United States General Accounting Office

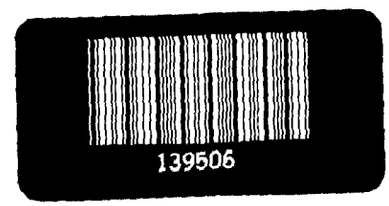
GAO

Report to the Honorable
Pete Wilson, U.S. Senate

July 1989

INTERNATIONAL TRADE

The Health of the U.S. Steel Industry



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GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-236037

July 12, 1989

The Honorable Pete Wilson
United States Senate

Dear Senator Wilson:

Title VIII of the Trade and Tariff Act of 1984 grants authority to the President to enforce the trade quotas currently protecting the U.S. steel industry. This provision is scheduled to expire on October 1, 1989, and the Congress is considering its extension. As you requested, this report provides data and analysis regarding the health of the industry and the quotas and other factors affecting it.

Background

Poor financial performance has long plagued the U.S. steel industry for a number of reasons. For several decades, the dependence of the U.S. economy on steel mill products has declined steadily and competition from domestic minimills and foreign producers has increased. Causes of the competitive problems include slow productivity growth brought on in part by slow implementation of new technologies and little effort at research and development, disproportionately high labor costs, global overcapacity, foreign subsidies, falling international shipping costs, air-pollution abatement costs, deterioration of the U.S. advantage in raw material costs, inland locations for many U.S. plants which increase the expense of importing high-quality iron ore from abroad, old integrated plants that are too small for efficient production using modern technologies, and an abundance of cheap steel scrap available for use by minimills.

Policies to protect the industry from import competition also have a long history. Tariffs existed prior to the 1960s at a time when imports, fair or otherwise, were negligible. Import quotas were negotiated in December 1968, and various quotas have been in effect for 12 1/2 of the 20 1/2 years since. Trigger-price mechanisms, in which imported steel sold below specified trigger prices was subjected to expedited antidumping investigations, were in effect for another 3 1/2 of those years.

In the early 1980s, the severe economy-wide recession resulted in major losses for the steel industry. As recovery began in 1983 and 1984, the substantial rise in the value of the dollar put U.S. producers at a competitive disadvantage, resulting in a surge of imports of steel (and other products). After conducting an investigation under Section 201 of the

Trade Act of 1974, as amended, the International Trade Commission concluded in 1984 that the U.S. steel industry was being harmed by this import surge and recommended a 5-year program of quotas and tariffs covering imports from all countries. Fairness of trade is not an issue in Section 201 cases. The purpose of this section is to provide temporary relief from import competition, whether fair or unfair. However, the industry had also filed many unfair trading cases against foreign producers.

Emphasizing his desire to avoid protectionism, the President rejected the Commission's recommendations on September 18, 1984 and set forth his own program aimed at countering unfair trade. He directed the U.S. Trade Representative to negotiate "surge control" arrangements with countries whose exports to the United States had increased significantly in recent years due to unfair trading practices. Title VIII of the Trade and Tariff Act of 1984 provided enforcement authority through October 1, 1989. The Trade Representative implemented his instructions by negotiating quotas on exports of steel to the United States. Unfair trading cases were withdrawn in accordance with provisions of these quota agreements. As of 1987, 29 countries supplying over two thirds of U.S. steel imports were covered by quota agreements.

Results in Brief

The primary cause of the loss of sales by the U.S. integrated steel producers has been declines, both long-term and cyclical, in domestic consumption of steel. According to one study, annual shipments by integrated and specialty steel producers declined from 1974 to 1985 by 44 million tons, of which 54.5 percent can be attributed to reduced U.S. consumption of steel, 18.2 percent to increased imports, 15.9 percent to increased shipments by minimills, and 11.4 percent to reduced exports.

The primary problem in the 1980s was the economy-wide recession, the effects of which were aggravated by the import surge that followed as a result of the high value of the dollar. Since 1985, the industry has regained competitiveness principally as a result of the substantial decline in the value of the dollar, improvements in labor productivity, and reductions and slower growth in wages and benefits. Consequently, the import surge has subsided and the import market-share goals set by the Congress and the President for the quota program have been met. Furthermore, the recovery of the U.S. economy from the recession has increased the demand for steel in the United States. As a result, the industry has returned to normal levels of profitability.

