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East Asian Steel Projections for the 1990s Revisited

In 1989 a research team from the Australia–Japan Research Centre (AJRC) undertook a study of the prospects for the East Asian steel industry for the 1990s. The aim was to assess the impact of developments in the region on industry strategies in Australia. This paper reviews those projections to see whether they were right or wrong. It also examines the growth of the East Asian industry over the last decade in the context of developments in the industry worldwide and reviews Australia's position in regional iron ore and coal markets during the 1990s.

The central focus of the AJRC study was on what opportunities might emerge in Australia for the supply of processed steel product to the East Asian region in the 1990s. The main conclusion was that East Asia would shift from being a long-time and significant net exporter of steel product to the rest of the world to being a significant net importer of steel product, given then established trends in production, consumption and trade. At the time, this was a radical conclusion. It had an important impact on thinking about trends in the regional steel market in Australia, in Japan and elsewhere in East Asia.

The main conclusions of the AJRC study turned out to be correct. The industry did not adjust to the pressures in the market exactly as predicted, partly because of the financial crisis in East Asia and Japan's domestic stagnation. However, the conclusions about the growth of China and its impact on regional steel trade were particularly prescient.

In the last decade, China has become the world's largest producer and consumer of steel while Japanese consumption and production have contracted. Both South Korea and Taiwan have increased their shares of production and consumption of steel. Australia has entrenched its position as the dominant supplier of iron ore and coking products to East Asia.

In 1989 a research team from the Australia–Japan Research Centre (AJRC) undertook a study of the prospects for the East Asian[1] steel industry for the 1990s (Drysdale and Tsukuda 1989; Drysdale 1992; AJRC 1994). They analysed the changing patterns of production and consumption of crude steel in East Asia in relation to the rest of the world in the decades leading up to the 1990s and sought to project production, consumption and net trade forward to 2000. The objective was to identify the factors that would impact on the business strategy of mining companies in Australia and the East Asian steel producers in the decade beyond 1989.

In this paper, we begin by reviewing the projections of the 1989 AJRC study to see whether they were right or wrong and, if they were wrong, why they were wrong. We then examine what actually happened to steel production, consumption and trade in the 1990s. Next, we assess Australia's position as a supplier of raw material to the East Asian steel industry in a period that saw the rapid rise of first the Korean and then the Chinese industry alongside that of Japan. We also describe the shift in steelmaking technologies in mature steel-producing economies. We conclude with some observations about the future pattern of Australia's steel trade relations with East Asia.

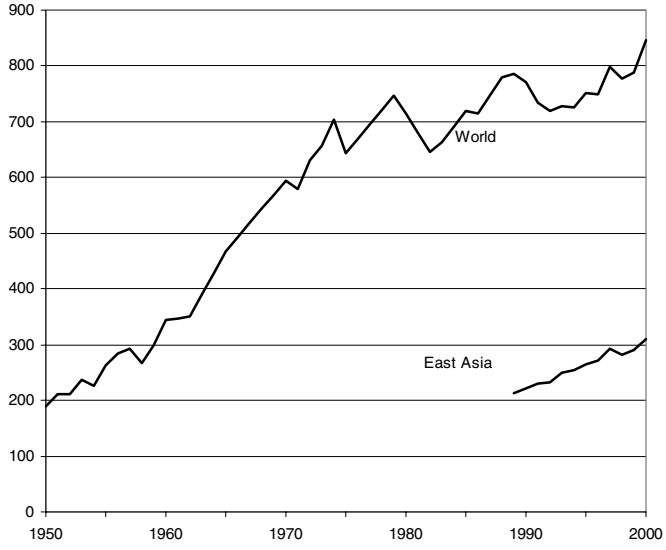
Background and projected outcomes

From about 1969, Northeast Asia[2] became a major player in the world steel industry. By 1973, Japan had become the world's biggest and most competitive producer, and the major industrial economies in Europe and North America were becoming substantial net importers of steel, significantly from Japan (Drysdale and Tsukuda 1989, p. 8). The demand for steel by industrial countries began to decline in 1973. This occurred because of stagnation in Organisation for Economic Co-operation and Development (OECD) economies, new metal-saving technology, and low investment levels. Steel production in industrialised countries fell even more than demand. Developing countries (especially Korea) moved to fill the gap in production, and their steel output grew strongly (Drysdale and Tsukuda 1989, p. 8). The rise of the Japanese industry led to steady integration of world steel trade. In 1989, the Northeast Asian region was set to become the key element in the future development of the world steel industry.

Between 1950 and 1974, the world steel industry grew steadily (at an average rate of 5.6 per cent), with production peaking at 704 million tonnes in 1974. There was a collapse in 1975, when the first energy crisis occurred, and another in 1979 (see Figure 1). Growth resumed again in the early 1980s (Drysdale 1992).

A major objective of the AJRC study was to examine the prospects of the Japanese steel industry in the 1990s. Drysdale and Tsukuda (1989, p. 12) concluded that production of high-value products could be expected to hold up but that production of standard technology items would decline and that eventually Japan would probably import a high proportion of standard technology products. The AJRC study suggested that, as a result of these and other developments in the region, during the 1990s Northeast Asia was likely to switch from being a substantial net exporter of steel products to being a substantial net importer of steel products.

Figure 1 World and East Asian crude steel production, 1950–2000 (million tonnes)



Source: International Iron and Steel Institute (2002).

In discussing the position of the Japanese steel industry at the end of the 1980s, the AJRC study noted the dominance of Japanese steel producers in terms of both scale of production and international competitiveness (Drysdale and Tsukuda 1989, p. 4). At this time, the Japanese steel industry was the largest of any single nation in the world. It was thought that the technological superiority of the Japanese industry in most areas of steelmaking was unlikely to be challenged in the medium term, especially at the high-value end of steel production (Drysdale and Tsukuda 1989, p. 4).

