

REPORT

Beyond the Boom

The Outlook for Global Steel



THE BOSTON CONSULTING GROUP

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Note to the Reader

Over the past several years, The Boston Consulting Group has worked with many leading steel-making and steel-using companies around the world. We recently undertook an assessment of the industry's future, drawing on insights we have gained in our hands-on work across the industry, our discussions with industry participants and observers, and our analysis of current developments and trends. We are very pleased to offer you the results of our study in this BCG report. As always, we welcome your comments.

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Preface

Steel is booming. Around the globe, mills are busy day and night turning out some 3 million tons of steel daily at sustained utilization rates rarely seen before. Steel companies in the so-called Triad—Europe, Japan, and the United States—are benefiting from high steel prices in their market segments and are showing strong cash flows. Moreover, despite the high cost of raw materials, profits are generally healthy. Also benefiting from the boom are the industry’s principal suppliers—including raw-material suppliers, steel distributors, and trucking and shipping companies.

The question is, how long can these good times last? The primary engine driving the boom has been China’s voracious appetite for steel. What will happen when China’s burgeoning steel capac-

ity significantly outstrips its demand? And what about similar developments in India, Brazil, and Russia? What trends will shape the industry over the next several years, and how can companies best position themselves today to weather the likely changes ahead?

The development of the global steel industry over the next decade will have a major impact on companies not only in the steel-producing industry but also in the steel-consuming segments—including construction, automotive, oil and gas, and mechanical engineering—as well as on national and regional economies. It will be vitally important for senior managers and policymakers to understand the underlying dynamics of this industry and to shape their strategies accordingly.



An Industry in Transition

The global steel industry is undergoing dramatic change. Long plagued by sluggish sales to slow-growing markets, it struggled from the mid-1970s until the turn of the century in the grip of a no-win stalemate. Overcapacity was rampant, and any improvement in efficiency—designed to cut costs and improve margins—inevitably exacerbated overcapacity. This performance stalemate, compounded by the industry’s high exit barriers, generated high cyclical and decades of declining prices.

But recently the industry has taken on new life. Demand has surged, fueled by China’s booming economy and voracious appetite for steel. From 2001 to mid-2006, China’s demand for steel exploded, growing at 25 percent per year. From 2002 through 2006, global steel production grew at more than 7 percent per year, culminating in an estimated 1.22 billion tons of crude steel produced in 2006.

China’s hunger for steel has also pushed global prices sharply upward. In about four years—from late 2001 to late 2005—prices rose dramatically. For example, prices for hot-rolled coil soared by a factor of 2.6 to 3.4 in Germany, Japan, and the United States. At the same time, strong price increases for steel’s raw materials—including iron ore, coke, scrap, and alloying materials—contributed to a very high cost floor for steel, which will somewhat constrain profitability in the immediate

future. Nonetheless, most steel makers achieved very healthy earnings in 2006.

Meanwhile, successful restructuring efforts, many initiated in the late 1990s, have strengthened the steel industry in most regions. Restructuring has included four principal elements:

- Accelerated consolidation (mostly within regions but increasingly also across regions)
- Privatization of money-losing government-run operations
- Reorientation of many steel companies to focus less on volume production and more on margin generation
- Modernization of steel-making facilities, especially in China, with India and the countries of the Commonwealth of Independent States (CIS) likely to follow suit in the next five to eight years¹

Thanks to these efforts, industry participants are performing more effectively than in previous years. Together, the increased demand for steel and the restructuring of the industry have contributed to strong performance improvement on the part of steel producers, yielding high revenues and solid profits significantly above the costs of capi-

1. The CIS comprises 11 former Soviet republics: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan.

tal. From 2002 through 2006, for the first time in decades, the steel industry outperformed all other basic-material sectors in terms of total shareholder return (TSR).² (See Exhibit 1.)

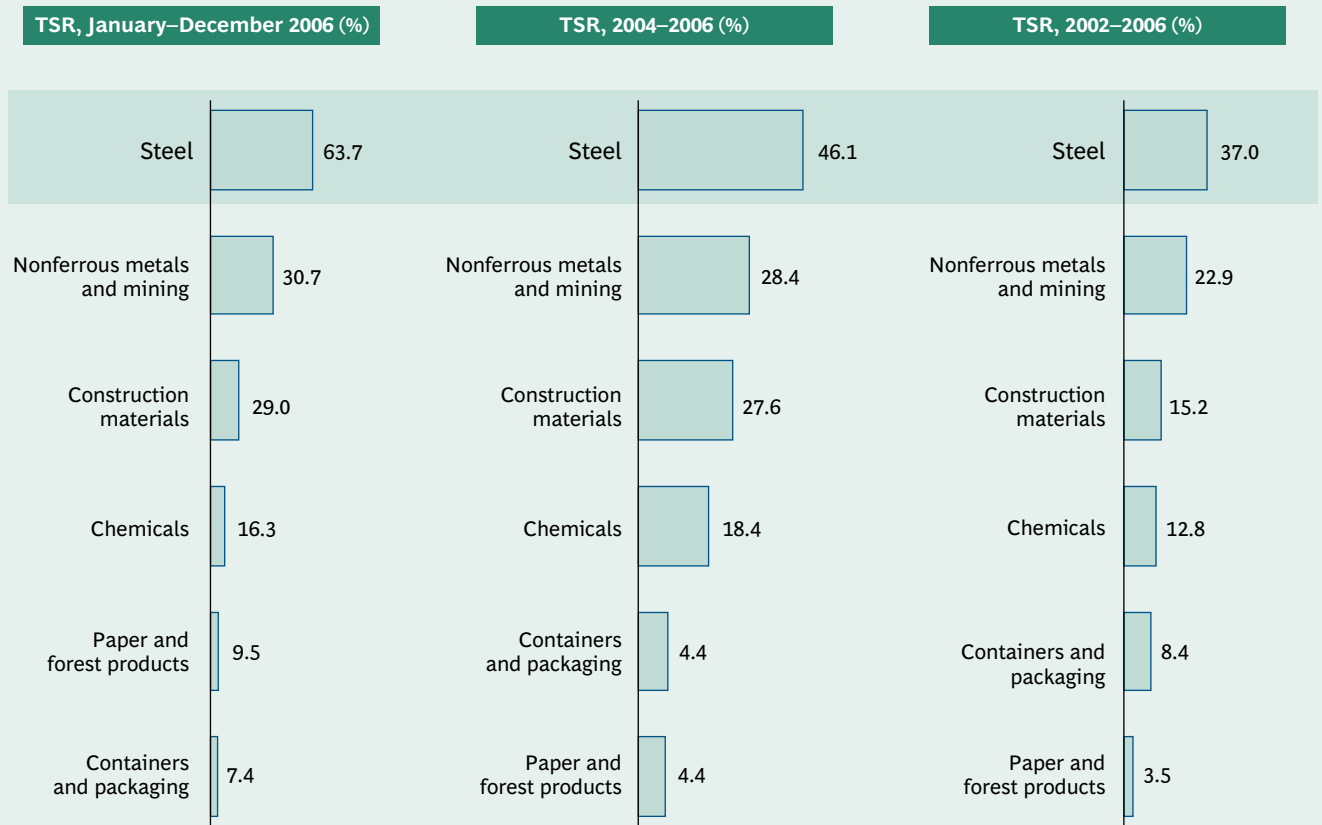
But how long will this situation last? Is this really the end of almost three decades of stalemate? Has the steel industry found a long-term solution to its

2. TSR equals share price increase plus dividends, divided by share price at the point of investment.

underlying structural problems, or will the recent positive results evaporate when China's strong demand ebbs?

To answer these questions, it is essential to understand the fundamental economic drivers of the steel industry and their implications for the future. First, let's take a quick look at the industry's development over the past several decades.

Exhibit 1: Steel Is Outperforming Other Basic-Material Sectors on Total Shareholder Return



Sources: Thomson Financial Datastream; Morgan Stanley Capital International; BCG analysis.
 Note: Total shareholder return is based on calendar year data in local currency.



The Three Phases of Industry Development

Since World War II, the steel industry has experienced three distinct phases of development: growth (1950–1973), stalemate (1974–2001), and boom (2002–2006). (See Exhibit 2, page 10.)

The Growth Period: 1950–1973

This period saw production climb by about 5.8 percent per year. The industrializing nations were building up their civil and economic infrastructures, and GDP per capita was rising, along with steel consumption. Steel served as a fundamental element in postwar reconstruction and redevelopment. All steel-consuming industries—primarily construction, automotive, mechanical engineering, and shipbuilding—experienced strong growth.

The Stalemate Years: 1974–2001

The oil shocks of 1973 through 1979 slowed consumption early in this phase. The production of crude steel stalled, growing at just 0.6 percent per year over the entire 27-year period. Steel prices declined steadily by 2 to 3 percent per year. The industry suffered from structural issues that continue to challenge participants: products that had become commodities, an exceptionally flat supply curve, fragmentation, and chronic overcapacity. The outcome, despite continuous cost reduction, was high cyclical and a global industry that—on average—actually destroyed value in most years.

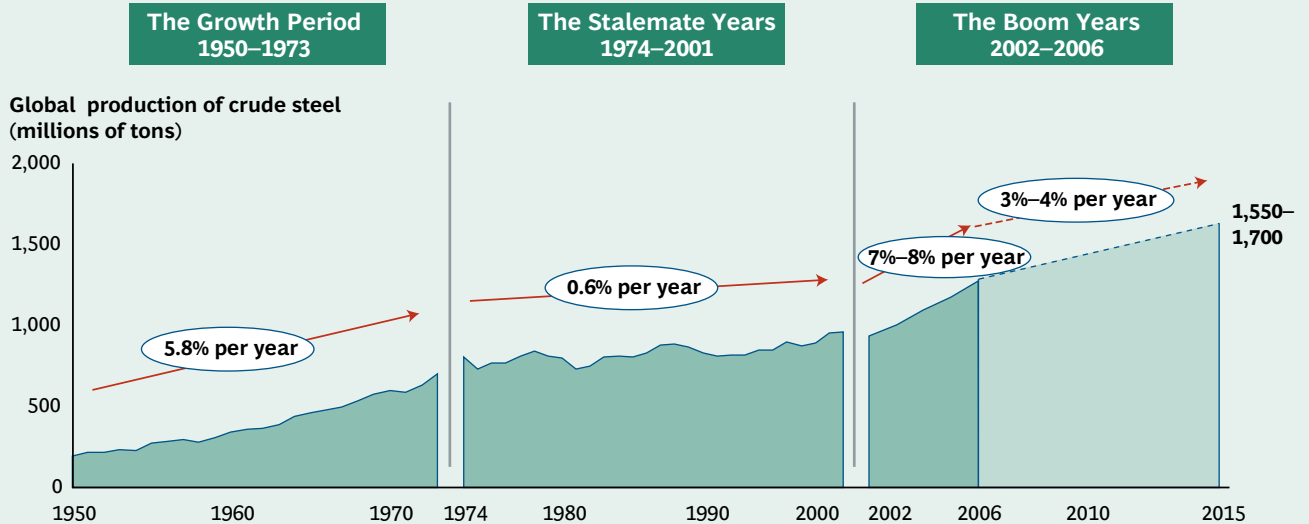
From 1992 through 2001, the industry's overcapacity hovered near 25 percent globally. The severity of this overcapacity varied considerably from region to region: the rate was appreciably higher in Japan, about average in Europe, and lower in the United States. (See Exhibit 3, page 10.) Eliminating even old and inefficient steel-making capacity proved to be very difficult because of the high legacy costs of closing down mills and the national political interests involved.