With the passing of the import surge, the effect of the quotas has declined substantially and the vast majority of them are now going unfilled. Thus, while expiration of the quotas might affect the market for a few individual steel products (particularly semifinished products), it would likely have little immediate effect on the market as a whole. Should the steel industry need protection from injury caused by subsidized or dumped imports, remedies are available under existing unfair-trade laws. The main effect of extending the quotas would be to protect the steel industry from possible future adverse exchange-rate changes or wage increases.

The Steel Industry in the U.S. Economy

The importance of the steel industry and its products to the U.S. economy has declined fairly steadily and very substantially over the past 40 years. The United States now consumes less than half as much steel per dollar of real gross national product as in 1950. The industry's share of total manufacturing employment is only one third of its share in that year, and its share of nonagricultural employment is less than one fifth its share in that year. Its share of the value added by all manufacturing is less than one third of what it was in 1958 (the earliest year for which we found data).

Not all of the industry has suffered seriously. The problems have been concentrated in the integrated-mill sector, which consists of the traditional steel firms with large operations that produce steel products from iron ore. The minimill sector, which consists of smaller-scale operations that produce new steel products from recycled steel scrap, has grown fairly consistently over the past 30 years. While production by integrated producers declined by 28.1 percent during the difficult years from 1980 to 1985, minimill production increased by 30.4 percent.

Import Competition

Though less important than declining demand, increasing import competition has been a problem for the U.S. steel industry. Several long-term factors contribute to this increased competition. The large amounts of labor required to produce steel make the industry's profitability sensitive to labor costs. Hence, low-wage developing countries have a competitive advantage over the industrialized countries. Furthermore, the wages and benefits in the U.S. steel industry are very high even after factoring out the high U.S. standard of living. After 1982, average hourly earnings (excluding benefits) in the industry declined some; however, in 1988 they were still over 38 percent higher than the average for all manufacturing, a higher margin than in any post-World War II year

prior to 1974 except for 1959. Including benefits raises the margin substantially (to 68 percent in 1987—the most recent year for which data is available).

Adding to the labor-cost advantage of developing-country steel industries is the growing demand for steel in developing countries that results from the process of development. Thus, it is not surprising that the steel industries of the United States, Japan, and the European Community are declining while those in developing countries are expanding. Still other factors, both positive and negative, affect the competitiveness of developing countries' steel industries. Some are inefficient; many receive subsidies and protection (as do the steel industries of many other countries). However, the pattern of growth and decline in the industry around the world is broadly consistent with what would be expected from considerations of labor cost and differences in growth of demand for steel.

The huge minimum efficient scale for modern integrated steel plants makes it likely that a developing country will be able to absorb only part of the output of a new plant, leaving the rest for export. Thus, considerations of labor cost, differences in growth of steel demand, and minimum efficient scale of steel plants suggest that developing countries may continue to build new plants and to export part of their output.

The U.S. steel industry's problem with imports has undoubtedly been exacerbated by its slow labor productivity growth over the years. The industry's labor productivity grew slowly relative to that of the rest of U.S. manufacturing for most of the post-World War II period, and little was done to improve it. The industry was slow to implement new technologies used in many foreign operations, such as the basic oxygen process and continuous casting; and in comparison to most other U.S. manufacturing industries, it invested little in research and development for most of the past three decades. Only since the early 1980s has the industry begun to recover lost ground.

Recession in the Early 1980s

The problems in the 1980s were cyclical, resulting primarily from the deep economy-wide recession. Sales of both domestically produced and imported steel are very sensitive to the business cycle and decline substantially during recessions. Accordingly, domestic-industry sales and imports generally fluctuate in the same direction rather than in opposite directions as would occur if imports were the industry's primary problem.

In the 16 years prior to the fourth quarter of 1981, only two quarters were unprofitable and no entire year was. Then declining demand for steel in the United States resulting from a severe recession began to cause losses. From the fourth quarter of 1981 through the fourth quarter of 1986, the industry lost money in 18 of the 21 quarters and 4 of the 5 years. Production and employment declined drastically. The industry hit bottom along with the rest of the economy in 1982. As it began to recover, imports began to surge, reaching a new high of 26.1 percent of the market in 1984.

