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# Big Steel



*Daniel Madar*

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**Big Steel**  
Technology, Trade, and Survival  
in a Global Market



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# Preface

Positioned at the centre of manufacturing, the steel industry is a key economic sector. Its member companies share changeable financial health, exposure to strongly cyclical demand, vulnerability to oversupply, and a tendency toward price warfare. The most common grades of steel are highly standardized, readily traded, and widely usable. Trade over great distances is encouraged by economies of scale and favourable transportation costs, enabling buyers to enjoy diverse supplies and competitive prices. World steel production grew slowly until this decade, when demand in Asia began to soar. In response, output increased by 58 percent, reaching 1.3 billion tonnes in 2007. More than one-third of that is exported, and 81 percent of net exports come from China, Japan, Ukraine, Russia, and Brazil.

With that prodigious volume, misalignment of production and demand can be severely problematic. When there is excess supply, the industry's economics tempt producers to cut prices instead of output. That encourages price warfare, which is a dangerous game in an industry with high fixed costs. Trade makes it possible for overstocks in home markets to be shifted elsewhere and, when local prices require it, to be offered at discount. Prices themselves vary widely – a 337 percent increase in this decade for hot-rolled coil, for example – and economic downturns can lead just as quickly in the opposite direction. All of this makes the industry a contingent milieu, and with most forms of trade protection illegal under WTO rules, producers are on their own. Major steelmakers are consolidating as they search for stability and diversified markets. The unexpected merger in 2006 of the world's two largest, Arcelor and Mittal, portends a massive global consolidation. Soon after that event, Canada's three big producers were acquired by steelmakers from Europe, the United States, and India.

Canada and the United States are each other's largest steel suppliers, and the industry's multiple products flow in both directions. Why that trade exists in an active and competitive world market can be explained by proximity, as the two countries' steelmakers are located around the Great Lakes

heartland and serve the same industries. Familiarity and common commercial networks are additional advantages. Gaining those advantages is one reason why foreign steelmakers – including Brazilian, Indian, and Russian ones that were once on the industrial world’s periphery – acquire Canadian and American firms.

The steel industry’s position in the international economy is the subject of this book. Discussed are the economics and technology of steelmaking, pricing and export strategies, the industry’s migration to Asia and Latin America, survival strategies, and the industry’s future in a globalized economy. Living not too far from the steel town of Hamilton, Ontario, has made me aware of the industry’s sheer size and presence. Imagining tall furnaces, massive mills, ships unloading tonnes of coal and ore, and plumes of flame illuminating the night should evoke in the reader a suitably expansive sense of this book’s subject. One of its recurring themes will be scale economies, which is a concept fully appropriate to this monumental industrial entity. An understanding of the situation and workings of steelmakers is this book’s objective.



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# 1 Introduction

The invention of the Bessemer converter in 1855 made it possible to produce steel in volume, transforming an expensive specialty product into “the quintessential material input” of modern economies.<sup>1</sup> Steel possesses an ideal combination of versatility and great strength. “Upon impact it does not break, shatter or easily distort ... and it can be rolled into shapes and subjected to temporary or continuous tensions without its ability to perform being seriously affected.”<sup>2</sup> Modern steelmaking technology can produce enormous quantities in a wide range of products and grades, and improvements in process efficiency have made the metal relatively inexpensive. Steel is the mainstay of some of the biggest industries – transportation, petroleum, machinery, shipbuilding, appliances, and construction – and the volumes involved make the steel commodity market, at \$1 trillion annually, the world’s largest.<sup>3</sup> Steel can be re-melted, making it also the world’s most recycled product.

In 2004, world steel output passed the milestone of 1 billion tonnes – up from 750 million tonnes only eight years previously – driven by burgeoning growth in China and India. World steel production for 2007 was 1.3 billion tonnes. Figure 1.1 shows the pattern in tonnes produced. In rates of growth, there was actually an 0.5 percent decline between 1990 and 1995, and growth of 2.4 percent between 1995 and 2000. Then came the acceleration: 6.2 percent between 2000 and 2005 and 8.3 percent in the two years alone between 2005 and 2007. By comparison, the rate of growth between 1970 and 1990 averaged 1.3 percent.<sup>4</sup>

Turbulence and instability characterize the industry, and the purpose of this study is to understand its situation in an international economy in which steelmakers have proliferated, governments have withdrawn their historic supports and protections, and steel has become a widely traded commodity. For established producers in the industry’s historical homeland of Europe and North America, the past four decades have seen a stark transformation.