In developing countries in East Asia, consumption was also growing strongly, notably in China. Between 1975 and 1985, Chinese steel consumption grew at an annual rate of 7 per cent, slightly higher than GDP growth. In China, consumption was increasing at a rate considerably faster than production. By the mid-1980s, China had become the largest market for Japanese steel. Steel consumption also grew strongly in Korea and Taiwan.

The AJRC study noted that Korean steelmaking costs had become the lowest in the world after the yen appreciation of the mid-1980s and suggested that Korean demand would continue to grow strongly until 2000. In particular, Korean demand for high-grade steel was expected

to increase as Korean businesses entered more advanced industries; exports of high-value products were also expected to rise as Korean investment in R&D in the steel industry paid off (Drysdale and Tsukuda 1989, p. 15).

At the time of the AJRC study, Taiwan's steel production was expected to grow strongly. Demand was also expected to grow strongly, until at least the mid-1990s, although it was noted that Taiwanese producers were looking for crude steelmaking opportunities abroad and focusing the domestic steel business on upstream processing (Drysdale and Tsukuda 1989, p. 15).

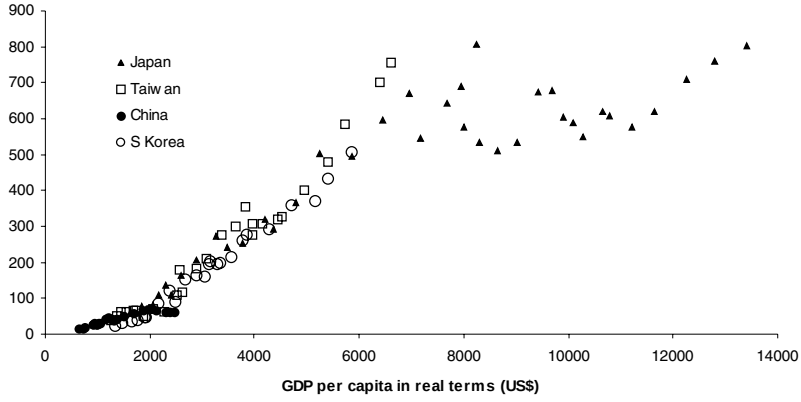
In 1989, Chinese steel production was growing strongly and import levels were high. Nevertheless, there was strong excess demand for steel in China. This was a constraint on growth and had the potential to slow Chinese modernisation more broadly. In 1989, steel demand in China was expanding at or around the same rate as overall GDP growth. The official estimate of forecast steel consumption by the end of the century was 100 million tonnes, but GDP was expected to grow by 7 per cent per annum. If steel demand continued to grow at that rate – and it had been growing even more rapidly than GDP in the 1980s – consumption would be expected to climb to about 160 million tonnes by the end of the century. Planned production by the end of the century was about 80 million tonnes. In other words, there would be a shortfall of at least 20 million tonnes on official estimates of demand growth – and a much larger shortfall on unofficial estimates (Drysdale and Tsukuda 1989, p. 16). The AJRC study concluded that the projected growth of imports would greatly impact upon international markets and the use of China's foreign exchange earnings.

In other words, the newly industrialising economies in East Asia were increasing their production and consumption of steel rapidly, whereas output in industrialised economies in Europe and North America was falling. The growth of steel consumption in these East Asian economies was closely associated with rising levels of per capita GDP (Figure 2 and Drysdale and Tsukuda 1989, p.4).

The bottom line was that Northeast Asia, including Japan, was likely to change its role in world steel trade. It would become a significant net importer of steel products in the 1990s, instead of being a significant net exporter of steel products as it had been in the 1980s. This change could place a strain on world supplies (see Figure 3c). Corollaries were that Japan and Korea would expand exports of high-end value products, while increasing imports of standard technology products, and that China's imports of steel would increase sharply.

Since the Australian steel industry was internationally competitive, it was expected that there would be opportunities for growing steel product exports from Australia to East Asia in

Figure 2 Steel consumption (kg) and GDP (US$) per capita



Source: AJRC (1994, Figure 4).

the 1990s (Drysdale and Tsukuda 1989). There had been expansion of Australian exports of steel, especially to China, and it was expected that Northeast Asian consumption and production trends could justify expansion of production facilities for semi-processed or processed steel products in Australia.

Actual outcomes in the 1990s

What actually happened to the East Asian steel industry during the 1990s?

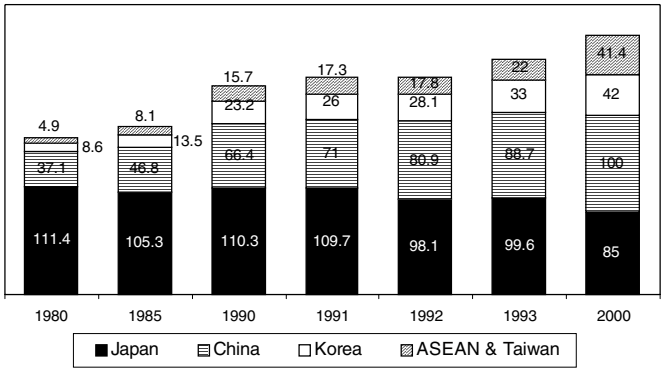
Production

During the 1990s, the growth of steel production in East Asia continued (Figures 1 and 4) but production in the rest of the world declined or did not grow significantly. In fact, East Asia has been the primary source of growth in both steel production and steel consumption since the mid-1960s.

