast, gross output and value added grew rapidly throughout the decade in China.¹ The volume of crude steel production increased throughout the period studied in China, Korea, and Taiwan. It declined some in Japan early in the decade and increased even more slowly thereafter. In other words, production values declined while production volume increased in the period from 1993–96 to 2001 in Japan, Korea, and Taiwan, suggesting that steel prices were falling during this period.

The quantity and value data also suggest a very different ranking of the region's steel industries. For example, the quantity data suggest that China surpassed Japan as the region's largest steel producer by 1997 but the value data suggest that the Japanese steel industry still produced approximately twice the amount of steel produced by the Chinese industry as late as 2000–01 (Table 1.1). The major reason for the difference in these rankings is the fact that China produces a large quantity of relatively low-quality, low-priced steel while Japan produces a much greater proportion of relatively high-quality, high-priced steel. Accordingly, this book is very careful to present information on both volume and values when available.

Contrary to some common perceptions, Northeast Asia accounts for much larger shares of world steel production and consumption than of trade in steel. For example, measured in volume (tons), the four major Northeast Asian economies, Japan, Korea, China, and Taiwan, combined to account for over one-third of the world's production of crude steel and apparent consumption of either crude steel or finished steel products in recent years (tons, Tables 1.1 and 1.2). In contrast, they accounted for only about one-fifth of the world's steel exports and about one-sixth of world imports, measured in either quantity or value terms (Tables 1.3 and 1.4).

Large differences in per capita consumption of steel among the four Northeast Asian economies reflect different stages of economic

development for these economies (Table 1.2). For example, in value terms per capita consumption is by far the highest in Japan, followed by Taiwan, Korea, and very distantly by China, whose per capita consumption was only 9 percent of Japan's level in 2001. In quantity terms China's per capita consumption was 23 percent of Japan's level in 2001, here again largely because China produces large quantities of relatively low-quality, low-priced steel. Per capita consumption in quantity terms is also higher in Korea and Taiwan than in Japan, probably for similar reasons.

Large declines in Japan's per capita consumption of steel between 1990–92 and 2001 (Table 1.2), both in quantity (19 percent) and value terms (36 percent) resulted in part from declining demand for steel as an intermediate input and slow growth in several industries that consumed relatively large amounts of steel (e.g., steel itself, construction; see Chapter 2). In Korea and Taiwan, per capita consumption grew through 1996 or 1997, but fell off some in subsequent years and further declines seem likely in the future if these economies follow the Japanese pattern. By contrast, China's per capita consumption of steel increased very rapidly, 165 percent in quantity terms and 114 percent in value terms, between 1990–92 and 2001. Although growth slowed markedly in 1997 and thereafter, especially in value terms, per capita consumption of steel is expected to continue growing as China continues to industrialize rapidly.

Despite relatively low export propensities (ratios of exports to production) of 10–16 percent, Japan has remained the region's largest steel exporter and revealed comparative advantage indices (RCAs) indicate it maintained a strong comparative advantage in the industry (Table 1.3).² RCAs also indicate Korea maintained a strong comparative advantage in steel and Korean exports were about one half of Japanese exports for most of the period. Korean export propensities were the region's highest, however, peaking at 36 percent immediately after the crisis in 1998, and fluctuating in the 20–26 percent range in other years. Although Taiwan's exports were much smaller than Korea's, its export propensities also increased markedly from 10–12 percent in 1991 and 1996 to 29 percent in 2001. Its RCAs also climbed over 1.0 from 1998 forward, indicating Taiwan had also developed a comparative advantage. By 1998–2001 China's exports were of similar magnitudes to Taiwan's but its exports propensities and RCAs were low as China's comparative disadvantage in steel persisted.

Steel imports have always been much smaller than exports in Japan, where they amounted to only 3–4 percent of apparent consumption (Table 1.4). Steel imports were also smaller than exports in all years in