## 2 Introduction

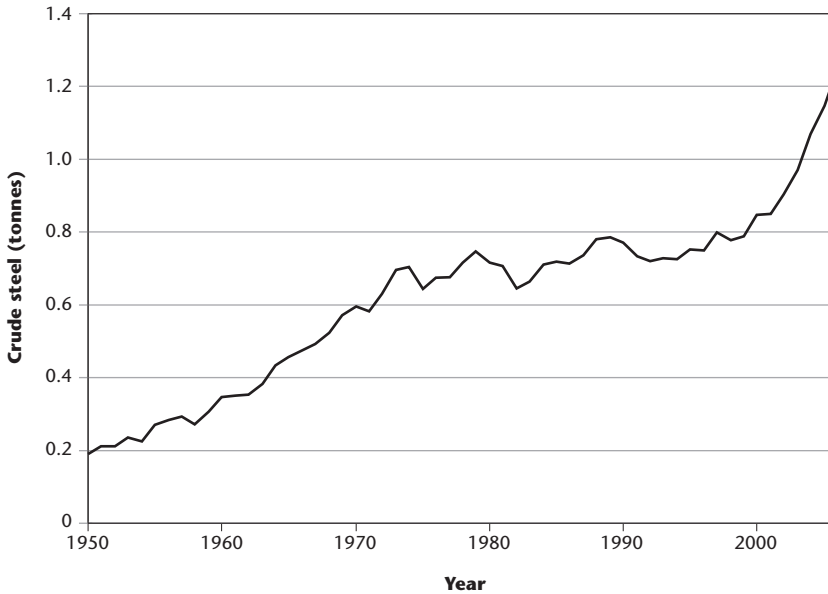


Figure 1.1 World crude steel production, 1950-2007. Reproduced with permission of the International Iron and Steel Institute.

In Europe, struggling steelmakers in both the state and the private sector have been consolidated and privatized, with the most viable parts combined into new firms and governments relieved of expensive and often obsolescent enterprises. One result has been Arcelor, an amalgamation of producers in France, Spain, and Luxembourg. In the United States, where there had been no state ownership, the process proceeded through bankruptcies, with rescue then coming from investors and consolidators. The largest successor was International Steel Group, whose components included the former Bethlehem Steel. There has been some of each measure in Canada, with the Ontario government assisting the recovery of one producer, Algoma Steel, while leaving the other, Stelco, to face bankruptcy court.<sup>5</sup> At the same time, Canada has been spared the United States' and Europe's large mill closings. Government protection against import competition was withdrawn as members of the General Agreement on Tariffs and Trade (GATT) and subsequently the World Trade Organization (WTO) agreed to reduce tariffs and other trade barriers in a series of agreements beginning in 1948. These changes have left European and North American producers to their own devices in fully contestable national markets.

The state's withdrawal of patronage compels us to focus on the industry itself. Here, the global trade in steel directs our attention toward pricing, market-capturing strategies, and the industry's international dispersion. At the heart of the industry's workings are technologies and cost structures,

which make dramatic turns of fortune an abiding prospect and survival a mutual concern. Across the industry's global expanse, consolidation is now blending once-national producers into entities that are new, large, and cosmopolitan – a dramatic result of steel production's migration to new locales.

While the industry in Europe and the United States was reaching its full maturity in the 1960s and beginning to pass into obsolescence (Canada's two main producers, Dofasco and Stelco, managed to avoid that decline – Stelco's bankruptcy came later, in 2004), new producers were emerging in Asia and Latin America. Though they were originally established to supply expanding domestic manufacturers, they were soon exporting their surpluses and beginning to treat foreign markets as key ones. Their efforts generated trade complaints in Europe and North America and partial protection under anti-dumping rules. Since then, privatized Russian steelmakers, facing limited home demand, have turned to exporting as well. More dramatically, China has suddenly emerged as the world's largest producer. The volume involved – that country accounts for fully one-third of world production – has raised concerns that Chinese steelmakers' determined quest for growth and revenue could overshoot demand, flood world markets with surplus steel, and collapse prices. The industry's cost structure has always made episodes of low prices dangerous for weaker producers; the prodigious capacity of China's steelmakers now worries even the strongest ones.

New producers have become consolidators, and steelmakers in Europe and North America, having shed inefficient capacity and invested heavily in new equipment, have become attractive takeover targets. By buying Inland Steel and later International Steel Group, Mittal Steel became, along with United States Steel and Nucor, one of North America's three largest producers. Mittal Steel had itself grown to global dominance through consolidation. Its founder, Lakshmi Mittal, had begun by acquiring mills in Asia, Mexico, and the Caribbean and then expanded to become the world's second-largest producer. In 2006, Mittal stunned the industry by buying the world's largest producer, Arcelor.<sup>6</sup> The new firm is massive, with output triple that of Nippon Steel, the next-largest. The merger raises the unprecedented prospect of the industry consolidating globally as major producers acquire smaller ones and, as did Mittal and Arcelor, combining with one another.