The industry was caught in a vicious cycle. The more it streamlined its operations, the more overcapacity it had. And local and regional crises added to the industry's difficulties. The collapse of the Soviet Union in 1990 threw the global relationship between supply and demand way out of balance. In 1990, Russia and Ukraine together were producing and consuming some 70 million tons of steel. By 1992, their domestic consumption had all but collapsed, flooding the world with excess steel.

Then, just five years later, economic crises in Asia, Latin America, and Russia caused more cheap steel to come onto the world market; some 40 million tons of additional export volumes came from Asia alone—the equivalent of 5 percent of global steel production at the time.

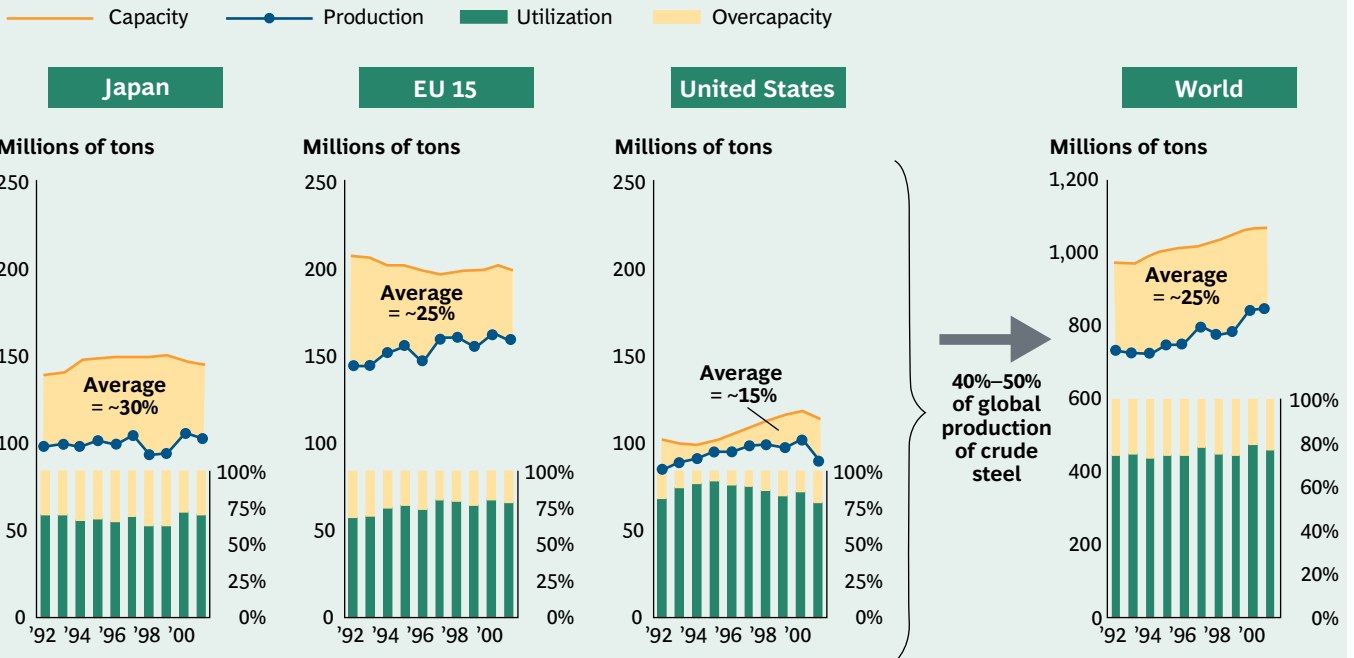
Only a very few companies were successful at generating sustained value during this stalemate period. Steel took on the image of a sunset industry, and steel companies had difficulty attracting investors, customers, and management resources.

Exhibit 2: There Have Been Three Stages in the Recent History of the Global Steel Industry



Sources: Iron and Steel Statistics Bureau; BCG analysis.

Exhibit 3: Global Steel's Overcapacity Averaged 25 Percent from 1992 Through 2001



Sources: International Iron and Steel Institute, *IISI Steel Statistical Yearbook*, 2002 and 2005; Organisation for Economic Co-operation and Development; American Iron and Steel Institute; BCG analysis.

Note: EU 15 = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

On the plus side, some farsighted companies responded by tightening their operations, increasing their automation, boosting their productivity, and pushing forward the consolidation process. So the top players emerged from this period far more efficient than they went into it. When the tide turned for steel, they were well prepared.

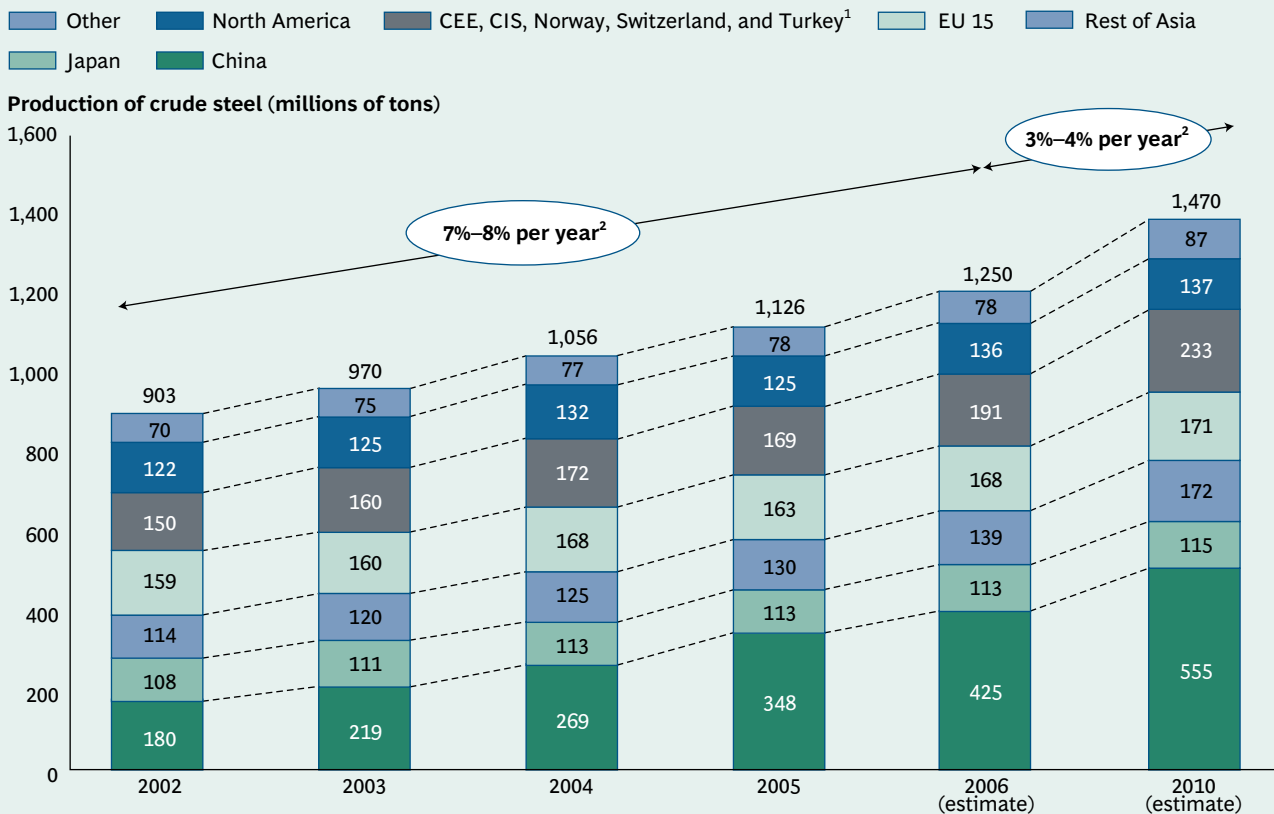
The Boom Years: 2002–2006

During the present period, the steel industry has once again become an important factor in industrialization. Global production of crude steel surged by 7 to 8 percent per year from 2002 through 2006, driven almost entirely by double-digit growth in China. (See Exhibit 4.) Key industries spurring this

surge include the fast-growing Chinese car-making and shipbuilding segments, as well as a massive expansion of infrastructure, including such flagship projects as the Three Gorges Dam and facilities for the 2008 Beijing Summer Olympics.

The huge demand from China has caused a commensurate leap in global steel prices. (See Exhibit 5, page 12.) Two additional factors have spurred and sustained these price increases: first and most obvious, temporary shortages of raw materials and steel-making capacity, and second—for the first time in the history of the industry—deliberate reductions in production by steel makers in the developed regions of the world, designed to reduce price volatility. When facing temporarily weak demand in early 2005, even the China Iron and Steel

Exhibit 4: China More than Doubled Its Steel Production from 2002 Through 2006



Sources: International Iron and Steel Institute, *IISI Steel Statistical Yearbook*, 2002 and 2005; Organisation for Economic Co-operation and Development; American Iron and Steel Institute; BCG analysis.

¹CEE (Central and Eastern Europe) = Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia, and Slovenia.

²Compound annual growth rate of global crude-steel production.

Association urged major domestic companies to adopt a price-over-volume strategy and to cut steel production by 5 percent to help maintain prices. This strategy has helped to limit temporary price drops to some 25 percent below peak levels. Prices have stayed well above five- and ten-year averages, more than compensating for the hefty increases in input costs.

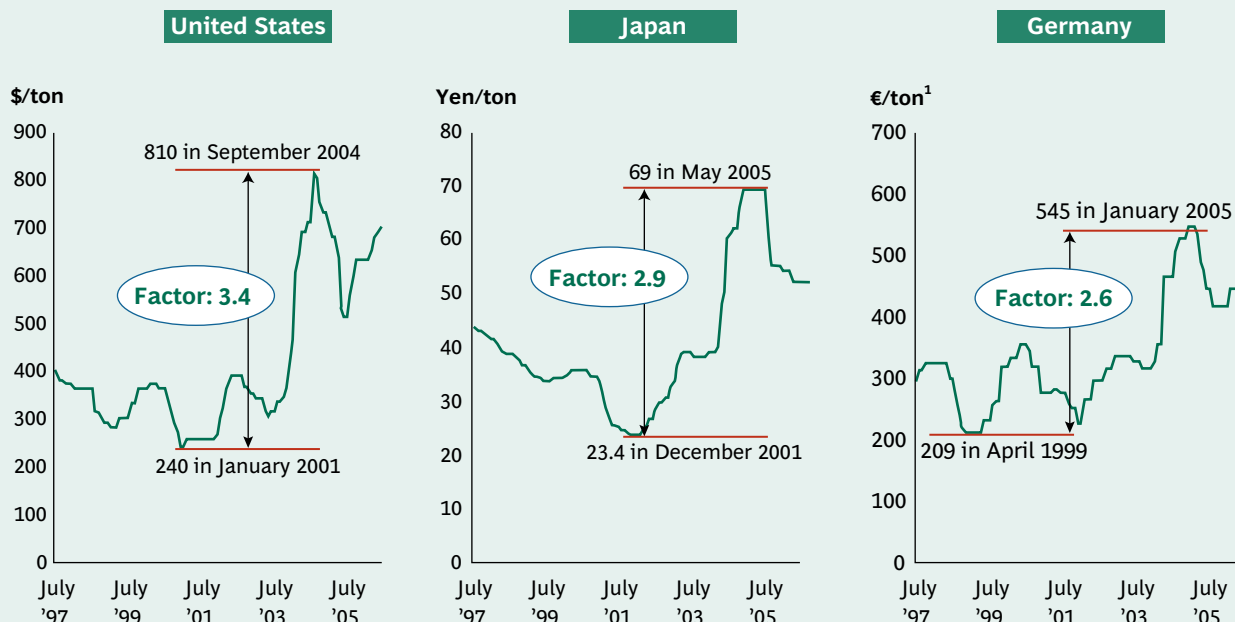
Prices for raw materials such as iron ore, coke, coking coal, and scrap have risen dramatically during this period, primarily because of high demand from Chinese steel producers and their exhaustion of limited market liquidity in global raw-material markets. (See Exhibit 6.) Prices have risen even more sharply for alloying materials such as chromium, vanadium, and molybdenum, as well as for zinc used in galvanizing; and prices for shipping and other steel-related services have soared.