Table 1.2 Apparent consumption of steel by region or economy

Indicator	1990-92	1993-96	1997	1998	1999	2000	2001
<i>Apparent consumption of crude steel (thousand metric tons)</i>							
World	734,524	727,033	789,493	783,645	800,306	870,348	880,901
Asia	263,210	317,961	343,571	311,298	347,047	379,231	411,214
Northeast Asia	211,349	254,543	270,557	253,125	281,713	309,141	332,295
Japan	94,074	81,971	86,002	71,187	70,629	80,561	74,998
China	75,156	115,370	119,660	131,700	151,150	163,240	196,350
Korea	23,595	33,754	39,655	26,018	35,464	40,000	39,727
Taiwan	18,523	23,448	25,240	24,220	24,470	25,340	21,220
Europe	297,496	203,652	212,582	222,968	215,424	236,850	230,297
North America	119,082	140,820	157,611	172,036	165,968	175,556	152,956
United States	96,675	113,462	123,586	134,629	127,467	132,891	114,261
Other regions	54,736	64,601	75,729	77,343	71,867	78,711	86,434
<i>Apparent consumption of finished steel (thousand metric tons)</i>							
World	623,232	633,335	697,659	691,800	708,843	768,326	781,919
Asia	228,652	280,685	305,171	279,224	309,993	338,223	367,941
Northeast Asia	185,667	226,248	242,331	229,144	253,805	276,663	303,152
Japan	88,323	75,629	79,881	70,300	68,900	76,100	73,200
China	59,798	99,074	103,508	113,934	130,754	141,210	174,180
Korea	22,109	32,008	37,912	24,720	33,761	38,333	38,092
Taiwan	15,437	19,538	21,030	20,190	20,390	21,020	17,680

Europe	246,982	175,744	187,003	196,689	190,082	208,904	203,153
North America	101,633	121,401	141,241	150,051	147,371	154,227	136,664
United States	83,322	100,207	113,358	119,816	116,393	120,012	106,164
Other regions	45,965	55,506	64,244	65,836	61,397	66,972	74,161
<i>Apparent consumption of steel (US\$ millions)</i>							
Northeast Asia	186,173	225,690	na	na	na	na	192,429
Japan	122,549	124,747	108,156	86,352	88,217	98,596	80,112
China	32,140	55,600	43,234	44,098	47,243	62,543	75,645
Korea	17,282	25,973	26,963	16,123	22,108	27,188	23,468
Taiwan (91, 96, 01)	14,202	19,371	na	na	na	na	13,204
<i>Apparent consumption per capita (kilograms finished steel)</i>							
Japan	713	603	634	556	544	600	576
China	51	81	83	91	103	111	136
Korea	510	712	825	534	724	816	805
Taiwan	749	919	967	921	924	952	792
<i>Apparent consumption of steel per capita (US\$)</i>							
Japan	988	995	857	683	696	777	629
China	28	46	35	35	38	49	59
Korea	399	578	587	348	474	578	496
Taiwan (91, 96, 01)	691	902	na	na	na	na	591

Notes: The figures for 1990–92 and 1993–96 are annual averages. North America includes Mexico.

Sources: International Iron and Steel Institute (various years); Statistics Canada (2003).

Table 1.3 Exports and indices of revealed comparative advantage in steel by region or economy

Indicator	1990-92	1993-96	1997	1998	1999	2000	2001
<i>Exports of finished and semi-finished products (thousand metric tons)</i>							
World	181,412	236,031	267,819	269,541	280,796	306,419	301,193
Asia	35,404	45,840	55,250	64,069	63,680	73,105	70,194
Northeast Asia	31,982	40,830	48,192	54,924	53,412	61,807	58,991
Japan	17,704	21,826	22,892	24,996	26,085	28,478	29,494
China	3,675	5,464	8,907	5,863	5,975	11,159	7,487
Korea	8,785	10,429	11,292	18,383	13,691	13,848	14,035
Taiwan	1,818	3,111	5,101	5,682	7,661	8,322	7,975
Europe	113,519	153,408	173,031	167,679	177,643	192,620	193,129
North America	10,869	13,979	16,739	16,260	15,925	17,166	15,188
United States	4,660	4,677	5,568	5,110	5,029	6,011	5,671
Other regions	21,619	22,805	22,799	21,533	23,548	23,528	22,682
<i>Exports (current US\$ millions)</i>							
World	109,362	139,873	155,487	153,551	136,248	154,487	143,122
Asia	24,741	34,437	40,061	39,119	36,098	42,646	38,968
Northeast Asia	20,522	26,465	30,871	30,685	27,965	33,552	29,934
Japan	13,608	15,838	16,446	15,493	14,227	15,820	14,902
China	1,514	3,200	5,137	4,004	3,398	5,316	4,147
Korea	4,238	5,259	5,995	7,557	6,329	7,207	6,459
Taiwan	1,162	2,168	3,294	3,630	4,011	5,209	4,426
Europe	65,799	75,185	78,399	80,277	68,543	73,669	70,924