The Import Surge and the Quotas

The most likely cause of the import surge was the rise in the value of the dollar against other currencies in conjunction with the recovery in U.S. steel consumption resulting from the general economic recovery. By one measure, the inflation-adjusted trade-weighted value of the dollar increased by over 35 percent from 1980 to 1985, making U.S. steel products that much more expensive relative to foreign products. At first, foreign products could not make much headway because the recession resulted in low demand for all steel, domestic and foreign. Then as the recovery began, both domestic sales and imports surged, and foreign producers were able to take advantage of the high dollar to gain market share.

At the peak of the import surge in 1984, the quota program was initiated to contain it. The quotas performed as intended, contributing to a slight decline in import market share in 1985. Since 1985, the value of the dollar has declined back below its level in 1980. As a result, the import surge has subsided, and the effect of the quotas has declined considerably. In 1985, quotas covering 79.2 percent of the total tonnage allowed under all of the quotas were completely filled and binding; in 1986, the figure dropped to 42.6 percent; and in 1987, it was only 28.4 percent. Preliminary data indicates the quotas were substantially less binding in 1988 than in 1987.

Import market share has declined every year since 1984, marking the longest string of consecutive declines since World War II. In 1988 it was down to 19.6 percent, which is below the levels in 1982 and 1983 when the surge first began.

Recovery of the Steel Industry

As a result primarily of the economy's recovery from the recession and secondarily of the declining share of imports in the U.S. market, the demand for U.S.-made steel products has increased considerably. Further, the U.S. steel industry has taken steps to reduce its costs. Consequently, the industry has recovered strongly, returning to historically normal levels of profits in 1987 and 1988.

The recovery in profits has been accompanied by a significant but less than complete recovery in production and almost no recovery in employment. Substantial further recovery in production and employment is unlikely because of retirement of excess capacity and improvements in labor productivity. Capability utilization in 1988 averaged 89.6 percent, its highest level in 14 years.[1] The length of the average workweek for production workers set new post-World War II highs in both 1987 and 1988, suggesting that the industry is trying to avoid employing more workers.

Though still suffering some ill effects, the major steel-producing states have adjusted to the reductions in production and employment in the industry. Civilian unemployment rates in these states have declined to levels near the national average, and per capita personal incomes have stabilized, though at somewhat lower levels, relative to the national average.

Objectives, Scope, and Methodology

To assess the health of the steel industry and the factors which affect it, we collected and analyzed data from a number of different sources, including the American Iron and Steel Institute, the International Iron and Steel Institute, the Office of Agreements Compliance at the Department of Commerce, the Bureau of Economic Analysis, the Bureau of the Census, the Department of Labor, and the National Science Foundation. We also reviewed analyses of the industry produced by the Brookings Institution, the American Iron and Steel Institute, the Congressional Research Service, and others. Because we did not audit the performance of any government agency or department, we did not obtain agency comments.

[1]Production capability is a concept used in the steel industry. It is defined as the tonnage capability to produce raw steel for a full order book based on the current availability of raw materials, fuels, and supplies, and on the industry's coke, iron, steel making, rolling, and finishing facilities. The capability utilization rate is production expressed as a percentage of production capability.

The data you requested and more detailed analysis are presented in the appendices to this report. The appendices are organized according to types of data, with the first covering financial data; the second covering operational data, such as production and employment; the third covering conditions in the steel market, such as prices, shipments, and imports; the fourth covering minimills; and the fifth covering the factors affecting imports, such as the quotas.

As agreed with your office, we plan no further distribution of this report until 30 days after its issuance date unless you release its contents earlier. At that time, we will provide copies to executive agencies, congressional committees, and other interested parties.

Major contributors to this report were Bruce G. Arnold, Project Manager and Economist, and James McDermott, Assistant Director. I can be reached at (202) 275-4812 if you need any additional information.