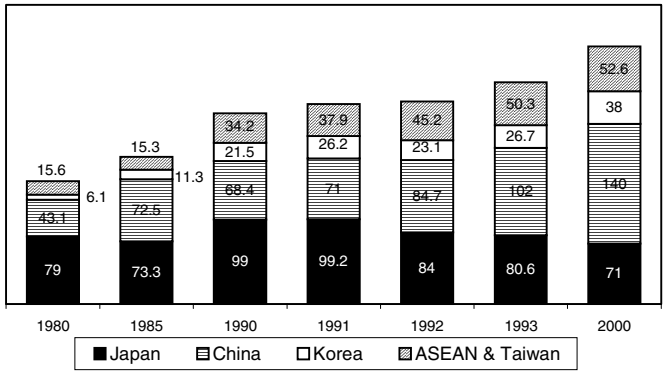
In 1989 world crude steel production was 786 million tonnes per annum, of which 206 million tonnes (26 per cent) were produced in East Asia (Figure 4). By 2000, world steel production was 847.4 million tonnes, of which 303.6 million tonnes (almost 36 per cent) were produced by East Asia. During the 1990s, world steel production was quite flat, but East Asian

Figure 3 Projections of East Asian production, consumption and trade in steel (million tonnes)

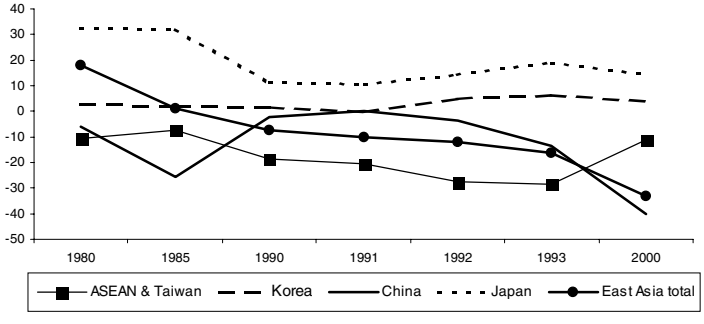
a. Production



b. Consumption



c. Net trade



Notes: Data for 2000 are projected East Asian steel production; projected East Asian steel consumption; and projected net trade in steel.

Source: AJRC (1994, Figures 3a, 3b and 3c).

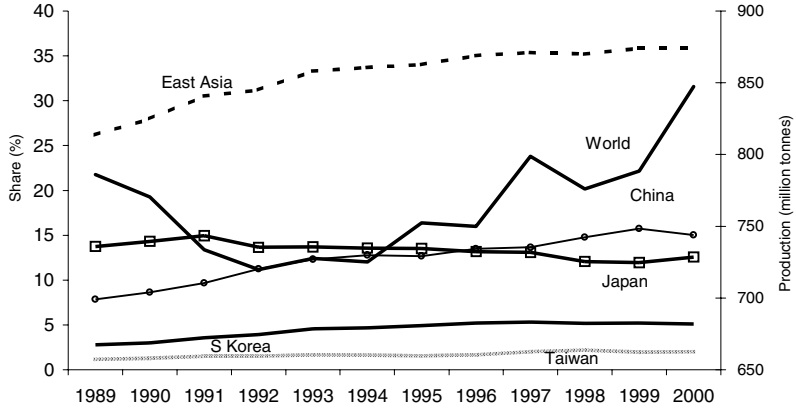
crude steel production increased very substantially, by around 100 million tonnes (see Figures 1 and 4), and China became the world's largest steelmaker, overtaking Japan. Between 1989 and 2000, Japanese production remained at around 107 million tonnes, while Chinese production grew from 62 million tonnes to 127 million tonnes, with a huge additional surge in output in 2001.

Figure 4 shows that the steady increase in East Asia's steel production in the decade to 2000 was due mainly to the expansion of steel production in China. China overtook Japan as the world's largest producer in 1996. Along with most sectors in the Japanese economy in the decade to 1998, crude steel production slipped into and out of recession, with virtually no growth at all over the whole decade. One reason was Japan's prolonged economic slump in the 1990s; another was that Korea and other competitive crude steel producers took market share from Japan.

Consumption

During the 1990s, world crude steel consumption was relatively flat. Japan's consumption fell by 13 million tonnes. However, the rest of East Asia increased its share of world consumption

Figure 4 Crude steel production, 1989–2000: world production (million tonnes); country share (per cent)



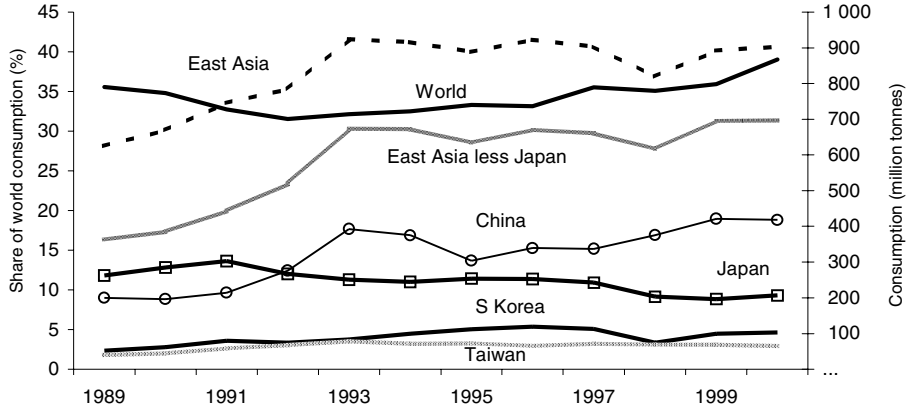
Source: International Iron and Steel Institute (2002).

from 28 per cent to 41 per cent (see Figure 5). This was largely driven by rapid industrialisation in China, where demand grew from 71 million tonnes to 163 million tonnes, adding 92 million tonnes to world steel demand. Consumption also rose strongly in Korea and Taiwan, which together added 33 million tonnes to world demand.