North America	7,650	10,201	13,339	12,835	11,228	12,760	11,423
United States	4,468	5,348	7,136	6,953	6,302	7,326	6,881
Other regions	11,171	20,051	23,688	21,322	20,379	25,412	21,806
<i>Revealed comparative advantage indices</i>							
Asia	0.83	0.84	0.87	0.91	0.89	0.86	0.88
Northeast Asia	1.23	1.18	1.27	1.30	1.29	1.28	1.29
Japan	1.40	1.33	1.40	1.41	1.40	1.35	1.54
China	0.67	0.78	1.00	0.76	0.70	0.85	0.63
Korea	1.94	1.69	1.59	1.96	1.82	1.71	1.80
Taiwan	0.47	0.64	0.91	1.04	1.26	1.33	1.32
Europe	1.27	1.21	1.19	1.17	1.17	1.21	1.21
North America	0.53	0.52	0.58	0.55	0.55	0.55	0.55
United States	0.33	0.31	0.36	0.35	0.37	0.38	0.40
Other regions	0.84	1.14	1.18	1.15	1.21	1.23	1.14
<i>Export-output ratios in Northeast Asia (percent)</i>							
Northeast Asia	11	12	na	na	na	na	15
Japan (plants, 4+)	10	12	14	16	14	14	16
China (firms)	5	7	13	10	8	9	6
Korea (plants, 5+)	23	20	22	36	26	25	25
Taiwan (plants, 91, 96, 01)	10	12	na	na	na	na	29

Notes: The figures for 1990–92 and 1993–96 are annual averages. North America includes Mexico.

Sources: International Iron and Steel Institute (various years); Statistics Canada (2003); Table 1.1.

Table 1.4 Imports of steel by region or economy

Indicator	1990-92	1993-96	1997	1998	1999	2000	2001
<i>Imports of finished and semi-finished products (thousand metric tons)</i>							
World	171,811	228,620	249,439	255,528	264,993	298,498	292,000
Asia	48,729	85,983	78,957	59,004	76,874	85,327	85,453
Northeast Asia	27,952	51,571	41,736	32,694	43,801	50,256	48,788
Japan	7,455	6,196	6,414	4,862	4,737	5,089	4,086
China	5,321	23,506	13,619	13,106	16,998	20,710	25,636
Korea	6,785	8,917	9,438	3,614	8,878	11,449	10,737
Taiwan	8,392	12,953	12,265	11,112	13,188	13,008	8,329
Europe	83,436	90,611	108,247	119,830	120,823	134,356	130,891
North America	20,908	31,159	37,979	49,595	43,146	50,907	41,463
United States	15,354	23,628	28,471	37,948	32,735	34,754	27,793
Other regions	18,738	20,867	24,256	27,099	24,150	27,908	34,193
<i>Imports (current US\$ millions)</i>							
World	109,362	139,873	155,487	153,551	136,248	154,487	143,122
Asia	31,520	48,146	50,222	37,783	39,252	45,958	41,669
Northeast Asia	14,225	23,637	21,852	16,327	19,123	23,579	20,431

Japan	4,339	4,487	4,239	2,981	3,049	3,737	2,840
China	3,608	9,978	8,264	7,505	8,740	10,699	10,839
Korea	3,174	4,917	5,394	2,543	3,828	5,150	4,190
Taiwan	3,104	4,255	3,955	3,297	3,506	3,993	2,562
Europe	53,737	60,350	65,183	71,964	62,130	67,805	64,941
North America	14,618	20,215	25,119	28,567	23,676	28,319	23,128
United States	10,685	14,963	17,650	20,563	16,315	19,185	15,176
Other regions	9,487	11,161	14,963	15,237	11,191	12,405	13,384
<i>Import/apparent consumption ratios (percent)</i>							
Northeast Asia	8	10	na	na	na	na	11
Japan (plants, 4+)	4	4	4	3	3	4	4
China (firms)	11	18	19	17	18	17	14
Korea (plants, 5+)	18	19	20	16	17	19	18
Taiwan (plants, 91, 96, 01)	22	22	na	na	na	na	19

Notes: The figures for 1990–92 and 1993–96 are annual averages. North America includes Mexico.

Sources: International Iron and Steel Institute (various years); Statistics Canada (2003); International Centre for the Study of East Asian Development (2003); Table 1.2.

Korea, but shares of apparent consumption were much larger, 18–20 percent in all years except the period after the financial crisis. In Taiwan imports were larger than exports through 1997, but exports became larger thereafter and import shares of apparent consumption fell from 22 percent in 1991 and 1996 to 19 percent in 2001. In China, imports grew very rapidly between 1990–92 and 1993–96, when import shares of apparent consumption increased from 11 percent to 18 percent. Imports stagnated thereafter and the import share of apparent consumption fell back to 14 percent by 2001.

The above discussion highlights how domestic markets dominate the steel industry in Northeast Asia, absorbing the vast majority of steel production in all of the region's economies. Moreover, Asian trade in steel tends to be highly concentrated within the region. By 1998–2001, about two-thirds of Asian steel imports came from other Asian economies (Table 1.5). The vast majority of Asian steel imports were from Northeast Asia. The intraregional share of imports was smaller in Asia than in Europe, where 85–92 percent of steel imports came from within Europe, but higher than in North America, where only about one-third of steel imports were intraregional during 1990–2001. In the North American market Europe and Asia each accounted for about one-fourth of the steel imports.