After several years of extremely high demand, many raw-material suppliers now find themselves in a very comfortable situation. In the case of iron ore, for example, three companies—BHP Billiton of Australia, Companhia Vale do Rio Doce (CVRD) of Brazil, and Rio Tinto of Britain—control more than 70 percent of the export market. Consequently, the 2005 earnings of these ore suppliers were significantly above their 2003 levels and outstripped the average earnings of the top ten steel companies by a wide margin. (See Exhibit 7.)

We expect prices for raw materials to stabilize at high levels until at least 2010. Further significant increases are rather unlikely because the planned reduction of local and temporary bottlenecks, combined with new exploitation projects, should lead to sufficient supply volumes and reduce the excessive price volatility of the spot markets.

Exhibit 5: Steel Prices Have Tripled in Recent Years

Regional Prices for Hot-Rolled Coil

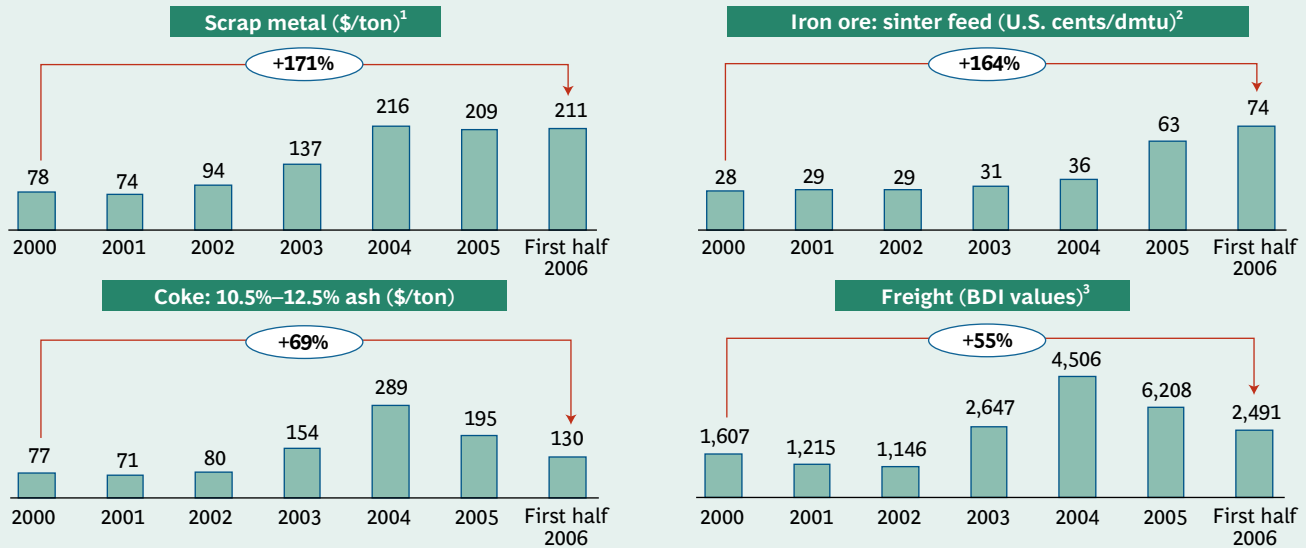


Sources: MEPS (International); BCG analysis.

Note: Prices refer to transaction prices paid by consumers and stockholders for prime material. Prices are for regular business transactions between customers and their local steel mills negotiated during the current month for delivery in the future. The transaction prices include all extras for the lowest-priced grade—sold from the mill. Delivery charges and local taxes are not included.

¹Prices before January 1, 2002, were calculated according to a fixed exchange rate of €1 = DM1.9558.

Exhibit 6: Prices for Raw Materials and Freight Increased Dramatically from 2002 to Mid-2006



Sources: Metal Bulletin; Steel Business Briefing; BCG analysis.

Note: All values represent yearly or half-yearly averages.

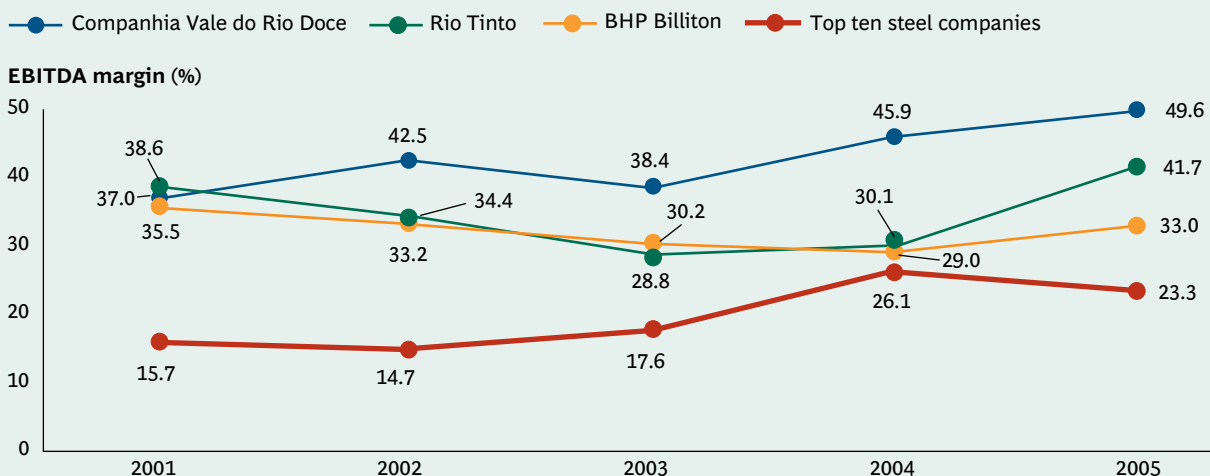
¹European export price out of Rotterdam for heavy scrap and grades 1 and 2.

²Sinter feed exported from Tubarão, Brazil, to Europe; dmtu = dry metric ton unit.

³BDI = Baltic dry index.

Exhibit 7: Iron Mining Companies' Margins Outstripped Steel Industry Margins from 2001 Through 2005

EBITDA Margins: Mining Versus Steel, 2001–2005^a



Sources: Thomson Financial Datastream; Thomson Financial Worldscope; Bloomberg; annual reports; BCG analysis.

Note: The values for the steel industry are weighted averages. The top ten players, by total shareholder return from 2001 through 2005, are Gerdau, Companhia Siderúrgica Nacional, Vallourec, Sistema Usiminas, Mittal Steel, Angang, IPSCO, Sumitomo, Rautaruukki, and Kobe Steel.

^aEBITDA = earnings before interest, taxes, depreciation, and amortization.

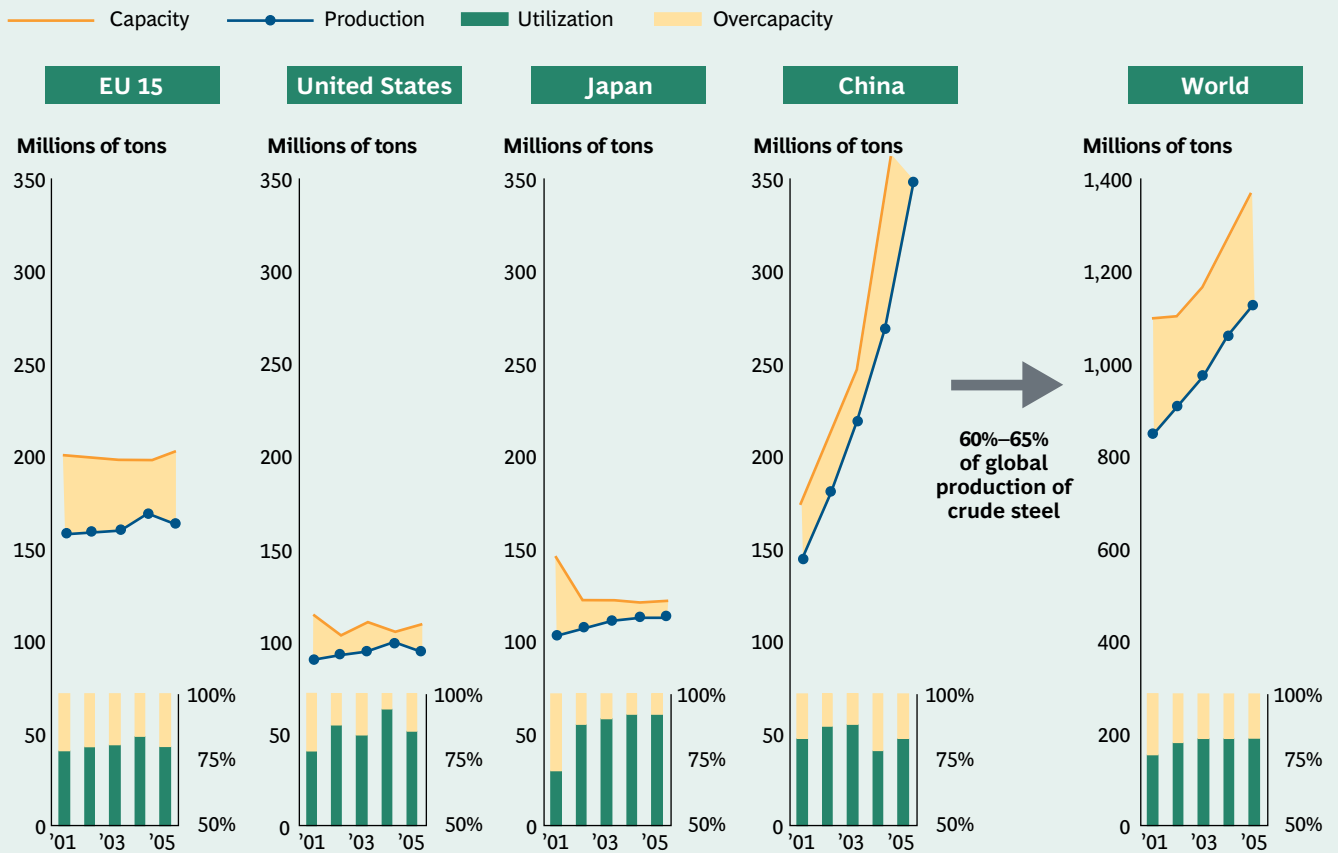
Steel companies have seen the industry's global overcapacity shrink from 23 percent in 2001 to about 17 percent from 2003 to 2005, although significant regional differences remain. (See Exhibit 8.) The real drama has been taking place in China. Spurred by investments in new capacity, China's domestic steel production has been outpacing its demand. In 2002, 2003, and 2004, China's capacity for producing crude steel *increased* on average by about 55 million tons per year—an amount larger than Germany's entire annual production of crude steel.