Consolidation is also occurring in other commodity metal industries. In 2006 Brazil's Vale (formerly Companhia Vale do Rio Doce, or CVRD), the world's largest iron-ore producer, purchased the world's second-largest nickel producer, International Nickel Company; and in 2007 the aluminum producer Alcan Inc. was bought by the British-Australian mining conglomerate Rio Tinto Group in a deal representing one of the largest foreign takeovers in Canadian history. For both acquiring companies, the goal was to supply the rapidly growing demand for industrial metals in China and India.

In the steel industry, one reason for consolidating in the wake of the Arcelor–Mittal merger is the defensive one of assembling comparable capacity. A similarly defensive reason is to grow large enough to close facilities in lean years and still remain in business. Closely related is the desire to establish a presence in multiple markets in the hope that downturns in some would be offset by stronger conditions in others. Gaining access by buying incumbent producers is yet another reason. Still another is achieving complementarity. For producers of high-value-added steels, that involves acquiring suppliers of semi-finished steel. For semi-finished steel producers, conversely, that means acquiring advanced processing facilities. A final reason is to secure proprietary technology and long-term clients – important assets in the lucrative and competitive top end of the market. In that segment, a growing demand for thin, strong, and formable sheet steel comes from the world's automobile industry as it seeks to produce lighter yet more crash-resistant vehicles. Mastery of sophisticated metallurgy made firms such as Arcelor quite valuable.

Consolidation proceeds apace. Canada's Dofasco was purchased by Arcelor in 2006 after a bidding war with Germany's ThyssenKrupp AG, and Algoma Steel a year later by Essar Global Ltd., a large, Mumbai-based conglomerate whose steel subsidiary is India's top flat-steel exporter. In July 2007, Stelco, having emerged from bankruptcy, announced that it was for sale; the following month it was purchased by United States Steel Corporation. The three firms are now known, respectively, as ArcelorMittal Dofasco, Essar Steel Algoma, and United States Steel Canada. On the American side of the border, in 2004 the Russian steelmaker OAO Severstal purchased Rouge Industries, the Ford Motor Company's spun-off steelmaker, and then made a series of subsequent acquisitions to become the fourth-largest American producer. What made these purchases attractive – even that of the decrepit Rouge Industries – was their position in North America's automobile industry. Enhancing Stelco's appeal was its capacity to supply steel for processing into high-margin products.

Larger firms are also prime candidates. United States Steel, whose output is four times that of either pre-merger Dofasco or Stelco, is still medium-sized compared to ArcelorMittal. Making the company a potential takeover candidate is its profitability and position in the American market. Corus Steel's similar position in the European market – where it was the second-largest producer – led to its purchase in 2007 by India's Tata Steel. As one index of the industry's structural transformation, a major component of Corus was the privatized remnants of British Steel.

### **Industry and the Position of the State**

As this sketch shows, the steel industry epitomizes globalization, which can be defined as the spread of production, markets, and investment across

national borders. Globalization is the result of the ending of state controls on the movement of goods and capital. Successive rounds of trade liberalization under GATT and its successor, the WTO, have reduced or eliminated tariffs and bound members to the non-discriminatory treatment of foreign goods. By agreeing to tariff reductions, states have given up their power to restrict imports by taxing them. More generally, under the WTO principle of national treatment, states are expected to impose no special disadvantages on foreign goods or special favours on domestic ones. These measures have opened the way to a massive increase in global trade. Governments, eager to promote exports, have added their encouragement.

Steel is readily exported because it is highly standardized, particularly when it comes to commodity-grade products such as structural steel, coiled sheet, and steel plate. To take a common example, one mill's steel reinforcing bars are direct substitutes for another's. For any good, product differentiation limits potential buyers and restricts trading opportunities; in steel, however, such differentiation affects only top-of-the-line specialty grades. For the much broader array of commodity-steel products, qualitative barriers are very low. The key differentiation is price – a fact with significant trade implications, as will be seen shortly. Overall, 36 percent of world steel output is exported – up from 22 percent in 1975 – and products circulate widely.<sup>7</sup>

This commerce reflects a fundamental reorientation. Historically, steel producers served their own national markets and occupied their respective positions within national industries. States regarded steel as a strategic commodity. Its importance in manufacturing – especially in armaments production – made it too vital to be entrusted to foreigners and too vulnerable to wartime interruption. In national economies more generally, steel represented massive concentrations of investment, employed thousands of workers, and was at the core of key industrial regions. Some governments nationalized the industry; others encouraged or tolerated cartels. Since then, as states have withdrawn their custody, the basis of ownership has evolved from national to global. Privatization has exposed steel producers to the financial markets, and the removal of investment barriers under WTO, regional, and bilateral agreements has made those producers available to foreign buyers.<sup>8</sup>