Net trade

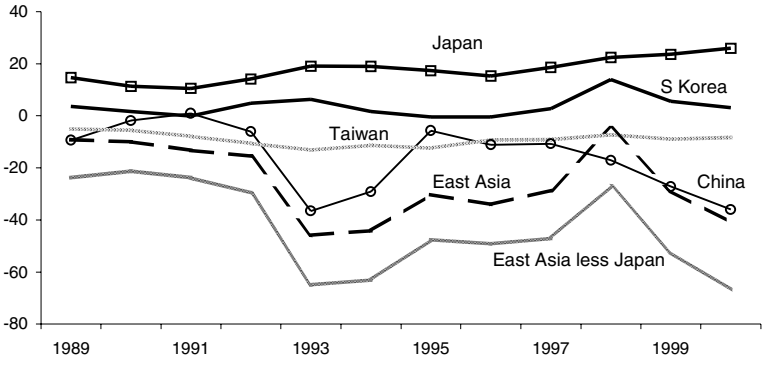
During the 1990s, Japan's net steel exports rose somewhat, because steel consumption fell even more than steel production. In the same period, except for 1991, the Chinese steel industry imported more and more steel. However, China's net steel trade position (measured in volume terms) varied considerably. In 1993 and 1994, there was a strong surge in steel imports; this was also the case from 1997 to the end of the decade and beyond. Korea was a net steel exporter for most of the 1990s; its exports increased after the devaluation of the won in 1997 and 1998 during the East Asian financial crisis (see Figure 6). Taiwan, on the other hand, remained a significant net importer throughout the decade.

Figure 5 Crude steel consumption, 1989–2000: world consumption (million tonnes); country share (per cent)



Source: International Iron and Steel Institute (2002).

Figure 6 Net trade in crude steel, 1989–2000 (million tonnes)



Source: International Iron and Steel Institute (2002).

Australia's position as a supplier of raw materials

These developments in the East Asian steel industry affected Australia's position as a world supplier of coking coal and iron ore.

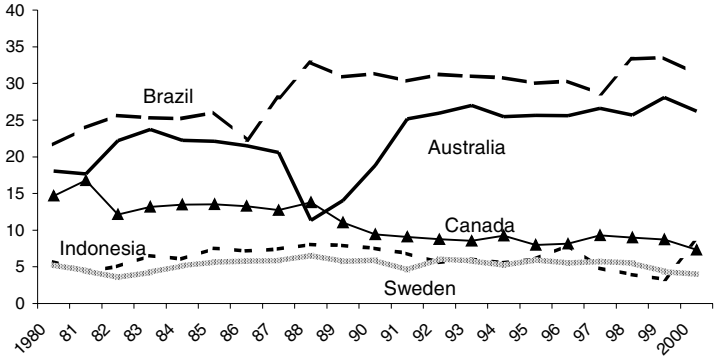
Iron ore

At the beginning of the 1990s, Brazil was the world's largest exporter of iron ore and concentrates, and Australia was the second largest. Canada, India and Sweden were also major players in the international iron ore export business.

In recent years, Brazilian and Australian dominance of the iron ore trade has grown (see Figures 7, 8 and 9). In 2000, Brazil held about 31 per cent of the market, while Australia had about 26 per cent. During the 1990s, Canada's share fell steadily (to only 7 per cent by 2000) but Australia's share grew steadily. A key factor in the growth of Australia's share was the strong competitive position of Australian producers in the fast-growing East Asian market.

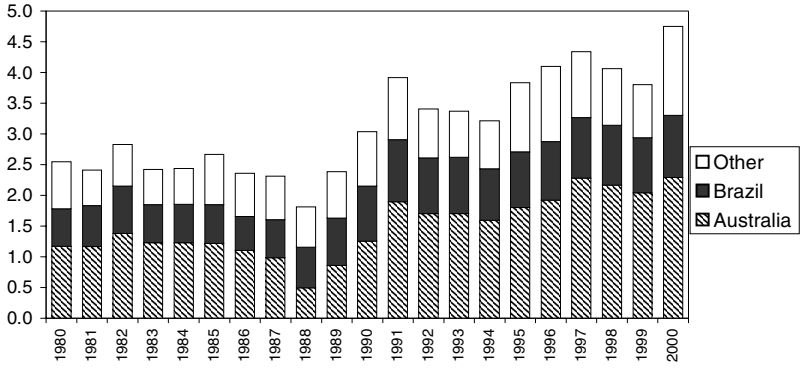
Steel production, steel consumption and the demand for steelmaking raw materials are expanding more rapidly in East Asia than in any other part of the world. Australia supplies most of East Asia's iron ore (more than 50 per cent in 1999; see Figure 9). Australian exports of iron ore and concentrates to East Asian steel mills doubled during the 1990s (Figure 8). Brazilian exports to East Asia grew by 60 per cent over the period. Australian exports to East

Figure 7 World share in exports of iron ore by country of origin, 1980–2000 (per cent)



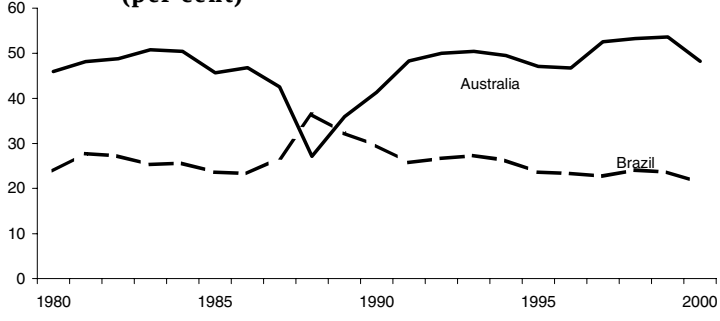
Source: International Economic Databank (IEDB), ANU.

Figure 8 Value of iron ore exports to East Asian steel mills, 1980–2000 (US$ billion)



Source: International Economic Databank (IEDB), ANU.