In December 2004, China became for the first time a net exporter of steel. (See Exhibit 9.) In the first half of 2006, China overtook Japan, Russia, and

the EU 25 to become the world's biggest steel-exporting country.³ China's total exports in 2006 are estimated to reach about 20 million tons. Chinese industry today continues to rely on net imports of certain types of steel, including high-strength steel plates used for bridges, buildings, and surface-treated products. Because of their geographic proximity, Japan and South Korea are China's major suppliers of high-quality steel, delivering more than half of its total imports.

3. The EU 25 comprises the following members of the European Union: Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

Exhibit 8: The Steel Industry's Capacity Utilization Improved During the Boom Phase



Sources: International Iron and Steel Institute; Commodities Research Unit; Morgan Stanley; Organisation for Economic Co-operation and Development; American Iron and Steel Institute; BCG analysis.

But China's position in the worldwide steel industry is evolving rapidly. China has considerably modernized its upstream production. (See Exhibit 10, page 16.) As recently as 1980, China was still making one-third of its crude steel using the outdated open-hearth process. Today, according to official sources, it has raised to Western levels the percentage of continuous-casting techniques it employs. Clearly, modernization will spur exports of Chinese products to world markets, creating additional competitive pressure. Steel producers in Japan and Korea, in particular, are already feeling this pressure.

On the other hand, because China does not have enough of its own raw materials for steel making,

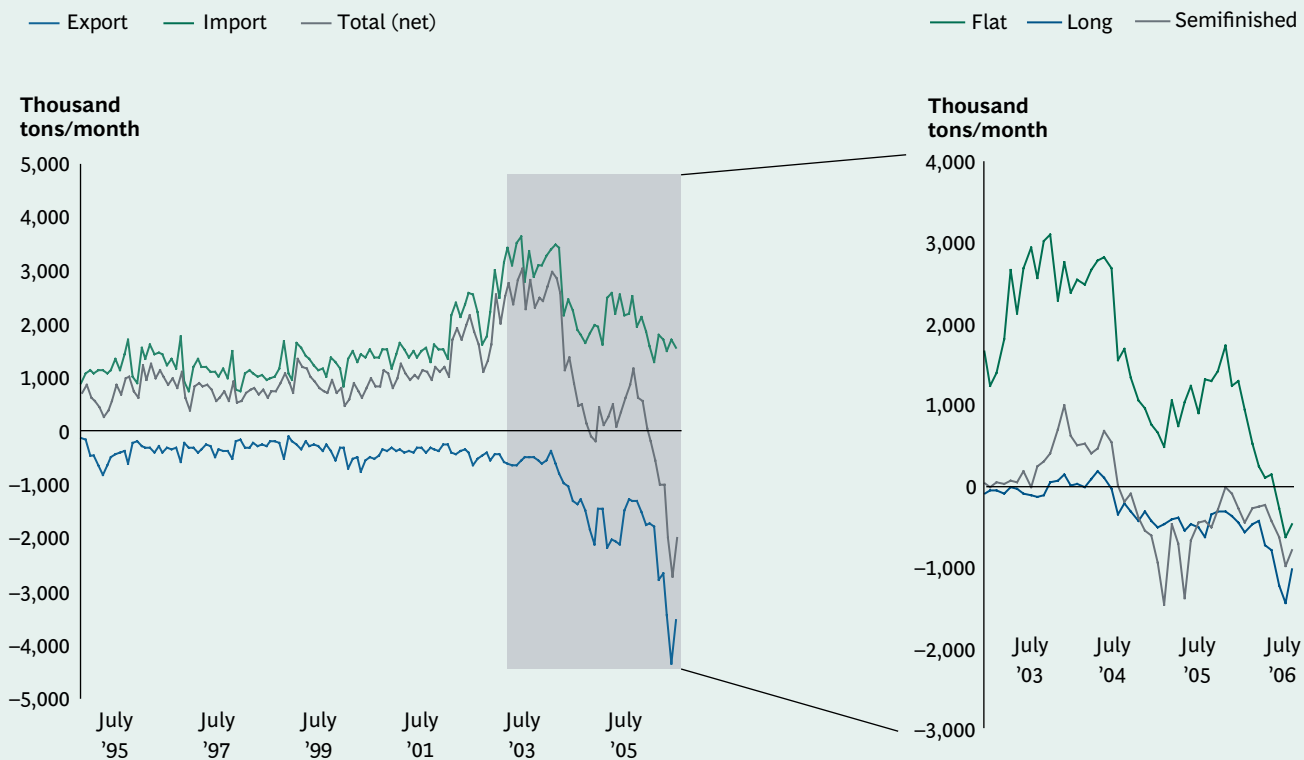
it has become highly dependent on imported raw materials. (See Exhibit 11, page 16.) For example, whereas in 1995 only 3.7 percent of the worldwide iron-ore trade flowed from Brazil to China, in 2004 this share increased to 10.8 percent. Similarly, the flow of iron ore from Australia to China rose from 4.7 percent to 12.6 percent of the worldwide total during the same period. In 2004 the Chinese share of the global iron-ore trade amounted to almost 30 percent.

To many steel producers, the period from 2002 through 2006 came as a huge boom. Newly consolidated and more efficient, they have been able to earn margins typical of boom times—year after year. But can these conditions persist?

Exhibit 9: China Has Become a Net Exporter of Steel

China's imports and exports of finished steel

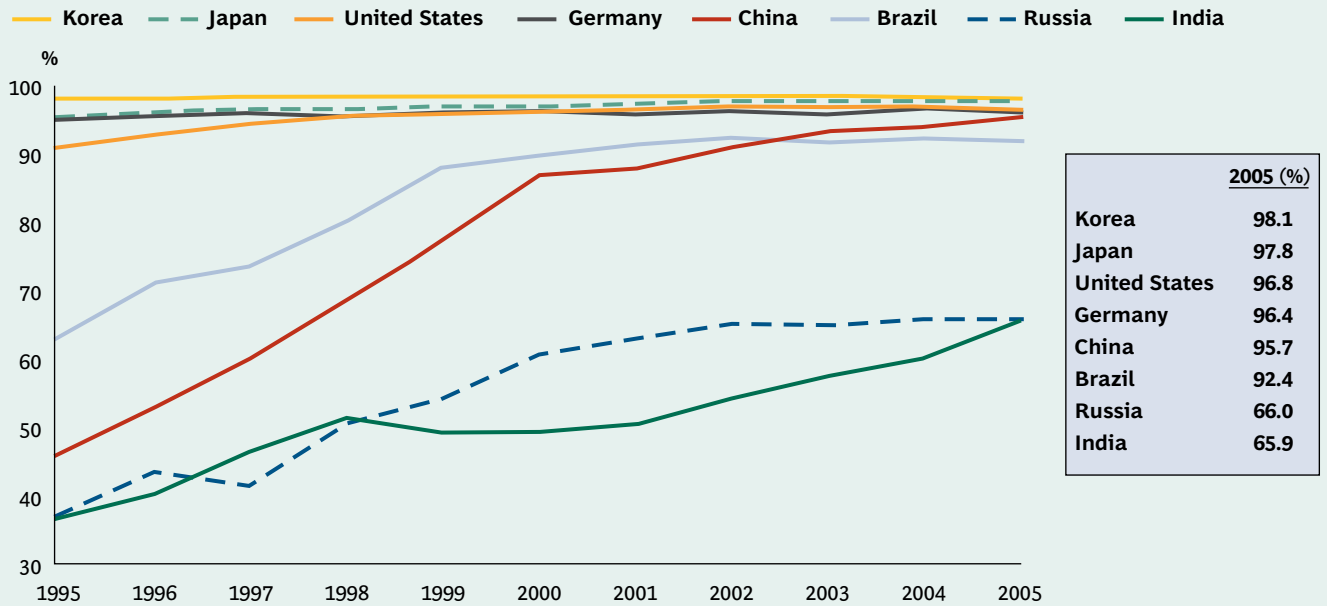
China's steel imports and exports by product type



Sources: Iron and Steel Statistics Bureau; BCG analysis.
 Note: Finished steel comprises flat and long products, tubes, pipes, fittings, and other products.

Exhibit 10: China Has Considerably Modernized Its Steel Production

Continuous Casting as a Percentage of Overall Production, 1995–2005



Sources: International Iron and Steel Institute; national statistics; BCG analysis.

Exhibit 11: Global Trade Flows of Iron Ore Have Shifted Toward China

50 million tons

1995 (total = 402 million tons)

To From	Europe	Japan	China	United States
Brazil	65	31	15	7
Australia	26	60	19	–
Canada	17	–	–	–
India	–	–	–	–

2004 (total = 556 million tons)

To From	Europe	Japan	China	United States
Brazil	57	31	60	8
Australia	16	76	70	–
Canada	14	–	–	–
India	–	–	40	–

Sources: Fearnleys; BCG analysis.

Note: Only trade flows greater than 7 percent of the total were considered.

The Future of Global Steel

The outlook for the global steel industry rests on four key questions:

- How fast will China's economy grow, in what directions, and with what impacts on steel?
- Will developments in the other BRIC countries and in Central and Eastern Europe (CEE) trigger the next growth wave?⁴
- What developments are likely in the Triad?
- Will industry consolidation continue globally, regionally, both, or neither?

Together, the answers to these questions will determine the shape of the global steel industry over the next decade.

Growth in China

China is currently the biggest driver of both demand and supply for steel. We anticipate that China's demand will continue to grow, but at a slower pace. Driving that growth will be continued expansion of China's industrial production and

4. The so-called BRIC countries are Brazil, Russia, India, and China. The CEE countries are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia, and Slovenia.

GDP, which it expects to quadruple between 2000 and 2020. At present, China's steel consumption per capita is still quite low relative to that of most developed and rapidly developing countries. (See Exhibit 12, page 18.)

Notably, China's government intends to ensure that domestic suppliers satisfy most of the anticipated increase in local demand. We expect that China will be able to meet that goal. It plans to add 100 million to 120 million tons of net domestic steel capacity by 2010 (after closing old and sub-scale production sites). This amounts to some 25 million to 30 million tons of additional capacity per year, beginning in 2006. Between 2005 and 2010, China's production of cold-rolled and coated flat products is projected to grow at more than 15 percent per year—significantly faster than long-steel products. (See Exhibit 13, page 19.)

Quality is an issue and will remain one for the next several years. However, China's rising investments in automation technology show its commitment to moving further up the quality pyramid. We estimate that at least through 2012, China's steel exports will most likely continue to be primarily commodity-grade long and semifinished products, while its imports will remain higher-quality flat products.