Governments might still wish to keep their steel producers under domestic control, but their power to do so is limited. That much was evident in the French government's vigorous efforts to block Mittal's takeover of Arcelor. The government regarded Arcelor as a national champion and worried about mill closings and layoffs. Though its efforts, joined by those of Arcelor's management, delayed the sale, it did eventually proceed. Appeals to the European Union (EU) were to no avail. As an indicator of openness, however, the Arcelor case is exceptional in that other governments have not resisted international steel takeovers, though they have been attentive to the effects

on competition. The biggest exception is China, which limits foreign participation to joint ventures, though conversely the government regards foreign takeovers as a suitable way for Baosteel, its major producer, to expand.

Nonetheless, in 2007 large foreign takeovers began to raise concerns in both Canada and the United States. In June 2007, Canada's Minister of Finance announced the formation of a Competition Policy Review Panel (CPRP) to examine Canada's Competition Act and the Investment Canada Act, with particular attention to whether the legislation should be changed to address investment by state-owned entities and considerations of national security.<sup>9</sup> This reconsideration was prompted by public reaction to a spate of very large foreign takeovers, including Arcelor's acquisition of Dofasco.<sup>10</sup> In October 2007, the industry minister ordered that issues concerning investment by state-owned enterprises and their national security implications be removed from the panel's mandate – an indication that the government might take up the question separately. A key recommendation of the panel's report, issued on June 26, 2008, was that existing investment restrictions should be reduced in the interest of improving productivity.<sup>11</sup> In July 2007, President George W. Bush signed the Foreign Investment and National Security Act. From now on, the treasury department's Committee on Foreign Investment, which monitors foreign acquisitions, will be required to fully investigate those investments that involve companies owned or backed by foreign governments.<sup>12</sup> Until then there had been no broad restrictions on foreign investment except in sectors where there was a risk to national security. The new American law was taken as a model by the German government, which was concerned that existing German and EU rules were not specific enough to cover foreign-government-backed entities, particularly Russian and Chinese ones.<sup>13</sup> Legislation passed by Germany to amend the Foreign Business Act now allows the government to block foreign investment of more than 25 percent in a German firm. The legislation was modified in January 2008 at the request of the European Commission (EC) to exempt firms of the European Union.<sup>14</sup> Meanwhile, in Japan, business reacted with anxiety to a government plan to change merger and acquisition rules so that the subsidiaries of foreign firms would be able to pay for takeovers with the parent firm's shares. The worry was that Japanese firms would be more vulnerable to large and wealthy foreign buyers. Specifically mentioned were Japanese specialty-steel producers.<sup>15</sup>

For those doing the buying, steel acquisitions are attractive both domestically and internationally. A strong domestic attraction is access to the acquired producer's home markets. A strong international attraction, created by liberalized trade, is the prospect of assigning facilities to entire world markets. Doing so can involve simply exporting items currently in production or, more expansively, investing in a fully specialized mill. The main constraints,



representing costs of trade, are locational and logistical. The fact that those costs are much lower in domestic than in international trade suggests why buying access to a producer's home market is a popular strategy. If the cost difference were to disappear, very different ways of organizing world steel production would become feasible.<sup>16</sup> At the same time, the amount of steel traded internationally, as was just seen, is substantial – an indication that foreign markets are served quite readily at current costs of trade.

Another limit on state authority is WTO rules that forbid the subsidization of exports. Subsidies paid directly to producers are permitted; however, these are actionable when they cause harm to the producers of other WTO members, when they impair the common benefits of WTO rules, or, more generally, when they cause "serious prejudice to the interests of another WTO member."<sup>17</sup> If those effects can be established, subsidies are subject to countervailing tariffs. WTO rules encourage members to resolve subsidy disputes through consultation. With steel products, such consultation occurred in 2002 when the EU, in multilateral discussions under the auspices of the Organisation for Economic Co-operation and Development (OECD) about the health and future of the steel industry, agreed to eliminate almost all subsidies to its steelmakers. In formal WTO proceedings, most cases have involved export subsidies. Much more infrequent are cases involving non-prohibited but actionable subsidies because they must be shown specifically to cause injury. Such harm is difficult to prove because the trade effects of payments to producers, in contrast to export subsidies, are usually more diffuse. The result has been a general reluctance to challenge other members' domestic industrial practices.<sup>18</sup> An exception is the United States, which uses direct industry subsidies less than its trading partners and has less reason to fear "retaliatory investigations."<sup>19</sup> Because actionable subsidies may be challenged by any WTO member, however, states awarding them are aware that they do not have an entirely free hand.