Figure 9 Share of Australia and Brazil in East Asian iron ore market, 1980–2000 (per cent)



Source: International Economic Databank (IEDB), ANU.

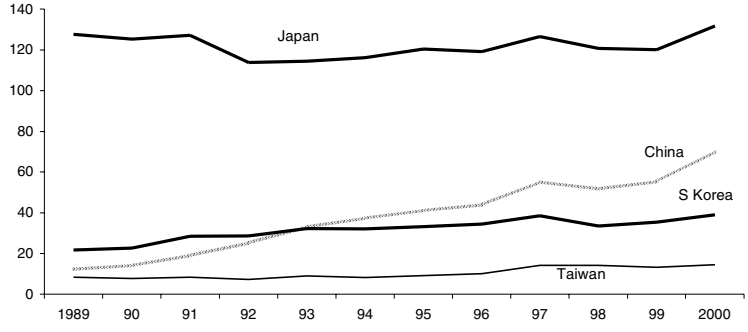
Asia are now growing at a faster rate than Brazil's, and Australia is coming off a higher base share than that of Brazil.

Figure 10 shows imports of iron ore for the major steel-producing East Asian economies. Japan is by far the largest importer. China's imports are growing strongly; at 70 million tonnes in 2000, they now exceed the imports of Korea and Taiwan. China is the world's largest producer of crude steel, but it is not the world's largest importer of iron ore and concentrates. This is because it has large domestic reserves of iron ore, although its mines cannot produce enough ore of sufficient quality and at a sufficiently competitive price to supply all domestic demand.

Coal

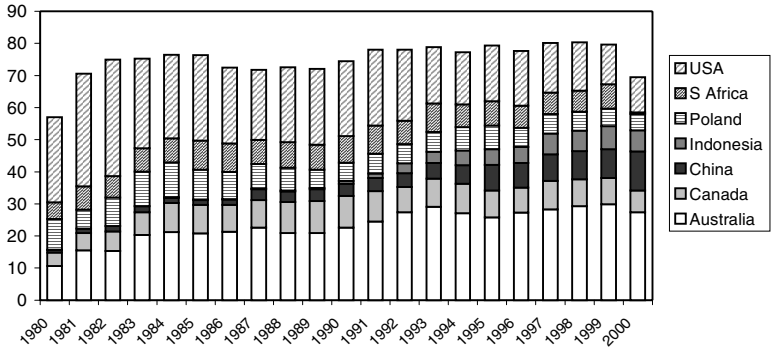
World trade in coking coal, coke and briquettes is quite different from that in iron ore in that it is not dominated by a few countries (Figure 11). Once, the United States was the largest exporter of coking coal. However, the devaluation of most currencies in terms of the US dollar during the 1990s weakened US competitiveness in world coal markets and corroded US market share (see Figure 12). Australia steadily increased its share of world exports as its products became more competitive and US products less competitive. In the 1990s, Australia tripled its exports of coking coal to the world, while US exports fell by 13 per cent. Australia has now emerged as the world's largest supplier of these products.

Figure 10 Imports of iron ore, 1989–2000 (million tonnes)



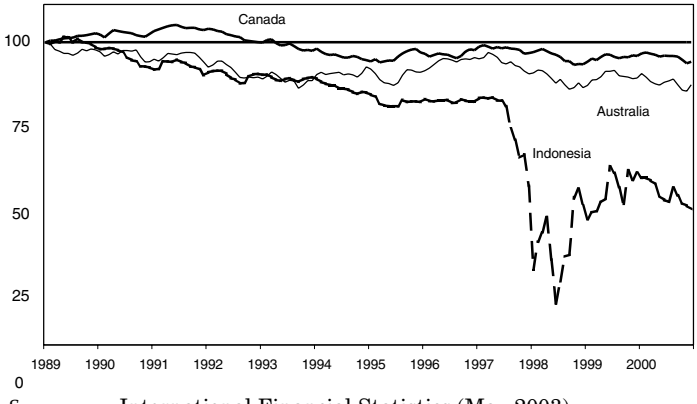
Source: International Iron and Steel Institute (2002).

Figure 11 Share in world coking coal exports by country, 1980–2000 (per cent)



Source: International Economic Databank (IEDB), ANU.

Figure 12 Index of real exchange rate movements of coal exporters relative to the US dollar, 1989–2000

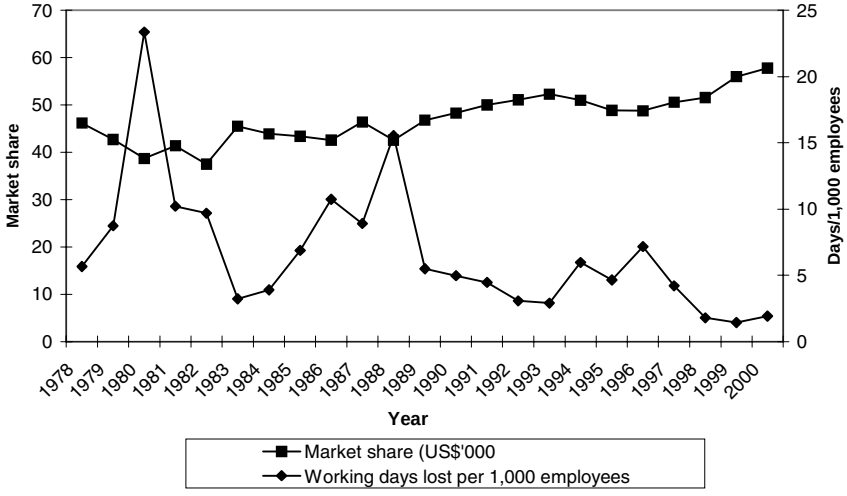


Source: International Financial Statistics (May 2003).