China's steel industry needs to consolidate further. Its level of concentration is still very low compared with other steel-making regions. According to the

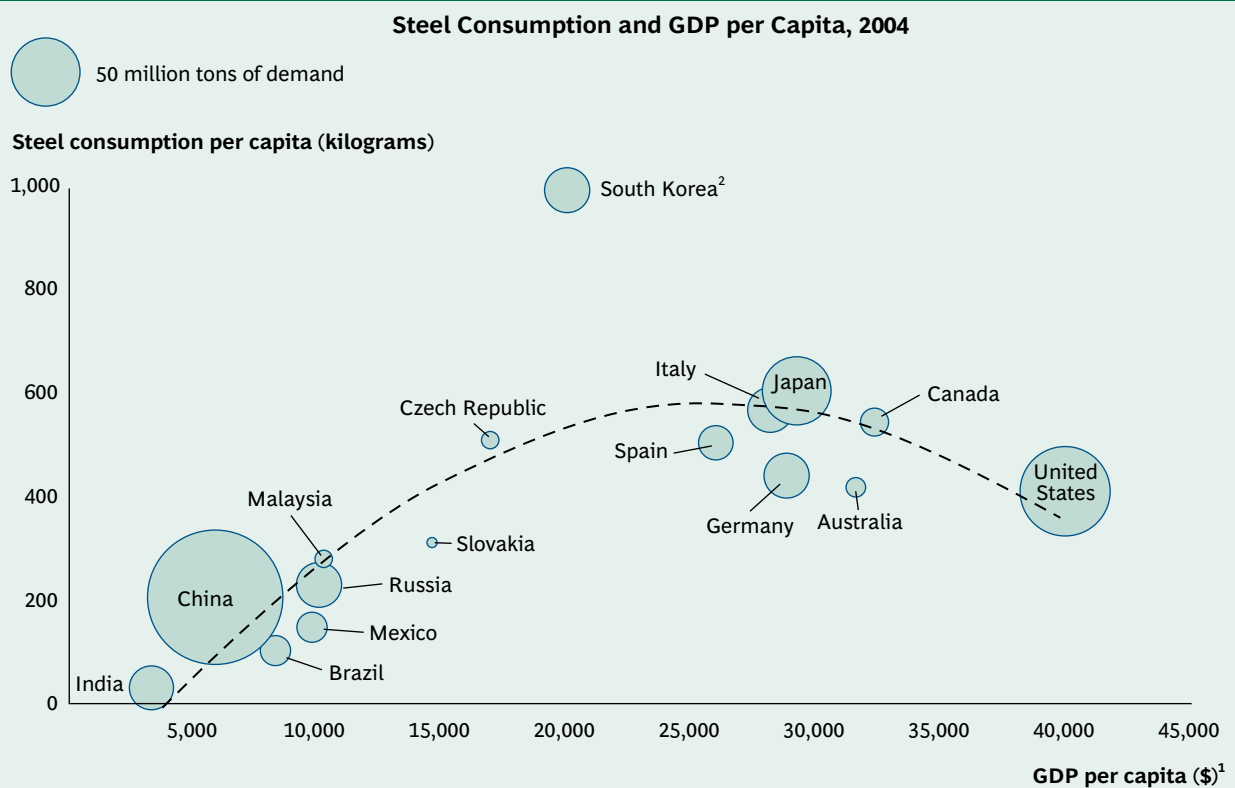
Chinese government's policy for the industry, announced on July 20, 2005, China plans ultimately to concentrate its more than 800 steel makers into some ten large units producing half the national output. If the government succeeds in executing this plan, each of these large units will have a capacity of around 20 million tons. In short, the Chinese economy would then have about ten companies in the top-25 league of the world's steel industry. China also wants to create two huge steel companies capable of competing with the global majors. In July 2006, Laiwu Steel Corporation and Jinan Iron and Steel Group, respectively China's number six and number seven steel producers, announced their intention to merge. In August 2006, numbers two and five, Anshan Iron and Steel Group and Benxi Iron and Steel Group, merged to form Anshan-Benxi Steel Group, or Anben. The companies resulting from the mergers, together

with Shanghai Baosteel Group, will become the country's new top-three steel giants.

For foreign steel producers planning to invest in China, the new policy stipulates that they must produce at least 10 million tons of carbon steel or 1 million tons of high-alloy steel annually. Existing restrictions preventing foreign steel makers from becoming majority shareholders in Chinese steel companies will most likely continue.

Despite these bold plans, China will not be the only powerful force shaping the future of the supply side of the world's steel industry, for two reasons. First, for quite some time there will be no such thing as a homogeneous Chinese steel industry. At present, the industry still consists of a large number of plants in widely dispersed locations with varying levels of structural advantage and disad-

Exhibit 12: China and the Other BRIC Countries Have Huge Potential for Increased Steel Demand



Sources: International Iron and Steel Institute, *IISI Steel Statistical Yearbook*, 2005; The Economist Intelligence Unit; BCG analysis.

¹Real GDP at purchasing power parity.

²High per capita steel consumption due to export-oriented industry segments (such as shipbuilding and automotive).

vantage, as well as varying levels of management competence. Each of these plants will ultimately need to identify and execute successful strategies for merging with others in order to compete both domestically and globally. So China still has a long way to go before it achieves the goals set forth in its steel-consolidation policy.

Second, steel's long-term lowest-cost producers will be located not in China but in South America and the CIS countries. So additional drivers of structural change in the industry's global cost base are likely to be low-cost imports from, say, Brazil, Russia, and Ukraine. In the next few years, these imports could be a more immediate challenge to the mature markets of the world than imports from China. In the case of Brazil, however, much of the expected capacity increase will take place in the context of cooperative agreements with established partners in Europe, Japan, and the United States. So these increases will not lead to an uncontrolled flood of cheap semifinished steel products into regions of the world with mature steel markets. Nevertheless, upstream capacity will move from some current locations in the Triad to Brazil, Russia, and Ukraine, thus making the least efficient upstream plants in the developed countries redundant.

Developments in the Other BRIC Countries and CEE

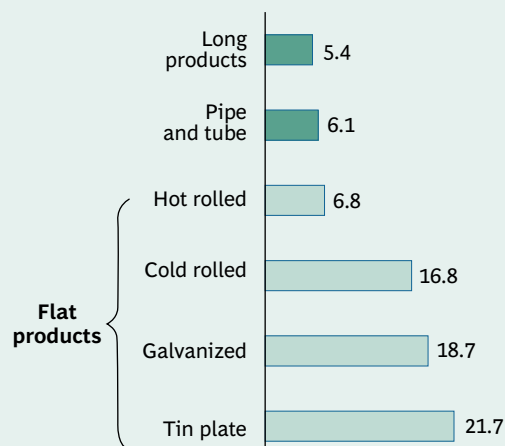
Companies operating in the BRIC countries enjoy significant advantages, as reflected in the steel industry's global and regional supply curves. (See the sidebar "The Global Supply Curve," page 20.) Moreover, a number of interesting developments under way in India, Brazil, Russia, Ukraine, and CEE will have implications for the global steel industry and specifically for the Triad.

India. India is currently among the top ten steel producers in the world and is in a good position to develop the industry further. India's steel producers are strongly cost-competitive, with very low labor costs. They also have sufficient reserves of iron ore (6 percent of worldwide deposits) and of coking coal (11 percent of worldwide deposits), as well as healthy foreign direct investments (nearly \$10 billion in 2005). The profits of the principal Indian steel producers have shown strong growth, thanks to liberalization and privatization.

Moreover, there is huge potential for growth in India's domestic market. The country's per capita consumption of steel in 2004 was only some 30 kilograms, compared with 200 kilograms in China and about 400 in Germany. (See Exhibit 14, page 21.) India's low per capita steel consumption reflects low investments to date in social infrastructure, fairly immature automotive and home-appliance industries, and a relatively small share of the economy represented by heavy industries and construction (only 25 percent, compared with Brazil's 35 percent, Russia's 38 percent, and China's 53 percent).

Exhibit 13: China's Production of Flat Steel Will Grow Faster than Its Production of Other Categories

Anticipated average annual growth in China's steel production, 2005–2010 (%)



Sources: World Steel Dynamics; BCG analysis.

Despite this modest consumption level, India plans to develop its steel industry to reach world standards for productivity and quality. India's National Steel Policy was approved by the Indian Cabinet Committee on Economic Affairs on November 3, 2005. Its long-term goal is a modern and efficient steel industry, operating according to world standards and catering to a diversified demand. The plan is to achieve global competitiveness in terms of quality, product mix, efficiency, and productivity. This will require indigenous production of more than 100 million tons per year by 2019–2020—up from 38 million tons in 2004–2005, of which some 25 percent is assumed to have been exported.

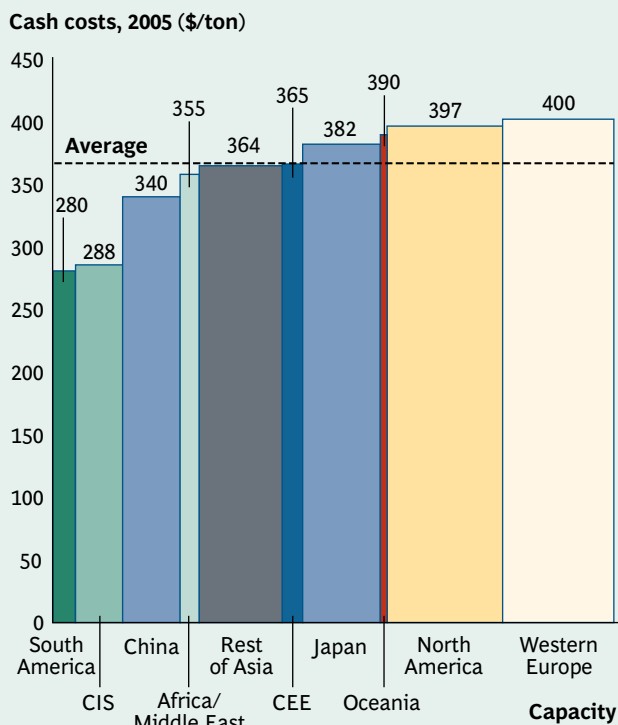
The Global Supply Curve

The supply curve concept is used to explain the long-term average profitability of an industry by looking at differences in production costs among producers. The horizontal axis denotes the capacity of various suppliers, whereas the vertical axis indicates the cash cost at which these volumes are produced. According to macroeconomic theory, the long-term average price in a market will be equal to the cost of the marginal producer (that is, the one with the highest cash cost that is still able to recover these costs in the market). Hence, the shape of a supply curve reflects the average profitability of an industry. Generally, the flatter the supply curve, the lower the average profitability.

The supply curve for global steel shows a sizable cost spread across regions, driven largely by differences in labor costs and the availability of raw materials. (See the exhibit below.) It implies significant advantages and healthy prospects for players in regions toward the lower end of the curve. In contrast, steel supply curves for individual regions tend to be rather flat, especially in developed markets such as the EU 15, reflecting the low profit levels of a less globalized industry during the stalemate years.

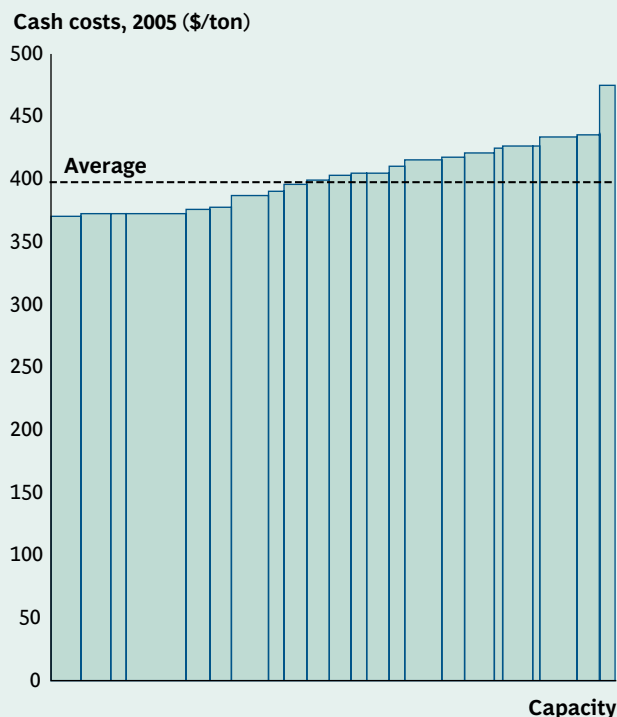
Steel Supply Curves Differ Significantly Between Regions but Are Often Flat Within Regions

Global supply curve for flat steel



Sources: World Steel Dynamics; BCG analysis.