Anti-dumping complaints are easier to prove and less expensive to litigate, and through them states have retained a powerful tool of intervention. Under WTO standards, states may impose tariffs to eliminate discount margins on imports. Investigation must show that imports are being sold below home-market prices or below the cost of production. If material injury is found, complainants can receive tariff relief. Safeguard rules are a similar but less potent measure. They allow the use of tariffs to remedy injury caused by an import surge; and unlike anti-dumping rules, they do not involve allegations of unfair practice and do not single out particular exporters. However, safeguard actions under current WTO rules are governed by stringent requirements and may be disallowed on appeal to the WTO.<sup>20</sup> Failure to comply opens the way to retaliation by affected trading partners. That prospect forced the Bush administration to revoke a set of special steel tariffs

imposed under safeguard provisions in 2002. In contrast to regular tariffs, which have steady effects, both anti-dumping and safeguard interventions are intended to operate exceptionally and case-by-case in very specific product subcategories. For producers facing longer-term international competition, neither is a dependable protection.

A third tool of intervention is competition law. By making collusion illegal and by authorizing measures to prevent or disband monopolies, it provides a means – should states choose to use it – of regulating the effects of consolidation. This bears on one incentive for global steel mergers – maintaining price stability by coordinating output levels among a workably small family of producers. The incentive to coordinate is rooted in the steel industry's cost structure, as will be seen shortly.

The world's automobile industry provides a preview of the kind of integrated global steel market made possible by trade liberalization. With an annual output of some 50 million cars whose average steel content, by weight, is 70 percent, the automobile industry is a prime customer. Consolidation has occurred there as well, with smaller firms such as Saab being acquired by larger ones such as General Motors (GM). With that has come the sharing of components and vehicle platforms. Product standardization allows component production to be dispersed internationally and assembly plants to be located in the large markets of Europe, the Americas, and Asia. For steelmakers, this opens an expansive prospect. Although North America's Big Three automakers descended into grave financial difficulty as a result of the global financial crisis of 2008, the longer-term outlook is that world automobile production will continue (although the automobile industry may be a re-organized one). Demand for automotive steels will also continue.

Though automakers prefer to deal with nearby mills, standardized requirements and dispersed production enable steelmakers to become global providers. One way of doing so is by acquiring steel firms, such as Dofasco and Stelco, which have an established automotive business. A more comprehensive strategy involves helping design vehicles that require a steelmaker's proprietary sheet steel and that are slated for manufacture at multiple world sites. With that eventuality in mind, major steelmakers are entering into increasingly close product-development relationships with world automobile producers. The best-positioned candidates are those, such as ArcelorMittal, that have design expertise and that can supply their proprietary product worldwide either on their own or in co-operation with other steelmakers.

### **Sectors, Cost Structures, and Prices**

It is easy to view industries as more or less alike. Trade politics studies, for example, often assume that firms demanding protection are motivated by simple rent seeking. That assumption makes it possible to model firms' behaviour mathematically and to portray purposeful political advocacy, but

it too readily generalizes among industries that may be very different.<sup>21</sup> Modern economies have multiple sectors with differing capital structures, technologies, markets, and international exposure. That fact became strikingly clear to researchers investigating the applicability of strategic trade policy. After studying the telecommunications, jet transport aircraft, automobile, and steel industries, they concluded: “The features of the sectors we discussed were so strikingly different, when examined with a sufficient degree of care, and the problems confronted by firms in those sectors were so disparate, that it made little sense to speak of a ‘trade policy problem.’” This was true in industries that were themselves conveniently regarded in aggregate: “even across areas that might be thought to have much in common as a class – ‘high-tech’ or ‘smokestack’ industries – careful examination of their market structure, conduct, and performance demonstrated clear and particular differences.” The trade problems of the automobile industry, the researchers found, were quite different from those of their smokestack industry counterparts in steel. For trade policy, also readily characterized in aggregate, the clear implication is that different industries require different treatments.<sup>22</sup>

Steel production shows how dissimilar different parts of the same industry can be. Technology divides the steel industry into two very distinct sectors – integrated producers and minimills. Integrated producers (a shorthand reference to vertical integration) refine iron ore into steel and roll it into an array of products. The process is continuous, requiring close coordination among adjoining facilities. The volumes involved make those facilities massive. Those facilities in turn impose formidable capital requirements and expensive cost structures. Minimills roll steel products from melted scrap. Their comparatively simple and cheap technology gives them a cost and price advantage, and they are efficient at moderate volumes. In an undifferentiated industry, firms are affected by the same conditions in the same way. In the steel industry, however, conditions related to capital costs and minimum efficient scale have created problems for integrated producers and opportunities for minimills. Because the integrated sector is the one that has been beset by difficulties, and because it accounts for two-thirds of steel production worldwide, it is the focus of this study. Integrated producers will be referred to simply as steelmakers unless minimills are being mentioned specifically. For the same convenience, steelmakers – again, unless minimills are a point of focus – will be spoken of as the steel industry.