Among other major exporters, Indonesia is perhaps the only producer that has the potential to rival Australia. Indonesia's exports have grown from near zero in the early 1990s to 6.6 per cent of the market in the year 2000.

One reason for Australia's increased international competitiveness is labour market reform and other reforms introduced in the 1980s. During this decade, there was a strong negative association (correlation coefficient –0.74) between days lost through industrial action in the Australia coal industry and Australia's share in the Japanese coal market (see Figure

Figure 13 Effect of some Australian labour market characteristics on Japan's coal imports, 1978–2000



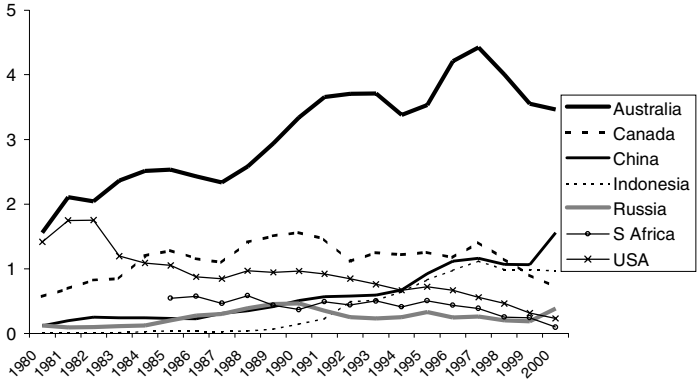
Notes: Correlation Coefficient = –0.74
Regression (1): Y(t) = a + bX(t) b = –0.00077 R square = 0.55
Regression (2): Y(t) = a + bX(t –1) b = –0.00058 R square = 0.30
Where Y = market share, X = no. of working days lost / 1000 employees

Sources: Industrial Disputes, Australia (Cat. No. 6321.0), Australian Bureau of Statistics, various issues.
International Economic Data Bank, Australian National University (compiled from UN Comtrade Database, Industrial Disputes, Australia (Cat. No. 6321.0), Australian Bureau of Statistics, various issues.

13). Australia's competitiveness in the market for coal exports to East Asia strengthened through the 1990s. Labour market and other reforms in the 1980s also strengthened Australia's international competitiveness. There is a strong negative association between days lost through industrial action in the Australia coal industry and Australia's share in the Japanese coal market (see Figure 13). Specifically, the correlation coefficient, which measures the association between these two variables, is –0.74. This is a very strong negative relationship. The lower levels of industrial action in Australia made its coal export supplies more reliable and saw Australia's share of the Japanese market for coal rise. There is a similar – though, as one might expect, slightly weaker – association between industrial action in the coal industry and Australia's market share in Japan by volume (correlation coefficient –0.68).

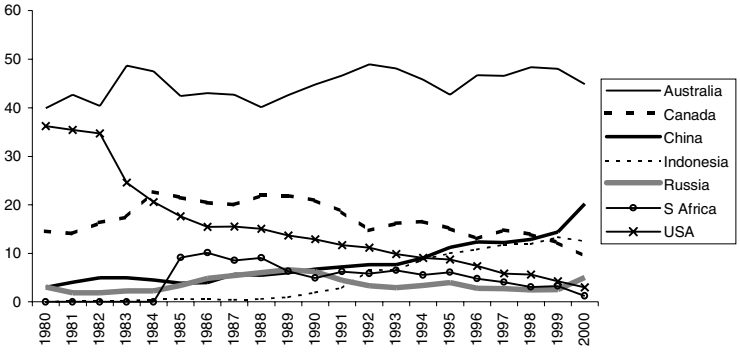
Australia increased its share of the East Asian coal products market from 40 per cent in 1980 to 48 per cent in 1999. This occurred at a time when the East Asian market for coal grew

Figure 14 Value of coal exports to East Asia by country of origin, 1980–2000 (US$ billion)



Source: International Economic Databank (IEDB), ANU

Figure 15 Shares of coal exports to East Asia by country of origin, 1980–2000 (per cent)



Source: International Economic Databank (IEDB), ANU.

by 197 per cent. In particular, the value of Australian coal exports to the East Asian market grew strongly in the 1990s (Figure 14). Australia held the largest share in that market at the beginning of the decade; by the end of the decade, its share had grown to almost 50 per cent (see Figure 15). Over this period, Australia's position as the lead supplier to East Asia was never challenged and this lead has continued to grow. The only other producers to increase their exports of coal to East Asia have been China and Indonesia, but their exports have grown less than Australia's (see Figure 15).

Steelmaking technologies

Changes in steelmaking technologies in mature steel-producing economies substantially affect raw material markets. In particular, changes in the mix of technologies could impact upon world trade in steelmaking products and raw materials.

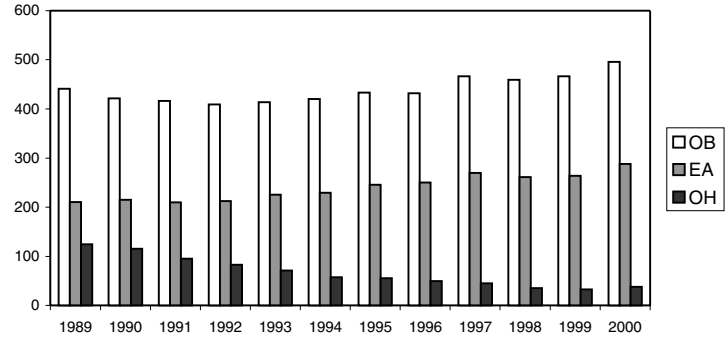
There are essentially three major methods of steelmaking: the oxygen blown converter (OB) method; the electric furnace (EA) method; and the open hearth (OH) method.

The OH method is still used in China and some Eastern European countries but is becoming less and less common because it generates large amounts of pollution. During the 1990s, the share of world crude steel production by the OH method fell from 15.9 per cent to 4.5 per cent (see Figure 16). Most countries now use OB or EA processes.