EU 15 supply curve for flat steel



Achieving this goal will mean growing production at 7 to 8 percent per year. Toward that end, India will need to increase its productivity substantially. It currently averages 38 man-hours per ton of cold-rolled material—far behind Brazil, at 5 man-hours per ton, and Egypt, at 15. India must also improve its process technology and product quality. We expect the Indian industry to grow strongly, but from a relatively small base. Arcelor Mittal’s interest in setting up new integrated operations in India, as well as the potential acquisition of Corus Group by the Indian steel producer Tata Steel—should the latter’s bid prove successful against the Brazilian steel maker Companhia Siderúrgica Nacional (CSN)—could accelerate this development significantly.

Brazil. Brazil’s steel industry should achieve strong growth in the next several years, given the growth

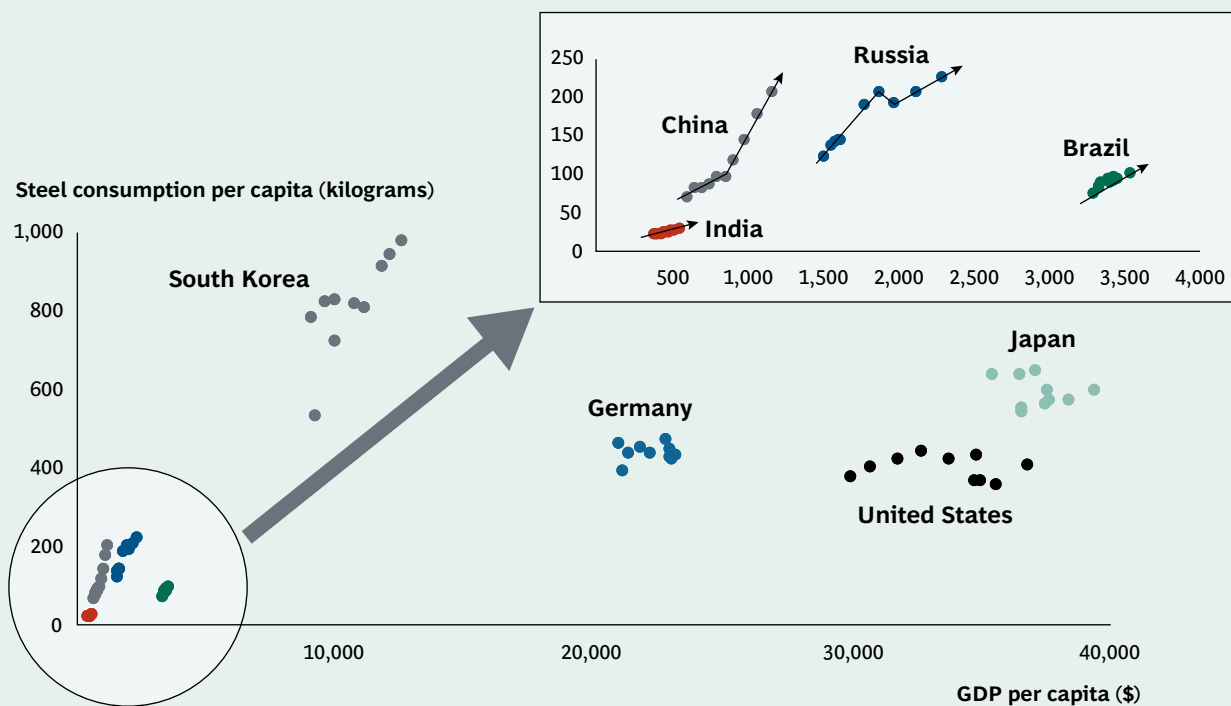
potential of the Brazilian economy and Brazilian producers’ favorable position as low-cost suppliers of semifinished steel products to mature markets, such as Europe and North America. Moreover, demand is growing well across Latin America. Exports to these regions will continue to provide Brazilian steel makers with generous margins.

Brazilian steel producers continue to have the lowest costs in the world, thanks to domestic reserves of high-quality iron ore, as well as low energy prices and low labor costs. Although raw-material costs are on the rise, we expect that profits will remain above average for the next five years as prices continue to stay well above historical trough levels.

In contrast to the Chinese steel industry, the Brazilian industry is highly consolidated, with the top four producers of flat and long products—Sistema

Exhibit 14: India Lags Other Steel-Making Countries in Per Capita Steel Consumption

Per Capita Steel Consumption Versus Per Capita GDP Development, 1995–2004



Sources: International Iron and Steel Institute; The Economist Intelligence Unit; BCG analysis.

Usiminas, Arcelor Mittal, Gerdau, and CSN—turning out about 80 percent of the national volume. These companies compete strongly on the basis of both technology and quality.

The principal reasons for the health of the Brazilian industry include its consolidation and the successful privatizations of the 1990s. Also important was the government's commitment, over several decades, to developing and growing this industry as an important contributor to Brazil's GDP through measures such as import-substitution policies. The attractiveness of the Brazilian market and its potential for growth are underscored by the presence of international players such as Arcelor Mittal and Nippon Steel Corporation. In addition, Shanghai Baosteel, ThyssenKrupp, and others are already implementing or studying many new projects involving upstream capacity for a deconstructed play (that is, with upstream processing in locations close to the ore mines). Exports are expected to increase significantly through the rest of the decade.

CEE, Russia, and Ukraine. Despite facing a number of inherited challenges, CEE will play an important role in both European and worldwide steel production. Its projected GDP growth of 4 to 6 percent per year will create a substantial improvement in economic conditions across the region and a consequent rise in steel consumption. Domestic demand is already increasing—as can be seen, for example, in Slovakia's booming automotive industry and in the swift growth of the engineering and machine industries in the Czech Republic and Romania.

In addition to this growing demand, CEE has a number of other advantages that will attract further direct investments in logistics and manufacturing: a highly skilled and experienced work force, a very good infrastructure, and a low-cost economy. For many industries serving Western Europe, CEE's costs are competitive with China's. Moreover, we anticipate that the merger of Arcelor and Mittal Steel Company will result in a more fluid combination of Western and Eastern European supply-and-demand markets, ensuring a cost-effective supply to downstream production facilities in Western

Europe—and providing Western European steel users with lower-cost steel.

In Russia and Ukraine, steel makers are enjoying attractive business conditions. Their domestic prices are higher than global prices, and the large players' production costs are lower because they are vertically integrated, commanding their own coal mines, ore mines, and power plants. Nevertheless, the region's continuous-casting ratio of just above 66 percent indicates that—on average—companies there still need to do a lot of modernizing to catch up with the world's leading steel makers.

The recent appearance of Severstal as a potential bidder in the takeover battle between Arcelor and Mittal reflects Russian players' ambition to gain access to modern steel technology as well as to large and valuable steel markets. After the failure of this first attempt to enter the Western European market, Severstal and its equally strong competitors, Magnitogorsk and Novolipetsk Steel, will probably look for other targets on which to spend their available capital.

Developments in the Triad

Established steel producers in the Triad will benefit from the strong further development of the steel-consuming industries in the BRIC countries and in CEE. This development should serve to promote a growing and profitable global market for steel, assuming that economic growth remains stable. On the other hand, the established steel producers will also see increasing competition from suppliers in these regions, especially if needed reforms and restructuring projects take place. If steel prices in the EU and North America remain high, imports from Brazil and Russia will become extremely attractive by comparison. The big three Russian players—Magnitogorsk, Novolipetsk, and Severstal—could use their strong cost position to attack the EU 15 and potentially also the North American market, or to acquire Western European assets.⁵ The Bra-

5. The EU 15 comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

zilian players are also well positioned to export to North America and to the EU 15.

But if the BRIC countries generate challenges to the Triad, they will also create opportunities. For example, leading steel companies may find it desirable to collaborate with BRIC producers to gain access to their fast-growing markets, particularly those where domestic suppliers have not been able to satisfy the demand for high-end material. Another opportunity is to reduce costs by investing in upstream capacity in a BRIC country for downstream processing elsewhere. In fact, Arcelor Mittal already processes its Brazilian- and Mexican-made slabs at its own downstream plants in the EU and the United States, where, for example, the cost advantage of imported flat carbon-steel slabs over domestic equivalents amounts to as much as \$90 per ton. (See Exhibit 15.)

A third option is to outsource specific functions, such as IT or R&D, to BRIC-based service providers. The expected rise in BRIC countries' production and available export volumes is likely to increase price pressure on commodity-type products in the Triad—and it will do so even more if BRIC demand should weaken. This pressure is expected to accelerate the transfer of upstream production capacities to BRIC countries by Triad-based steel makers that may not wish to reinvest in their home countries after their upstream facilities reach the end of their useful life. The growing availability of lower-priced products could also lead to renewed calls for protectionist measures in countries with

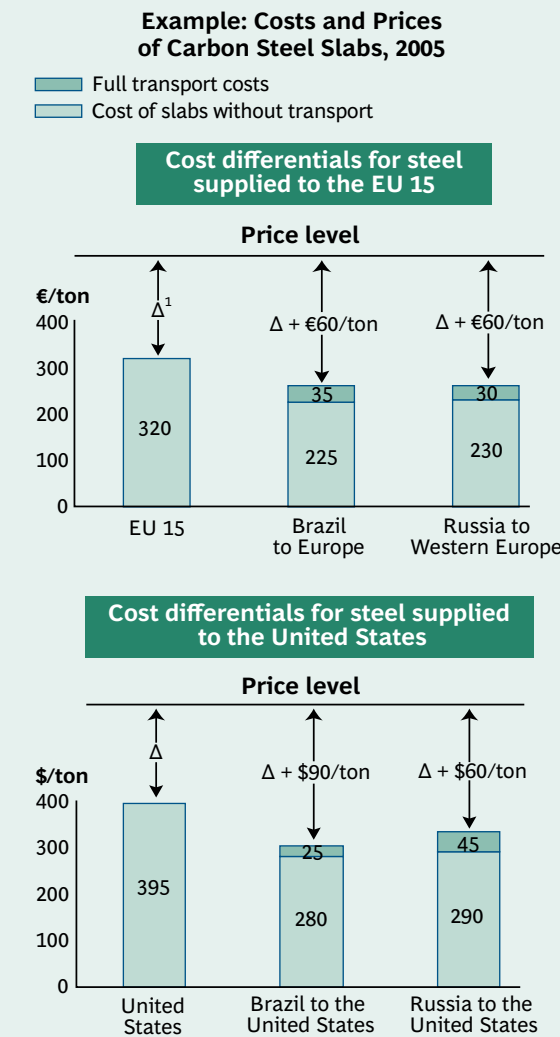
their own steel-making facilities, although global consolidation makes national protectionism increasingly difficult.

Industry Consolidation

In the past, industry consolidation contributed to reduced cyclicity. Today the top ten steel makers represent about 28 percent of global production. (See Exhibit 16, page 24.) Besides Arcelor Mittal, a truly global player, four of the top ten are in Asia, three in Europe, and two in the United States.