To proceed beyond categorical assumptions, it is necessary to understand the steelmakers’ basic technology and economics. The key fact to appreciate is that cost structures and cyclical demand make the steel industry inherently volatile and difficult. Expensive technology imposes high fixed costs that must be covered through good times and bad. Because that technology is efficient at high volumes and produces in a continuous process, it encourages producers to cover fixed costs by maintaining output. They can do so in the

short run because variable and marginal costs are normally comparatively low. Yet the demand for steel derives directly from the demand for durable goods, and that demand varies with the business cycle. When steel demand falls, the combination of fixed, variable, and marginal costs makes it reasonable to cut prices instead of output. When all producers do the same, they depress prices further, and those unable to persist, given the high costs they bear, face bankruptcy. Cutting output is an option when variable costs are high, but that condition does not often occur in integrated steelmaking. Steel's substitutability makes prices pivotal, and high volumes make small differentials important. In the same way, steelmaking's standardized and portable technology makes the same efficiencies and volume-based pricing power available to anyone who uses it. Though that technology reduces labour-cost differentials between producers in wealthy industrial and industrializing countries, it also makes direct competitors of producers in places such as China.

Capital-cost barriers and scale economies in steelmaking have always provided the structural basis of oligopoly, and vulnerability to overproduction and low prices has provided incentives for steelmakers to actually behave as an oligopoly. Competition law forbids price fixing, but for a long time a system of price leadership was possible in the American steel industry, and in Canada an informal specialization in particular submarkets limited direct rivalry. Stability broke down in the 1960s when minimills, which had strong cost advantages and no interest in coordinating prices, began entering the industry and when national steel markets became open to imports. Minimills were reluctantly accommodated, but imports were challenged in trade tribunals. Minimills and imports contributed directly to the industry's travails and forced its reorganization. An exacerbating factor was that many of the imports came from new producers using the latest technology. That drove home the fact that the industry's large and segmented production facilities, together with its weighty cost structure, make modernization piecemeal and expensive, particularly for producers most in need of it and especially when prices are under pressure.

Cooperative incentives have reappeared at the global level. The scale of the largest steelmakers, along with accumulating surplus capacity in the industry, raises the same worry that once beset national markets: producers seeking to increase their own income will lower prices for everyone. National markets, in which supply and demand could be kept aligned, are no longer a protection. In an open trading system, surpluses in one country can be shifted to others. As was once true of producers in national markets, however, globally consolidated producers have both the limited numbers and the shared incentives to develop a common understanding of production levels and prices. Lakshmi Mittal himself has expressed hope for this result.<sup>23</sup>

Prices are indeed the central element. As the point of differentiation in a highly standardized array of products, they figure centrally in strategies to capture domestic and foreign market share. Even more practically, prices mediate success and failure. Understanding prices, and the incentives and constraints that are derived from them, requires a basic knowledge of steel-making technology and cost structures. In the same way, understanding the setting in which pricing strategies operate requires attention to oligopoly.

### **Survival, Stability, and the Public Interest**

For steelmakers in open economies such as Canada and the United States, what is at issue is survival and stability amidst global competition without the protection and patronage of the state. There are three basic options: protectionism, consolidation, and aligning in close relationships with major global customers such as the automobile industry. None of these is surefire. The most direct forms of protectionism are now illegal under WTO rules, and available expedients – most notably anti-dumping actions – operate partially and unpredictably. Consolidation offers the ability to achieve synergistic efficiencies among multiple installations, to serve multiple markets, and – assuming like-minded incentives among fellow producers – to achieve market stability. Competition authorities, however, have the power not only to prosecute price fixing but also to prevent market dominance by blocking mergers and ordering divestitures. Regulation may not be the only obstacle. Producers, even with sufficient latitude, may not be able to maintain a collective discipline. If they were to cut back their own output in the face of weak prices, they would have reason to fear creating market space for their rivals. More generally, the production and investment decisions that determine global capacity are guided by individual incentives with no common interest or strategy. One consequence is surplus capacity in addition to surplus production. The third option – aligning with major customers – promises the benefits of interdependence and shared commitments, but alignments can change. A steelmaker's partner has the buyer's free hand to choose and discard. As the suddenly dire circumstances of the Big Three automakers showed in 2008, partners can also fail. Since none of these options is fully secure, the steelmakers' future in considerable measure is what they and the market make of it. Under the conditions of globalization, that is an open prospect with all its attendant advantages and hazards.