Although many of the region's large steel firms are multinational firms with operations in many countries, foreign operations are less prevalent in steel than in many other manufacturing industries. For example, in Japan multinational parents employed 93,258 workers or about two-fifths of Japanese total in 2001, but the ratio of employment in foreign affiliates to employment in Japanese parents was only 0.52, compared to 1.13 for all manufacturing industries combined (Ministry of Economy, Trade, and Industry, 2004).

1.2 Issues raised by restructuring and related economic principles

The vast restructuring in Northeast Asia's steel industry raises several important issues, which are in turn related to various portions of the economic literature. These include issues related to (1) steel's changing role as key industrial and military input and corresponding changes in the role of the state in the Northeast Asia's steel industry; (2) macroeconomic influences on industry performance, in particular the Japanese slowdown after 1992 and Asian financial crisis and its aftermath

Table 1.5 Shares of steel imports in major regions by source (% of regional imports, except where noted)

Importer, source	1985–89	1990–92	1993–96	1997	1998	1999	2000	2001
World Imports (US\$ millions)	85,885	109,362	139,873	155,487	153,551	136,248	154,487	143,122
Asia	25	23	25	26	25	26	28	27
Northeast Asia	21	19	19	20	20	21	22	21
Japan	17	12	11	11	10	10	10	10
China	1	1	2	3	3	2	3	3
Korea	3	4	4	4	5	5	5	5
Taiwan	1	1	2	2	2	3	3	3
Europe	60	60	54	50	52	50	48	50
North America (including Mexico)	6	7	7	9	8	8	8	8
United States	2	4	4	5	5	5	5	5
Other regions	10	10	14	15	14	15	16	15
Asia's Imports (US\$ millions)	23,697	31,520	48,146	50,222	37,783	39,252	45,958	41,669
Asia	57	57	57	62	66	65	65	67
Northeast Asia	49	46	43	48	51	52	54	53
Japan	38	30	25	25	25	27	27	27
China	2	4	5	8	7	6	8	6
Korea	8	10	9	10	12	11	11	11
Taiwan	2	3	4	6	7	8	8	9
Europe	25	22	20	17	17	13	12	14
North America	3	4	3	3	3	2	2	2
United States	2	3	2	2	2	2	2	2
Other regions	15	16	20	19	15	20	20	17

Table 1.5 Continued

Importer, source	1985-89	1990-92	1993-96	1997	1998	1999	2000	2001
Europe's Imports (US\$ millions)	38,227	53,737	60,350	65,183	71,964	62,130	67,805	64,941
Asia	2	3	3	3	5	5	5	5
Northeast Asia	2	2	2	2	4	3	3	3
Japan	1	1	1	1	1	1	1	1
China	0	0	0	1	1	1	1	1
Korea	0	0	0	0	1	1	1	1
Taiwan	0	0	0	0	1	0	1	0
Europe	91	92	91	90	88	88	85	86
North America	1	1	1	1	1	1	2	1
United States	1	1	1	1	1	1	1	1
Other regions	5	4	5	5	6	6	8	8
North America's Imports (US\$ millions)	13,335	14,618	20,215	25,119	28,567	23,676	28,319	23,128
Asia	31	26	18	18	27	24	24	23
Northeast Asia	28	24	16	15	24	19	19	19
Japan	22	17	10	9	14	9	8	9
China	0	1	1	2	2	2	3	3
Korea	5	5	3	3	6	5	5	5
Taiwan	1	1	1	1	1	2	3	2
Europe	34	30	31	25	22	22	23	23
North America	23	33	33	37	32	36	34	37
United States	7	16	14	17	15	18	18	20
Other regions	12	12	17	20	19	18	18	17

Notes: The figures for 1985-89, 1990-92, and 1993-96 are annual averages. North America includes Mexico.

Source: Statistics Canada (2003).

in the late 1990s; (3) trade and protectionism; and (4) industrial organization and scale economies. All of the following chapters analyze one or more of these issues and the purpose of this section is to provide an overview of them.