In the 1990s, about 56 per cent of the world's steel was produced by the OB method. This process uses coke as both a source of energy and a reducing agent. At high temperatures (2000°C) in a blast furnace, the reducing agent (coke) combines with the oxygen in the iron ore to form carbon dioxide and carbon monoxide; this leaves molten iron (liquefied pig iron) in the bottom of the furnace for collection.

In recent years pulverised thermal coal (PCI) has partially replaced coke as the energy source in the steelmaking process (Koerner 1992, p. 19). Each unit of PCI input replaces a unit

Figure 16 World steel production by steelmaking method, 1989–2000 (million tonnes)



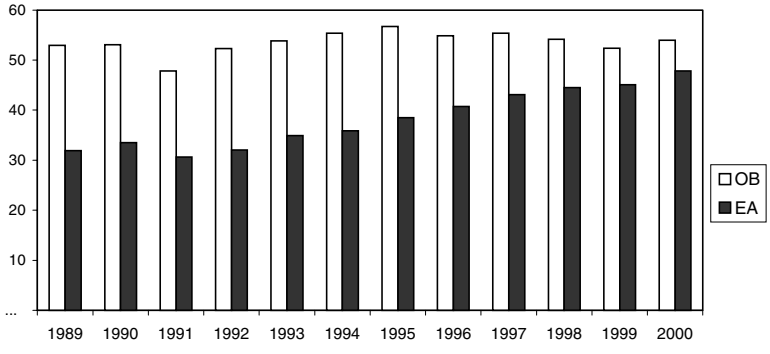
Notes: OB is oxygen blown converter method; EA is electric furnace method; OH is open hearth method.
Source: International Iron and Steel Institute (2002).

of coke. Theoretically, coke consumption rates could fall to 200 kilograms per tonne of pig iron (Porter 1985, Chapter 1). At Japanese Steel Mills (JSM), coke consumption per tonne of pig iron produced fell from around 600 kg in the early 1960s to 480 kg in the 1980s and 450 kg in the 1990s.

EA technology is a relatively new method of steelmaking that involves direct reduction of the feed, which may be lump iron ore, scrap, hot briquette iron or pellets. In this process, either coke or gas combines with oxygen in the feed material to leave molten 'sponge iron' (which is about 82 per cent iron). For environmental and other reasons, the EA method is gaining in popularity, especially in mature industrial economies. In particular, the United States and the European Union (EU) have increased the amount of crude steel produced by this process. In the 1990s, the United States increased the production of crude steel by this method by 34 per cent (Figure 17). On current trends, the United States will soon use the EA method to produce most of its crude steel. Similarly, the EU increased its production of steel by the EA method by 32 per cent during the 1990s; production by the OB method declined by 7 per cent over the same period (Figure 18).

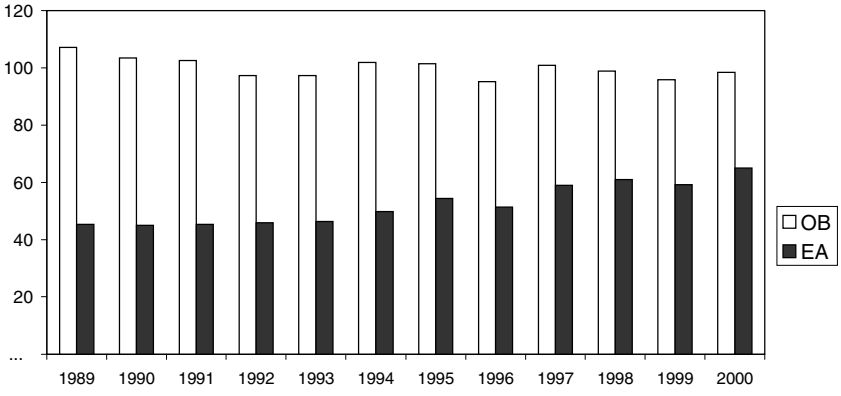
The situation is somewhat different in East Asia. In China, crude steel production by the OB method increased by 176 per cent during the 1990s (Figure 19). Production by the EA method increased by 39 per cent, and production by the OH method decreased by 86 per cent.

Figure 17 US steel production by steelmaking method, 1989–2000 (million tonnes)



Notes: OB is oxygen blown converter method; EA is electric furnace method.
Source: International Iron and Steel Institute (2002).

Figure 18 EU-15 steel production by steelmaking method, 1989–2000 (million tonnes)

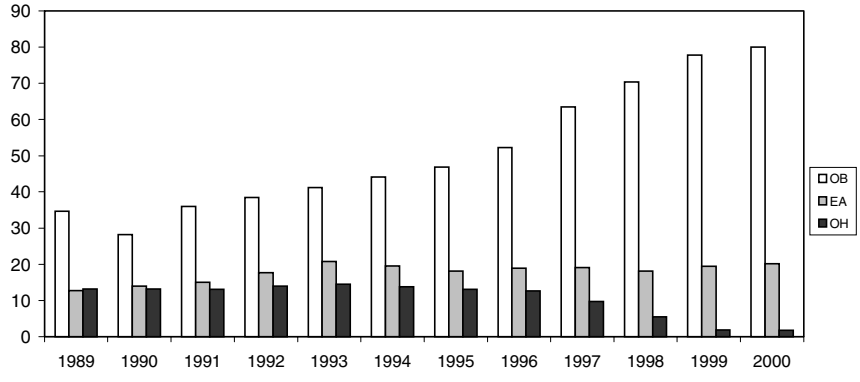


Notes: OB is oxygen blown converter method; EA is electric furnace method.
Source: International Iron and Steel Institute (2002).

In Japan, there was a decline of 13 per cent in production using the OB method (Figure 20). Production by the EA method fell by 17 per cent.