Political economy has much to say about the incentives of economic actors and their connection to the public interest. An important balance of interests appears in the formal literature on trade protectionism, in which the theoretical efforts of the economist Jacob Viner continue to be influential. Anti-dumping actions, in his view, must reconcile a cheaper and reliable foreign supply, which lowers costs for the public, with the weakening or

elimination of otherwise viable domestic producers, which represents a prospective loss to the public of both competitive prices and usefully invested capital. In making assessments, the focal interest is the public's and not the producer's. A similar emphasis can be seen in competition law, whose purpose is to serve the public interest by prohibiting producers from curtailing or eliminating competitive markets.

In the same way, a justification for anti-dumping rules is that they prevent producers, particularly ones enjoying a protected home market themselves, from gaining market share abroad by cutting prices long enough to drive out incumbent producers. Whether such predation actually occurs in trade has been a subject of empirical research, and trade economics has devoted much attention to protectionism more generally. A related question is this: What kinds of producers are the most likely to seek protection? An important consideration is factor mobility – being able to shift resources from one application to another. The steel industry's specialized and expensive equipment is not particularly flexible. Proof of this can be seen in the industry's closing of plants that were unable to meet lower prices and conceding entire product lines to minimills and imports. Another proof can be seen in the industry's historically frequent use of anti-dumping actions – a fact that originally prompted this study.

Why did steel production become established in Asia and Latin America, and why were its new firms able to challenge the incumbents? Current literature in economic geography has concise and powerful explanations for industrial location, the development and persistence of industrial regions, and the advent of trade. Trade advantages, the literature asserts, are not rooted immutably in particular places; they can be created by states. By sponsoring investment in new industries, states can lock in factors that would otherwise be unstable or temporary. Key to success are economies of scale and transportation costs. States in Asia and Latin America, acting on one view of the public interest, played an active role in promoting steel production. By helping these industries become established, they encouraged the migration of technology and altered the international division of labour. That was possible because steelmaking technology can be installed anywhere in the world and is for sale. The pattern of international steel production may change if energy costs, which rose sharply in 2007 and significantly increased the costs of transportation, were to return (a prospect considered in Chapter 6).

These states have withdrawn from direct control and ownership, and some steel producers, notably in Brazil, have done much better on their own. Industrial migration has entered a second stage as successful Asian and Latin American producers, joined by privatized Russian counterparts such as OAO Severstal, use their profits to acquire established firms in Europe and North America or enter into shared ventures. From a global perspective,

these developments represent a reverse flow of industrial ownership and organization from periphery to centre. The results can be sizable. The second-largest minimill operator in North America is Gerdau Ameristeel, whose majority owner is Brazil's Gerdau SA. In 2007, it acquired Dallas-based Chapparral Steel, North America's second-largest structural steel producer. Although Gerdau, unlike Brazil's other steelmakers, was always in the private sector, it exemplifies the reverse pattern. Similar movement can be seen with Tata Steel's acquisition of Corus Steel and Essar's acquisition of Algoma Steel. All of these developments are further steps in the steel industry's global consolidation. They go well beyond the original motives of government sponsorship, and the link to the public interest becomes ever more indirect as these firms pursue autonomous interests of their own. Even so, the initiating condition, which combined state action with a public purpose, is worth remembering.

### **The Plan**

As this brief survey illustrates, the steel industry's recent evolution suggests how changes that have encouraged globalization have affected one of the key sectors of modern economies. Steelmaking's situation at the centre of industry makes its condition vital. As has also been seen, these matters resolve into four topics: the technology and economics of steel production, approaches to contesting markets amidst oligopoly, the industry's international dispersion, and strategies for surviving in a global environment. A fifth topic that follows directly from these is the steel industry's future in a global economy, and the implications that follow for industries more generally.

Chapter 2 briefly explains the industry's technology, cost structures, historical organization in Canada and the United States, cycles of prosperity and distress, and ability to modernize. An understanding of steelmaking technology is necessary if we are to understand as well the industry's crucially important cost structure. Explaining that technology will also show, to the benefit of concreteness, what the industry actually does. That in turn will enable us to understand, in practical terms, matters that can easily become abstract and hypothetical (and often appear so in the formal literature).

Pricing and market capturing strategies are the topic of Chapter 3. Behaviour in oligopolies scarcely resembles standard economic models of competitive markets. It is inherently strategic, and the stakes are ultimately zero-sum: even in expanding markets, what one producer gains another loses. Discounting prices is one strategy for capturing share in export markets, and this may involve price discrimination – selling the same good at different prices at home and abroad. That raises the questions of when state intervention is justified and whether particular industries are especially subject to injury. Economists have devoted much attention to both matters. Demands

for protection have interested political economists, whose perspectives conclude the chapter.