The steel industry has traditionally been one of the most promoted and protected industries in Northeast Asia and elsewhere. Steel has long been a key industrial and military input, giving it some characteristics similar to those of other public goods such as police or fire services and communication or transportation infrastructure. Correspondingly, national governments have strongly promoted the industry by various means. For example, during the 1950s and 1960s in Japan and during the 1970s in Korea and to a lesser extent in Taiwan, respective governments used a variety of policy instruments, ranging from import protection to preferential supply of low-interest government loans, export promotion, and tax breaks and special tax measures, such as accelerated depreciation and investment tax credits.³

Japan was able to overcome its high dependence on imported iron ore and coal through development of modern harbors capable of servicing new large-scale bulk carriers of these raw materials from overseas. By constructing large greenfield steel mills adjacent to the harbors, Japan accomplished two objectives: expanded production of steel as an important domestic industrial input and efficient export capabilities in steel, taking advantage of economies of scale and reductions in transportation costs. Japan's steel producers were encouraged to expand capacity and modernize with the government providing infrastructure and various incentive measures mentioned above (Yamawaki, 1988).

In the early 1970s the Japanese government engineered the merger that formed the largest steel maker in the world at that time, Nippon Steel. In Korea private conglomerates or *chaebol* were encouraged to enter the industry and expand capacity in the heavy industrialization drive that began in 1973. Pohang Iron and Steel Company (POSCO) was established during this period as a state enterprise with access to credit on favorable terms. In Taiwan the government owned and operated the largest firm there, China Steel, which began production in 1974 (Wade, 1990). In China the government continues to own and operate all its large steel firms.

However, the 1990s was a watershed decade for Northeast Asia's steel industry partially because governments greatly reduced their support for the steel industry in Korea and China, and all governments increasingly emphasized market-based solutions to problems in the industry. In Japan, this process had begun decades earlier in the 1970s. In Taiwan,

the government continued to own a large stake in China Steel, but this company was much smaller than the large steel firms in other countries and smaller companies accounted for a much larger portion of the steel industry in Taiwan than in Japan, Korea, or China.

One reason that governments increasingly emphasized market-based arrangements in the industry was because of large macroeconomic difficulties encountered in Japan from the early part of the decade and then in Korea in the latter part. Although the Japanese slowdown was not sharp, it was prolonged, which played a major role for the large downsizing in the country's steel industry. In Korea, there was a very sharp contraction following the Asian financial crisis of 1997–98, which greatly reduced domestic demand for steel and contributed to a large spike in Korean exports in 1998. The Japanese and Korean slowdowns also left governments far less able to provide large financial support to steel industries there. In China robust economic growth kept demand for steel growing rapidly throughout the period and growth was also steadier in Taiwan because it too was able to avoid a severe downturn in this period.

Protection from import competition was an important element of government intervention in Japan until the early 1970s, and in Korea, China, and Taiwan until the early 1990s. The literature that links trade theory with industrial organization shows that trade policy may raise domestic welfare if oligopolistic profits can be shifted from foreign firms to domestic firms. In the strategic trade policy literature, it is assumed that the government is able to set its policy and alter the perceived cost structure of firms in advance of the firms' production decisions. Brander and Spencer (1985) illustrate that export subsidies improve the relative position of a domestic firm in noncooperative rivalries with foreign firms, and allow the domestic firm to expand its market share. Krugman (1984) shows that when marginal cost declines with output or when there are dynamic economies of learning-by-doing, protecting domestic firm increases the domestic firm's market share in both the domestic and export markets. While policy makers in Northeast Asian countries probably protected the steel industry in the earlier period based upon the infant-industry argument,⁴ rather than upon the argument for the strategic government policies suggested by Brander and Spencer (1985) and Krugman (1984), they conceived steel as a strategic sector as indicated above. Thus, they maintained a relatively high degree of protection until the domestic firms became competitive in the world market.

US protectionism in its steel industries has also attracted a lot of attention in Northeast Asia. Indeed, interest in the effects of renewed US protectionism in the late 1990s was one of the motivations to

organize the project that has eventually led to this book. However, Northeast Asia's protection of its own steel industries has declined in recent years as the region increased emphasis on market-based solutions. China's entry into the World Trade Organization (WTO) was also very significant in this respect. In addition, the United States has been a small market for Northeast Asia's steel industries, which made US protectionism a relatively minor concern in and of itself. A larger concern is that China has apparently begun to imitate the US attempt to limit imports through anti-dumping actions and other measures and other countries in Asia might follow.

Restructuring in Northeast Asian steel resulted in a marked consolidation of the region's industry with some important mergers and the proliferation of strategic alliances. In Japan and Korea, the steel industry has always been best characterized as an oligopoly, in which a relatively few large firms have a potentially large degree of power over price and output in the industry. Recent restructuring has probably strengthened the market power of the largest firms. The degree of concentration also appears to be increasing in China with mergers among some of its largest steel makers. Only Taiwan has what might be characterized as a monopolistically competitive industry in which firms exercise relatively little market power.⁵ One of the most important reasons steel tends to be an oligopoly is technical, the existence of substantial plant-level scale economies in many product lines. Accordingly, it is technically impossible to turn steel into a competitive industry when these product lines occupy a large portion of production. One question that arises is then do the region's authorities think it is necessary to regulate the large steel firms in order to prevent them from abusing their apparently growing market power? If so what form should this regulation take?