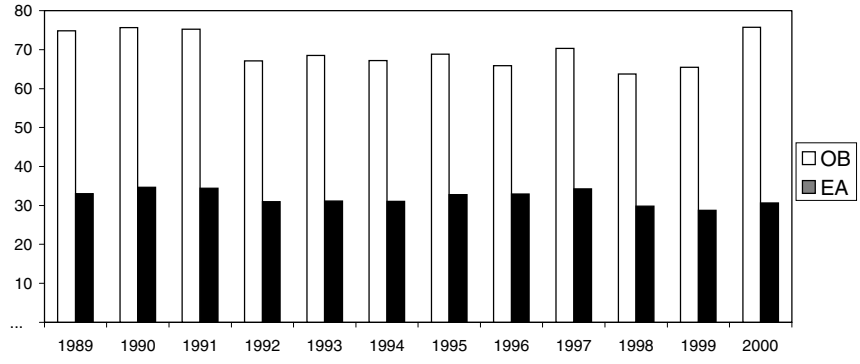
EA production is not so widely diffused in East Asia as in North America or Europe, so the strong growth of the East Asian industry continues to rely on the availability of high-

Figure 19 China's steel production by steelmaking method, 1989–2000 (million tonnes)



Notes: OB is oxygen blown converter method; EA is electric furnace method; OH is open hearth method.
Source: International Iron and Steel Institute (2002).

Figure 20 Japan's steel production by steelmaking method, 1989–2000 (million tonnes)



Notes: OB is oxygen blown converter method; EA is electric furnace method.
Source: International Iron and Steel Institute (2002).

quality raw material from countries like Australia. However, changes in the mix of steelmaking technologies in North America and Europe presage changes that are likely to be replicated in East Asia in coming decades.

Conclusion

The AJRC projections for 2000 (AJRC 1994) for East Asian steel were 268.4 million tonnes for production (Figure 3a), 301.6 million tonnes for consumption (Figure 3b) and 33.2 million tonnes for net imports (Figure 3c). In fact, production totalled 303 million tonnes (Figure 4), consumption was 352 million tonnes (Figure 5) and net imports were 40 million tonnes (Figure 6). China alone had net imports of 36 million tonnes in 2000, and net imports continued to grow into 2001 despite the huge surge in production from that year.

Overall, the AJRC projections were consistent with, if somewhat more conservative than, the aggregate outcomes. Underneath the aggregates, however, outcomes were strongly influenced by the financial crisis in 1997–98 and the long stagnation in Japan. The projections accurately foresaw the rise of Chinese consumption and the rise in Chinese net imports of steel to 36 million tonnes, compared with the 40 million tonnes projected in the AJRC study. With slack demand for steel in both Japan and Korea in the late 1990s, a significant proportion of

China's increased demand for steel imports could be supplied from within the East Asian region.

The Australian industry benefited from strong regional demand for steel imports. Moreover, through the substantial investment by BHPBilliton in the Western Australian HBI plant, it positioned itself to take advantage of the growth on the market for semi-processed product in the region. In the event, this investment was bedevilled by choice of under-proven technology and cost over-runs, but the market projections on which the investment decision was made justified the strategy.

The AJRC studies projected a decrease in Japan's net exports (Drysdale and Tsukuda 1989; AJRC 1992, p. 3), but in reality Japan's net exports increased because consumption fell faster than production. This was the result of the unforeseen and protracted economic slump in Japan. The Japanese economy is yet to resume sustained growth. The severe slump has persisted longer than most predicted, and is associated with structural problems in the Japanese economy. But even the resolution of these structural problems is unlikely to see expansion of the Japanese steel industry. The next phase of steelmaking in Japan will require substantial restructuring in the industry as well as an eventual change in the steelmaking technology mix.

Japan is still Australia's most important market for iron and coal, but its relative importance has declined. This trend is permanent. The growth of other East Asian markets such as Korea, Taiwan, and China (for iron ore) is profoundly changing the structure of Australia's trade with the region in steel raw materials. These changes will intensify over the coming decade as China emerges as a major new market for the Australian industry.

At the end of the 1980s official (Chinese Government) projections had Chinese steel production at 80 million tonnes by the end of the 20th century (Drysdale and Tsukuda 1989, p. 16). By 2000, China was already producing 127 million tonnes of crude steel. At the end of the 1980s, Chinese official estimates estimated consumption at 100 million tonnes in 2000. This consumption level was achieved before 1993; by 2000, steel consumption had reached 163 million tonnes. China's integration into the world steel trade has been rapid. China's entry to the World Trade Organization will reinforce the momentum of integration into international markets. High steel consumption and steel import growth rates seem set to continue.

The financial crisis was a severe blow to the Korean economy after a sustained period of economic growth (with average annual GDP growth of 9 per cent per annum over the previous 20 years). For the steel industry, the devaluation of the Korean won and the reduction of

domestic consumption with the crisis-induced recession led to a dramatic increase in net exports. On the positive side, the crisis gave added impetus for much-needed reform of economic structures, including the management of the steel industry.

Australia's position as the dominant supplier of raw materials to the region became more deeply entrenched during the 1990s. In the years ahead, new steelmaking technology and the use of PCI may have a major effect on Australian exports of quality coking coals. On current trends, Indonesia and China can be expected to continue to take market share of coal, but not necessarily from Australia, since the major losers in the East Asian raw material markets have been US exporters.

Use of the EA method of steel production is expanding rapidly in industrialised nations but the OB method of production will still be around for quite a while in East Asia, especially in China. It will, therefore, be some time before there is a major impact on raw materials trade from the introduction of this technology into East Asian markets.

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Notes

1 China, Korea, Japan, Taiwan, the ASEAN economies, Australia and New Zealand.
2 Japan, China, South Korea and Taiwan.

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