In our view, the industry is very likely to consolidate further. In addition to China's plan for radical consolidation, many of the leading steel producers have ambitious growth plans that will entail further consolidation. Lakshmi Mittal, CEO of Arcelor Mittal, stated in June 2006 that winning companies in the steel industry will have somewhere between 150 million and 200 million tons of annual capacity by 2015 and that scale is crucial in the pursuit of value. Clearly, the combined Arcelor-Mittal group is particularly well positioned to achieve this scale and this advantage. Shanghai Baosteel, China's biggest steel company—which, although founded only in 1998, is already the world's fifth-largest steel maker (producing 22.7 million tons in 2005)—intends to become one of the world's top three players by 2010. And the potential acquisition of Corus Group by Tata Steel would create a new entity with a production volume very close to Baosteel's, thus forming the new sixth-largest steel maker

Exhibit 15: High Prices in the EU 15 and the United States Could Attract New Entrants



Sources: World Steel Dynamics; BCG analysis.
 Note: The exchange rate in 2005 was \$1 = €0.805.
¹Δ = margin.

in the world. Similarly, if CSN's competing bid for Corus proves successful, the merger of those two companies would create the new fifth-largest steel maker in the world, with almost 24 million tons of production annually.

In addition, as privatization continues, newly privatized companies will be required to create value. And as consolidation continues, companies will acquire the kind of scale that attracts greater scrutiny from the capital markets, which results in better management—for value creation, not volume production. Moreover, further consolidation in the steel industry will allow companies to serve their global customers better, with more consistent offerings and greater supply-chain efficiencies.

A linear extrapolation of the current consolidation process indicates that the top ten companies will hold a global market share of almost 35 percent in 2010. This might mean three or four players producing more than 80 million tons, and five or six players producing between 40 million and 60 million tons. In our view, the stimulating effect of the Arcelor-Mittal merger and the dampening effect of the increasing difficulty of forming new global mergers and alliances will balance each other out. Hence, that linear extrapolation should be a reasonable forecast of the consolidation rate for the remainder of this decade.

Although stocks in the steel sector have outperformed those of other industries during the recent boom years, the current combination of mostly moderate valuations and high earnings will stimulate more mergers and acquisitions (M&A). Furthermore, even large, successful companies whose shares win high valuations on leading stock markets are in danger of becoming acquisition targets now that the Arcelor-Mittal merger has created a market leader three times the size

of the new company's nearest competitor. Many steel companies now realize that they may be as vulnerable to hostile bids as Arcelor was and are considering potential defense strategies. An obvious one is to use their strong cash positions to become acquirers and consolidators themselves.

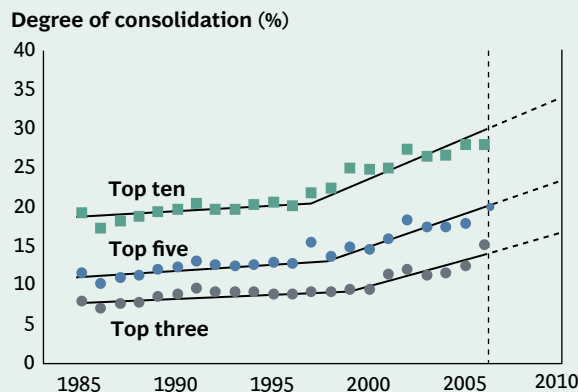
The benefits of further global consolidation will include reduced overcapacity and better management of the balance between supply and demand, because larger players with more plants serving more markets are better able to adapt production to fluctuations in demand. They can also better control their materials costs, thanks to greater purchasing power and the ability to acquire raw materials.

Larger companies can also make the market less volatile; that is, they can manage price cyclicality better than smaller companies. They tend to have broader and deeper insights into the market and therefore better information on which to base decisions about pricing and production. And their decisions have a stronger impact on the market as a whole than do those of smaller companies.

Another benefit of increased scale is the ability to manage and extract value from knowledge. Merging two steel companies provides an additional opportunity to exchange operational knowledge and extend best practices across the combined entity very quickly. This is true also for functional areas such as procurement, capital expenditure management, and product development, in which scale also provides enhanced leverage. For example, larger steel companies can conduct significant product-development efforts at a lower cost per ton than smaller companies, creating increased opportunities to expand the market base and provide better products for customers.

Exhibit 16: Global Consolidation of the Steel Industry Has Accelerated Since the Mid-1990s

Global Market Share of the Top Three, Top Five, and Top Ten Steel Companies



Sources: International Iron and Steel Institute; BCG analysis.
 Note: Market shares are based on production figures for 2005 and take into account the Arcelor-Mittal and the Anshan-Benxi mergers.

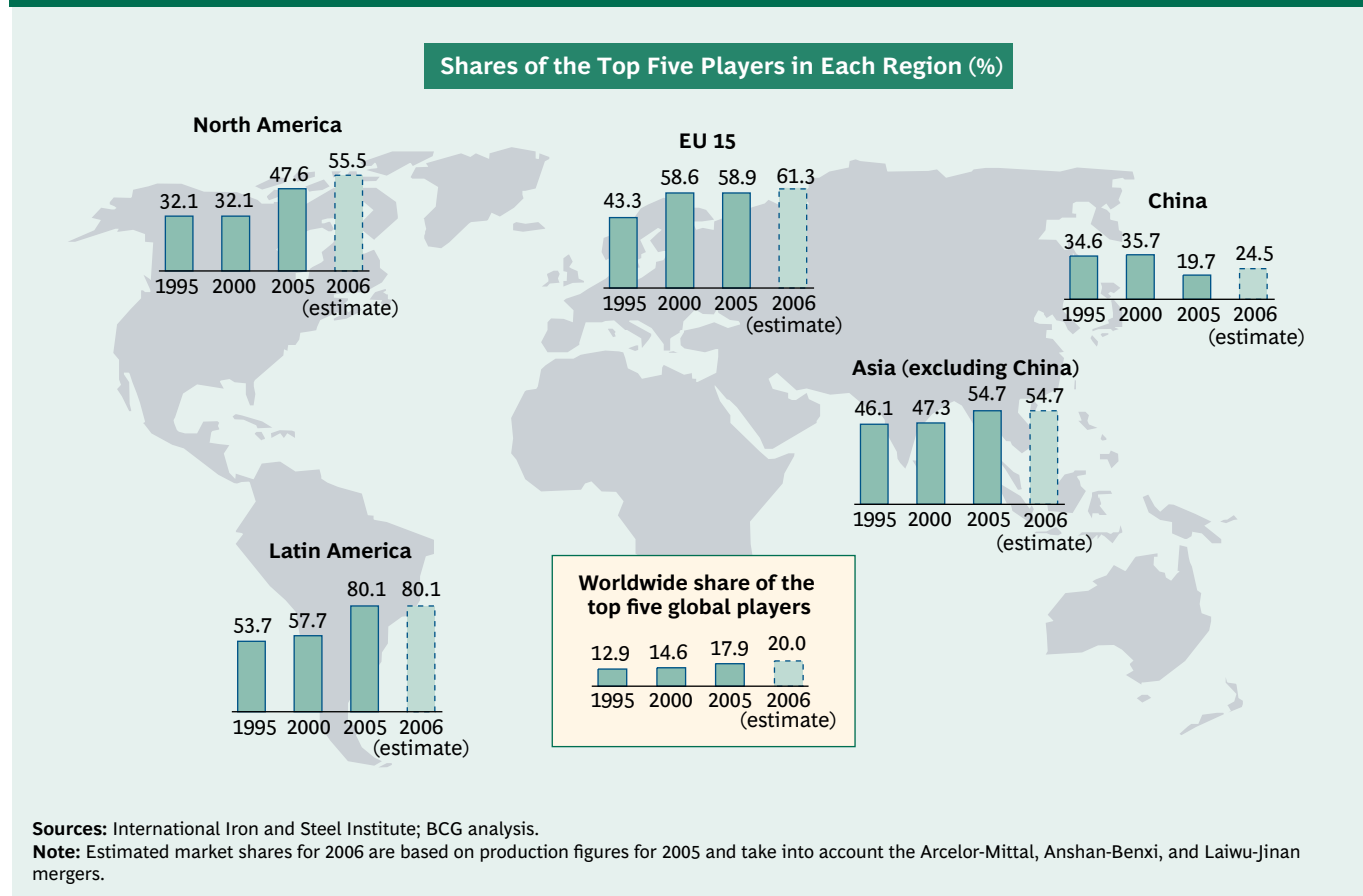
The trend toward interregional mergers is expected to continue. Some of the largest steel makers in the Triad have already turned to the emerging markets of Asia-Pacific, CEE, and Latin America in their search for promising M&A candidates. Meanwhile, intraregional consolidation has reached high levels in Europe and Latin America and moderate levels in North America and Asia (excluding China). In China, the enormous growth of capacity has outpaced the ongoing consolidation of the industry, so the share of the top five players is actually lower today than it was in 1995 and 2000. (See Exhibit 17.) However, we expect that the Chinese government's consolidation strategy will reverse this trend by 2010.

In terms of potential interregional acquisitions or partnerships, there is a clear motivation for steel

makers in both developed and developing countries to strengthen their international presence. Steel makers in developed countries are likely to use facilities in low-cost countries to make structural improvements in their upstream cost positions. At the same time, there will be greater demand for high-quality steel products from important customers such as automotive and appliance manufacturers, which are increasingly moving their production to low-cost countries. Meanwhile, low-cost producers in Brazil and CEE will definitely try to catch up with high-quality steel makers in order to enter premium-priced markets, eventually establishing their own downstream capacity or distribution systems—or both—in Europe and North America.

Accelerated interregional acquisitions do not preclude further intraregional consolidation. How-

Exhibit 17: Consolidation of the Steel Industry Is Moving Forward at Varying Paces



ever, in Europe and North America, opportunities for further consolidation are limited by antitrust legislation.

In China, as discussed above, further consolidation is planned. Currently, only 15 of China's more than 800 steel makers have an annual capacity of more than 5 million tons, while another 40 have capacity between 1 million and 5 million tons. Most Chinese steel mills are relatively small, with high proportionate fixed costs. New mills are increasingly being located on the coast, but several older plants still face high transportation costs and difficult logistics.

The Outlook for the Global Industry

We anticipate that the worldwide steel industry will achieve significant growth of 3 to 4 percent per year through 2015, to achieve global production of 1.55 billion to 1.7 billion tons in 2015. (See Exhibit 2, page 10.) Over the same period, sustained high prices for raw materials (especially ore) and increasing consolidation will help to stabilize steel prices. The long-term profitability of the steel industry will most likely be better than during the stalemate phase before 2002, although it will clearly not be as robust as during the recent boom years.

We expect that during this period the global market will bifurcate more sharply into mass markets on the one hand and oligopolistic high-end markets on the other. The mass markets will expand in developing countries, fed by growing global-trade volumes driven by capacity increases in commodity segments worldwide. Meanwhile, the high-end markets, such as the automotive sector, will experience stricter requirements for quality and performance.

The Triad markets are likely to achieve only sluggish volume growth of less than 1 percent per year through 2015. Nonetheless, strong and innovative players in Europe, Japan, and North America will maintain their considerable edge in terms of know-how over potential new entrants until at least then.

The established players in the Triad will continue to concentrate on high-quality products while increasing their upstream capacity in low-cost countries and maintaining their facilities for final production closer to their customers in order to meet their demands for shorter lead-times.



Three Basic Roles for Steel Companies

For much of the latter half of the twentieth century, the steel industry was seen as dirty, slow growing, low profit, and poorly managed, tarnished by multiple bankruptcies and hobbled by widespread political interference. Today the industry has the opportunity to reinvent itself, because many of the disadvantageous macroeconomic conditions that afflicted it in the past have changed for the better.