1.3 Northeast Asia's steel production, employment, and trade

The four chapters in Part II of this book summarize major trends in production, employment, trade, and related indicators and examine the factors that affected the performance of the steel industry in Japan, China, Korea, and Taiwan. In Chapter 2, Oleksandr Movshuk, Eric D. Ramstetter, and Hiro Lee investigate the causes that led to a sharp contraction of Japan's steel industry in the 1990s. By the 1980s, the growth rate of value added slowed down considerably while employment contracted markedly. During the 1990s both value added and employment declined. Although part of the decline can be attributed to declining

steel prices in the 1990s, the sharp fall in employment indicates the large scope of restructuring in Japan's steel industry. Movshuk, Ramstetter, and Lee decompose the growth of sales in several dimensions, first showing that declines in intermediate material costs and the operating surplus or profits accounted for the large portions of falling steel production in most years, but that falling labor costs have become more important in recent years. Second, declines in domestic demand components, both price and quantity, accounted for much larger proportions of the decline in steel production than do declines in exports. Third, declines in domestic sales of hot-rolled steel, cold-rolled steel, and crude steel, as well as declines in production of blast furnace products, rolled products, and steel materials were also relatively large compared to declines in other product categories. The authors suggest that the prolonged slowdown of the Japanese economy from 1992, reduced use of steel as an intermediate input, and to a lesser extent, the collapse of Asian demand after the financial crisis of 1997–98 were some of the major factors causing the significant fall in production and employment of Japan's steel industry in the 1990s.

Despite the extremely rapid growth in steel consumption and production volume in China since the early 1990s, China lags behind the other three Northeastern economies in technology. In Chapter 3, Oleksandr Movshuk takes a close look at recent trends in production capacity, product mix, technological modernization, and trade propensity of China's steel industry. He observes that excess supply of steel products with low value-added content (e.g., rails, bars, rods, tubes, and pipes) and excess demand for products with high value-added content (e.g., hot-rolled and cold-rolled steel, galvanized sheet, and stainless steel) have persisted in the domestic market. In other words, China has been a net exporter of relatively low-quality steel and a net importer of relatively high-quality steel. China's comparative advantage in low-quality steel reflects its relatively low technological level of steel production. Movshuk then discusses major reform initiatives to modernize the industry, including the conversion of state-owned enterprises (SOEs) into corporate entities and recent efforts to create internationally competitive steel conglomerates around the four largest steel producers in China (Anshan, Baoshan Shougang, and Wuhan). To evaluate the impact of these recent reform initiatives on enterprise efficiency, the author reviews major studies that examine the efficiency of Chinese steel makers, and discusses their policy implications for reforming this chronically underperforming sector. Despite noteworthy progress in upgrading the technological facilities, he concludes that recent restructuring

initiatives have not resulted in a significant improvement in technological efficiency.

Korea was sharply affected by the Asian financial crisis of 1997–98, which caused large reductions in its domestic demand and production. After the crisis, a number of Korean firms, including a few medium-sized steel firms, became insolvent and had to cease operations, while other firms suspended or cancelled planned investments. Tae Yol Lee examines the vulnerability of Korean steel makers with the overcapacity problem after the crisis and how they restructured their operations in Chapter 4. Lee observes excess capacity supply in rolling facilities compared to its crude steel capacity, which led Korea to become a net importer of crude steel and a net exporter of finished steel. In addition, he analyzes the role of international trade in Korean steel, highlighting the important role the large increase of exports played in 1998 as a buffer for Korean steel makers in the midst of the crisis. Finally, Lee uses a simple model of interactions between domestic steel demand and macroeconomic variables to illustrate how exchange rate adjustments played an important role in the recovery of Korea's steel industry after the crisis.

While Taiwan's steel output and exports remained relatively small until the mid-1980s, it emerged as an efficient steel exporter in the late 1990s. In Chapter 5, Hung-Hua Tien first examines major stages in the historical development of Taiwanese steel industry, with a particular focus on changing production capacity, technological development, and involvement in international trade. She then employs data envelopment analysis (DEA) to estimate the relative performance of eight major Taiwanese steel firms and finds that the pure technical efficiency had less importance as a source of inefficiency compared with the scale of production. The results suggest that the development of a more efficient and competitive steel-making sector should be encouraged in Taiwan and that there should be more emphasis on improving scale efficiency, rather than pure technical efficiency.