A standardized and portable technology has enabled the steel industry to migrate from its original centres in Europe and North America and become a significant exporter. It has also empowered steelmakers to challenge incumbent producers in their home markets. Chapter 4 summarizes current international patterns of steel production and use, explains economic geography's account of industrial location and the basis of trade, outlines the development of steel production and exporting in Japan, South Korea, Brazil, Russia, and China, and considers respective cost advantages. To place these matters in a more general perspective, the chapter concludes with international political economy's views of technological diffusion, the relationship between state and industry, and the international division of labour.

Global steel gluts are a real prospect. Given the scale and speed of expansion, currently in China and prospectively in India, and given the reality that markets rise and fall, the potential volumes in store would test even the most robust producers' ability to withstand surpluses and low prices. The use of trade to unload overstocks combines badly with the steel industry's tendency toward unstable finances; the result is a contingent and worrisome milieu. Chapter 5 discusses the current pattern of exportable surpluses and considers three survival strategies: protectionism, consolidation, and forming close relationships with major customers.

The use of anti-dumping laws to garner the protections once available through tariffs has been criticized by economists. Cases, they argue, are too easy to win. For industries facing threatening import levels, however, that makes anti-dumping actions an attractive expedient. A review of a sophisticated economic literature evaluates the practice and its current suitability for the steel industry. Global consolidation is well underway and holds out the prospect of coordinating prices with outputs. Many in the industry expected that Mittal's merger with Arcelor would start a bandwagon. Whether other majors such as Nippon Steel and ThyssenKrupp will conclude blockbuster mergers like Mittal's remains to be seen. So also is whether consolidation will actually deliver co-operative outcomes. One limit is conflicting self-interest among producers; another limit is competition law. A third strategy is to exploit technological advantages at the top of the product line, where the largest customer is the world's automobile industry and the demanded product is specialty steel. In a world market of standardized commodity steel products, volatile prices, and competitors joining the lower end of the market, this represents the industry's most promising opportunity. An assessment of that prospect concludes the chapter.

Chapter 6, employing differing assumptions about costs of trade, presents two alternative views of the steel industry's global future. In the first, the present difference between international and domestic trading costs remains,



with international trade being more expensive. In the second, the difference disappears, with international trade becoming as cheap as domestic trade. Sharply divergent outcomes emerge. With trading costs unchanged, the industry's current level of international activity simply continues. An indicator of how globalized the industry is even now is that one-third of world steel production is exported. The important implication, however, is that the industry's current approach to organizing world production may not change significantly. In the second outcome, globalization progresses to a seamless world in which, because of fallen trade costs, specialized facilities serve international markets. Inherent in both outcomes are the standardization and utility that make steel a naturally globalized commodity.

Will the steel industry's present hierarchy of commodity and specialty steel producers remain? Commodity-steel production is now the mainstay of producers in industrializing countries, while specialty steel is a sector in which producers in Europe, Japan, and North America have regrouped after shedding much of their lower-end capacity. For commodity steelmakers, going upmarket is an attractive option, and those serving large domestic economies are positioned to develop the necessary scale, returns, and expertise. A related matter is ownership. Large investment funds with direct or indirect ties to governments have begun entering world financial markets. That represents a return of the state and raises the question of purposes and effects. For the investing state, do purposes extend beyond normal asset management? And for the receiving state, do effects extend to national economic and security interests? A very recent and unexpected complication is higher energy and transportation costs. If those costs were to become permanent, they would impose significant trade disadvantages on remote suppliers. The chapter concludes with four brief forecasts about the future of world steel and five broader implications, drawn from the steel industry's experience, about the world economy.

An eclectic approach has been necessary. Understanding steel's cost structure and operating constraints – a key source of the industry's often fragile finances – requires visits to microeconomics and industrial engineering. Pricing behaviour and market-capturing strategies take one into the precincts of industrial organization. Steel's expansion to new centres in Asia and Latin America becomes clear in light of economic geography's emphasis on economies of scale and transportation and of the state's ability to lock in factors that generate trading advantages. Anti-dumping rules originated in competition law, whose provisions also set potential limits on international consolidation. Insights from organizational interdependence clarify the industry's prospects of forming close ties with major customers.

An advantage of an eclectic approach is that it brings together literatures whose specialized focuses and methodologies more often keep them in separate realms and, for non-specialists, constitute barriers to entry. By pooling

their contributions, we will be able to treat the industry with the necessary scope, ranging from the cost economics of individual producers to the patterns of global production and trade. Doing so will unify an important but disparate set of developments and connect them to a common industrial base. There have been some general treatments of the steel industry, but they were written in the 1970s and 1980s when it was in crisis and very different from today.<sup>24</sup> The present effort is set specifically in the current context of globalization and international consolidation. In presenting these matters, it aims for the kind of straightforward utility that characterizes steel itself.