Some key players are now in a position to introduce critically important improvements:

- Continuing the consolidation trend
- Embracing high-growth regional markets
- Shifting some upstream production to low-cost countries
- Improving marketing to gain access to latent demand
- Managing for value, not for production volume
- Providing service that ensures customers' satisfaction, rather than just meeting sales preconditions
- Basing pricing decisions on underlying microeconomics and true shifts in intrinsic supply and demand

In our view, every steel maker should choose to play one of three basic roles for the long run: global player, regional champion, or niche specialist. (See Exhibit 18, page 28.)

Global Player

A global player has a capacity of more than 50 million tons deployed in a global network of production facilities. Each global player produces the full range of steel products, with a significant base of commodity products. As of early 2007, of the more than 100 takeovers in 2005 (with a total acquisition volume of over \$30 billion), only Arcelor Mittal can be seen as a truly global player.

Global players are capable of tapping into the many advantages of manufacturing in developing countries, including lower wages, lower costs of energy and raw materials, lower capital-expenditure requirements, and proximity to new sources of demand. For example, a possible arrangement for a global player might be to do low-cost upstream production in Brazil; conduct innovative and technology-driven downstream production in Europe, Japan, or Korea; and secure access to rapidly developing countries, such as India or Russia, by cooperating with domestic steel makers or outsourcing specific functions, such as IT or R&D.

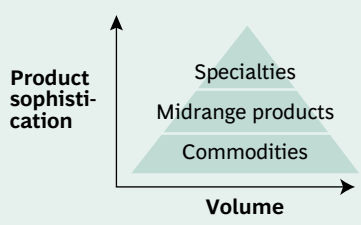




Required key activities for global players include extending their presence worldwide; strategically

integrating acquired companies into the group; leveraging their global networks to build cost-optimal value chains; securing global client relationships (with automotive players, for example); establishing uniform best-practice and quality standards across their production networks; and becoming cost leaders (especially in the upstream area).

One example of an exceptionally effective global player operating in a traditionally low-tech commodity market is Cemex, the Mexico-based global cement producer. For two decades, Cemex has delivered compound annual growth of more than 20 percent in sales and earnings before interest, taxes, depreciation, and amortization (EBITDA) through a long series of consecutive acquisitions. In 2005, sales exceeded \$15 billion (after the suc-

cessful acquisition of British cement producer RMC Group), yielding a net income of more than \$2 billion. Cemex makes extensive use of modern logistics technology at all of its operations around the world in order to dispatch cement to its customers' construction sites with very high reliability. It has achieved this outstanding performance by introducing a strict system of business process standardization called the Cemex Way. The Cemex Way is designed to ensure that Cemex absorbs best practices from each of its acquisitions and spreads them across the entire company, thus permanently improving its standardized business processes across the global enterprise. Very much like Cemex, global steel players will need to define and deploy a uniform operating model, ensure operational discipline, and allocate investment funds

Exhibit 18: Steel Companies Should Consider Playing One of Three Basic Roles

	Description	Geographic presence	Products	Differentiating features
 <p>Global player</p>		<ul style="list-style-type: none"> • Global network with production facilities in each region 	<ul style="list-style-type: none"> • Full range • Equal share of commodities, midrange products, and specialties 	<ul style="list-style-type: none"> • Scale (more than 50 million tons) • Global presence • Purchasing power • Backward integration
<p>Regional champion</p>	 <p>Type I</p>	<ul style="list-style-type: none"> • Strong regional presence • Based in the Triad with access to low-cost countries 	<ul style="list-style-type: none"> • Focused portfolio of high-value products 	<ul style="list-style-type: none"> • High quality • Strong customer relationships • Technology leadership
	 <p>Type II</p>	<ul style="list-style-type: none"> • Strong regional presence • Based in a low-cost country 	<ul style="list-style-type: none"> • Commodities and selected midrange products 	<ul style="list-style-type: none"> • Cost position • Local presence
<p>Niche specialist</p>		<ul style="list-style-type: none"> • Few production locations • Multiple sales locations 	<ul style="list-style-type: none"> • Narrow product portfolio • High-margin specialties 	<ul style="list-style-type: none"> • Product uniqueness • High quality • Customer solutions

Source: BCG analysis.

to the most promising opportunities around the world in order to achieve sustained success.

Regional Champion

Regional champions have production volumes of 10 million to 50 million tons and are strong in one core region, although they may have some operations or sales elsewhere. Type I regional champions, which are based in the Triad, must have access to upstream production facilities in low-cost countries to stay cost competitive. Type II regional champions, which are based in low-cost countries, need access to modern technology and R&D-driven customer relationships in the Triad to catch up.

In general, these players offer a diversified product portfolio based on a solid volume of commodities. Their key differentiating features are either cost leadership or technology leadership. Regional champions generally enjoy good market opportunities, especially when serving fragmented customer segments, thanks to steel's high transport costs, which favor local over global trading.

Like global players, regional champions can take advantage of opportunities offered by globalization either to gain access to attractive markets or to reduce costs by performing some functions in low-cost regions. Type I regional champions should also be sure to maintain their technological edge by investing in new products and conducting joint product development with key customers. Type II regional champions can leverage their (often very strong) domestic positions and cash flows to develop the skills and balance sheets required in order to gain access to downstream assets in the Triad—while defending themselves against suitors.

It is interesting to note that both types of regional champions tend to have complementary strategies. Often a Type I and a Type II regional champion can achieve their respective goals—improving the company's overall cost position by moving upstream production to low-cost countries, and gaining access to modern technology and R&D-driven customer segments—by joining forces in a cooperative relationship. For example, the potential

new company to be formed by Tata and Corus or, alternatively, by CSN and Corus might serve the interests of both companies simultaneously and could thus become an interesting model for other global collaborations.

Niche Specialist

Niche specialists typically produce less than 5 million tons of steel per year. Their portfolios contain mainly high-margin products, such as engineering or tool steels; special product forms, such as heavy plate or tin plate; or special processes, such as quenching. In general, niche specialists based in developed countries offer their products to both regional and global customers. Because their products require complex production processes, these companies usually have only one or a few production sites and many—often global—sales locations. Required key activities for niche specialists include fostering growth through product innovation, often undertaken jointly with customers; strengthening their service business; and concentrating on high-quality products to maintain their competitive edge.



Imperatives for Steel Executives

Steel companies today must contend with unprecedented opportunities and risks as the industry undergoes widespread dynamic change. Even steel executives with more than three decades of experience say that they have never experienced a period in which the positioning and fate of individual companies could change as quickly as they can today. And there is no single set of guidelines that can help all companies survive and thrive in this dynamic environment, because they all start from different positions and face unique constellations of economic and social conditions. The key is knowing exactly where your company stands and being prepared to act swiftly and decisively to seize opportunities and avoid unnecessary risks.

From our experience over the past five years in more than 100 engagements with steel industry leaders around the globe and with their customer and supplier industries, we have distilled three basic suggestions as to how steel executives can best position their companies to gain competitive advantage: know your position, be prepared to act, and watch your back.

Know Your Position

Make sure that you have a realistic view of your current market position, business model, and success factors. Part of this challenge is to know the

value to your business of each of your customers. Also, make certain that you know your customers' businesses intimately: the challenges they face, as well as their specific product and service requirements, economic cycles, substitution risks, and price trends. Evaluate the height of the change barriers that may prevent your customers from buying steel from your competitors, and try to determine how you can raise those barriers higher.

Identify your position on the global and regional supply curves. Which competitors have better cost positions than you have and why? Evaluate your potential for achieving cost reductions in each individual cost factor compared with your key competitors. Given the great importance of the raw-material base, how can you secure your supply? How can you decrease your consumption of raw materials? Given the substantial increase in global steel capacity over the next few years and the resulting decrease in the industry's asset productivity, how can you best manage your company's asset utilization for the highest possible productivity?

Evaluate your product portfolio by both the current and the future value of each activity. Manage your R&D pipeline strictly according to expected future value. Make sure that your product portfolio generates the maximum value that you can extract from your asset base as well as from your customer base.

Be Prepared to Act

Plan ahead by at least ten years. What scenarios might you face in your regional, product, and customer segments? Which is the most likely scenario, and which alternatives might reasonably be expected to occur? How does your strategy and risk profile look in the light of these scenarios? Will your standalone business model prove successful? Can you improve your positioning by engaging in strategic alliances, partnerships, or joint ventures or by acquiring other market participants? Make sure that you have a basic decision tree that describes the most valuable options within each scenario.

Watch Your Back

Identify the positions and options of your competitors and of potential new market entrants. Which companies might be interested in acquiring your company? Why? Are you vulnerable to a hostile bid? Which defense mechanisms could help you maintain your capacity to act? Are they already in place or do they still require implementation? What is a feasible escalation sequence in case you are attacked?

Mittal's hostile bid for Arcelor and the ensuing successful merger have demonstrated that no steel company is immune to a hostile takeover. In today's environment, being very large and highly profitable is no longer sufficient to ensure independence. Careful managers should make sure that they know where their company stands at all times, what their long-term vision for the company is, and what concrete options they have—both defensive and proactive.

Of course, further consolidation will make the steel industry more efficient. Moreover, continuing consolidation will also help companies earn the cost of capital. So taking part in another company's consolidation plans is not necessarily negative. But each steel company's management should have a clear view of which steps toward strategic consolidation will generate the most value and therefore deserve support.

If you feel any uncertainty about your company's current position, strategic options, and risk of becoming a target, take action fast. You may find it helpful to set up a senior-level working group, drawn from all areas of the company, to explore these issues and arrive at clear recommendations.

The boom phase has offered the steel industry a unique opportunity to restructure and strengthen itself for a new era of prosperous growth and development. Make sure that your company is among the active designers of the new steel-industry landscape.

For Further Reading

The Boston Consulting Group publishes other reports and articles on the topic of capturing global advantage that may be of interest to senior executives in the steel industry and related areas. Recent examples include:

China's Global Challengers: The Strategic Implications of Chinese Outbound M&A
A report by The Boston Consulting Group, May 2006

Organizing for Global Advantage in China, India, and Other Rapidly Developing Economies
A report by The Boston Consulting Group, March 2006

"Spurring Innovation Productivity"
Opportunities for Action in Industrial Goods, November 2005

"The New Economics of Global Advantage: Not Just Lower Costs but Higher Returns on Capital"
Opportunities for Action in Operations, July 2005

"Winning in Today's Chinese Automotive Market"
Opportunities for Action in the Automotive Industry, June 2005

"Globalizing R&D: Building a Pathway to Profits"
Opportunities for Action in Operations, May 2005

"Globalizing R&D: Knocking Down the Barriers"
Opportunities for Action in Operations, May 2005

"Avoiding Supply Chain Shipwrecks: Navigating Outsourcing's Rocky Shoals"
Opportunities for Action in Operations, March 2005

The Central and Eastern European Opportunity: Creating Global Advantage in Serving Western Europe
A Focus by The Boston Consulting Group, January 2005

Navigating the Five Currents of Globalization: How Leading Companies Are Capturing Global Advantage
A Focus by The Boston Consulting Group, January 2005

Capturing Global Advantage: How Leading Industrial Companies Are Transforming Their Industries by Sourcing and Selling in China, India, and Other Low-Cost Countries
A report by The Boston Consulting Group, April 2004

"What Is Globalization Doing to Your Business?"
Opportunities for Action in Industrial Goods, February 2004

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