1.4 Trade policy issues, restructuring, and strategic alliances

Steel has been a source of trade friction between the United States and Northeast Asian countries since the late 1960s when Japanese exports to the US market increased drastically. Steel exports to the United States have been under some forms of restriction in the past three and a half decades. For example, the Japanese government agreed to voluntarily

restrict its steel exports to the United States in 1969. The quantitative restrictions were initially imposed for three years, but in 1972 the voluntary restraint agreements (VRAs) were extended for three additional years. After VRAs were lifted in 1975, the US steel imports increased sharply and the steel lobby launched a political drive to fight the import surge, accusing foreign steel makers of dumping. In 1978, the US government introduced the trigger price mechanism (TPM) to set minimum prices for steel in the US market. Imported steel entering the United States below the minimum price was subject to formal anti-dumping investigations by the US Department of Commerce and the US International Trade Commission. Although the TPM was suspended in 1982, Northeast Asian steel makers continued to face US protectionist measures and actions in the past two decades, including the reinstatement of VRA from 1984–92, a large number of anti-dumping petitions filed by US steel makers after the Asian financial crisis that eventually led to punitive anti-dumping duties in many cases, and the imposition of safeguard measures in 2002–03.

The effects and implications of protectionist trade measures for the US steel industry in the 1970s and 1980s have been investigated by a number of studies (e.g., Canto, 1984; Crandall, 1981, 1987; Lenway and Schuler, 1991). These studies suggest that some of the policies that limited US steel imports in the 1970s and 1980s had a significant effect on reducing steel imports, at least in the short run.⁶ However, they also suggest that trade protection in the earlier decades did not induce US steel makers to become more internationally competitive. Two of the three chapters in Part III assess the implications of US steel protection and the related issues in the post-Asian financial crisis of 1997–98. In Chapter 6, William E. James and Craig Parsons posture that large fluctuations in US trading partners' export prices of steel have resulted from extreme exchange rate changes, as well as from excessive capacity resulting from depressed demand conditions. In particular, the authors examine the competitive firm behavior as an alternative explanation of dumping and consider the possibility of collusive behavior of steel firms under the anti-dumping actions. James and Parsons consider the possible avenues East Asia may explore for resolving the trade dispute and the economic costs associated with US steel protection.

In Chapter 7, Hiro Lee and Dominique van der Mensbrugge assess the effects of US safeguard measures that were imposed in March 2002 and terminated in December 2003, after the WTO's Appellate Body report of November 2003 upheld the complainants' arguments that the US steel safeguards were in violation of WTO rules.⁷ The authors employ

a dynamic multi-country computable general equilibrium (CGE) model to estimate the impact of the temporary safeguards on economic welfare, real GDP, trade flows, and sectoral output and average cost of steel and the related industries. Not surprisingly, the effects on Northeast Asian countries are extremely small because their exports to the United States constitute small percentages of their total steel exports. Although US economic welfare increases slightly in 2002–03 because of an improvement in its terms of trade, its real GDP declines by small percentages because an increase in output of the steel industry is more than offset by reductions in output of other industries, particularly those that use steel intensively as an intermediate input. The effects on output of the steel-consuming industries in Northeast Asian countries are positive, but they are extremely small. Canada and Mexico, which were exempted from the safeguard measures, would benefit the most because of a sharp increase in their exports to the United States. Lee and van der Mensbrugghe also compare the outcomes between (1) the perfect competition and constant returns to scale and (2) imperfect competition and increasing returns to scale, and find that the magnitudes of the effects of the US policy are significantly greater under the second case.

The last chapter of this book examines recent restructuring as well as mergers and strategic alliances among Northeast Asia's large steel makers. Many large steel firms aggressively restructured their operations in the last decade. This restructuring was particularly far-reaching in China, Japan, and Korea, with some firms liquidating, others merging, and strategic alliances being strengthened. Partially because of this restructuring, employment in most large steel firms began to fall rapidly after the early 1990s. The Asian financial crisis also had an especially large impact on Korean firms as domestic demand contracted sharply in 1997 and 1998. Commensurate with decreased Asian demand and strong US growth, exports to the United States surged in the late 1990s, and the United States then charged numerous steel producers in Northeast Asia and elsewhere with dumping. This firm-level analysis reveals few differences in firm performance between the late 1990s and previous years that would substantiate such charges. Northeast Asian steel makers also sold most of their output in domestic markets and the vast majority of exports went to other Asian countries, not to North America or Europe, suggesting that the dumping issue was not quantitatively important to these firms. On the other hand, the tendency of governments to promote greater reliance on market-based solutions in an industry that once received highly preferential treatment has been of much more consequence. The proliferation of mergers and strategic

alliances among the region's largest steel makers also raises potentially important antitrust questions.

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Notes

1. In Japan, gross output and value added both fell slightly less than one-third between 1993–96 and 2001, following increases of 3 percent and 8 percent respectively, between 1990–92 and 1993–96. In Taiwan, gross output fell 17 percent and value added declined 9 percent following increases of 46 percent and 25 percent, respectively. In Korea, the declines were 6 percent and 2 percent, respectively, following increases of 43 percent and 37 percent, respectively. In China gross output and value added increased by 62 percent and 91 percent, respectively, in the early period and by 41 percent and 27 percent in the latter.
2. RCAs are calculated as the ratio of (1) the share of steel exports in total exports for a country to (2) the share of worldwide steel exports in total worldwide exports. In a world where trade flows are determined solely by comparative advantage (comparative costs), RCAs exceeding 1.0 indicates a comparative advantage in the commodity category in question and RCAs less than 1.0 indicates a comparative disadvantage. In reality, however, comparative prices determine comparative advantage and RCAs are thus influenced by factors related to the price–cost margin (e.g., tariffs and other import protection as well as imperfect competition), in addition to comparative costs. When RCAs are consistently higher or lower than 1.0, however, it is likely that comparative prices and comparative costs are strongly correlated.
3. Lee (1993) finds that the steel and transport equipment industries benefited the most from Japan's industrial policy during the 1960s.
4. According to the infant-industry argument, a nation may have a potential comparative advantage in a product, but because of lack of know-how and the initial small output level, the industry cannot compete with more established foreign firms. Temporary protection is then justified to establish the domestic industry during its "infancy" until it can meet foreign competition, achieve economies of scale, and reflect the nation's long-run comparative advantage.
5. However, Wade (1990, p. 100) suggests that China Steel had a virtual monopoly in the domestic market. Although mini-mills producing specialty steel of high quality have had a presence in Taiwan, they were reliant on basic steel input from China Steel.
6. For example, Crandall (1981, p. 114) estimated that the trigger price mechanism would have resulted in a reduction in the US import share of steel from 18 percent to 13 percent.
7. The complainants were the European Union, Norway, Switzerland, China, Japan, Korea, New Zealand, and Brazil.

References

- Brander, James A. and Barbara J. Spencer (1985), "Export Subsidies and International Market Share Rivalry," *Journal of International Economics*, 18: 83–100.
- Canto, Victor A. (1984), "The Effect of Voluntary Restraint Agreements: A Case Study of the Steel Industry," *Applied Economics*, 16: 175–86.
- Crandall, Robert W. (1981), *The U.S. Steel Industry in Recurrent Crisis*, Washington, DC: Brookings Institution.
- Crandall, Robert W. (1987), "The Effects of U.S. Trade Protection for Autos and Steel," *Brookings Papers on Economic Activity*, 1: 271–88.
- International Centre for the Study of East Asian Development (2003), "Recent Trends and Prospects for Major Asian Economies," *East Asian Economic Perspectives*, 14 (Special Issue), February.
- International Iron and Steel Institute (various years), *Steel Statistical Yearbook*, 2000–03 issues. Brussels: Committee on Economic Studies, International Iron and Steel Institute (2001–03 issues downloaded from www.worldsteel.org).
- Krugman, Paul R. (1984), "Import Protection as Export Promotion: International Competition in the Presence of Oligopoly and Economies of Scale," in H. Kierzkowski, ed., *Monopolistic Competition and International Trade*, Oxford: Oxford University Press.
- Lee, Hiro (1993), "General Equilibrium Evaluation of Industrial Policy in Japan," *Journal of Asian Economics*, 4: 25–40.
- Lenway, Stefanie A. and Douglas A. Schuler (1991), "The Determinants of Corporate Involvement in Trade Protection: The Case of the Steel Industry," in R. E. Baldwin, ed., *Empirical Studies of Commercial Policy*, Chicago: University of Chicago Press.
- Ministry of Economy, Trade, and Industry (2004), *Dai 32 Kai Wagakuni Kigyō no Kaigai Jigyō Katsudo [The 32nd Survey of Overseas Business Activities of Japanese Companies]*, Tokyo: National Printing Bureau (in Japanese).
- Statistics Canada (2003), *World Trade Analyzer*, 2003 CD-ROM, Ottawa: Statistics Canada.
- Wade, Robert (1990), *Governing the Market: Economic Theory and the Role of the Government in East Asian Industrialization*, Princeton: Princeton University Press.
- Yamawaki, Hideki (1988), "The Steel Industry," in R. Komiya, M. Okuno, and K. Suzumura, eds, *Industrial Policy of Japan*, San Diego: Academic Press.