Sincerely,

Allan I. Mendelowitz

Allan I. Mendelowitz, Director
Trade, Energy, and Finance Issues

Contents

Figures

Abbreviations

EC	European Community
ITC	International Trade Commission
GAO	General Accounting Office
GNP	Gross National Product
NSF	National Science Foundation
PPP	Purchasing Power Parity
R&D	Research and Development
USTR	United States Trade Representative
VRA	Voluntary Restraint Agreement

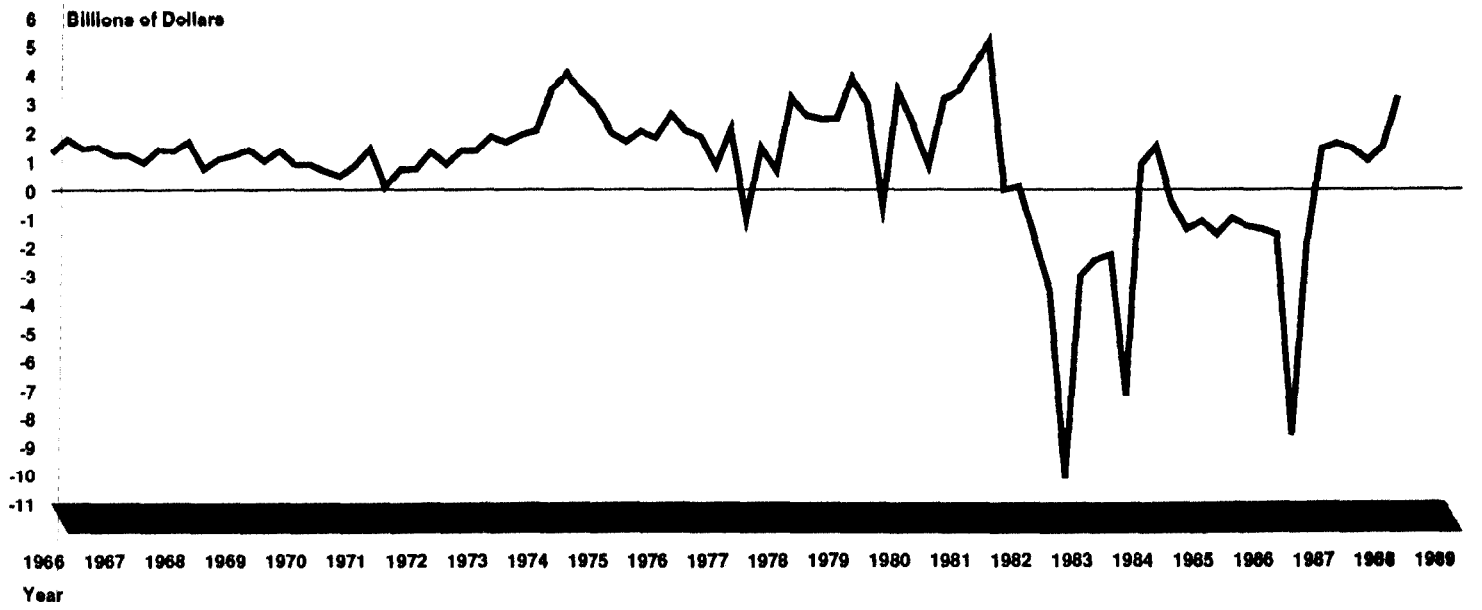
All data source abbreviations are defined in appendix VI

The Financial Health of the Industry

For over two decades the steel industry has earned lower rates of return on assets than has the rest of manufacturing. However, the industry was profitable every year until 1982. Then from 1982 to 1986 it suffered severe losses. After 1986, the industry's rate of return on assets returned to historical levels and has since remained there. Stockholders' equity has started growing again, and inventories are at low levels relative to shipments.

Figure I.1A illustrates the changing fortunes of the steel industry in recent years. In the 16 years leading up to the fourth quarter of 1981 (1981.Q4), only two quarters were unprofitable and no entire year was. Then from 1981.Q4 to 1986.Q4, the industry lost money in 18 of the 21 quarters and 4 of the 5 years. Since then the industry has made a dramatic recovery, returning to normal levels of profits in 1987 and 1988.[1]

Figure I.1A: Annualized Net Income After Taxes: Steel Industry



Source: QFR.[a]

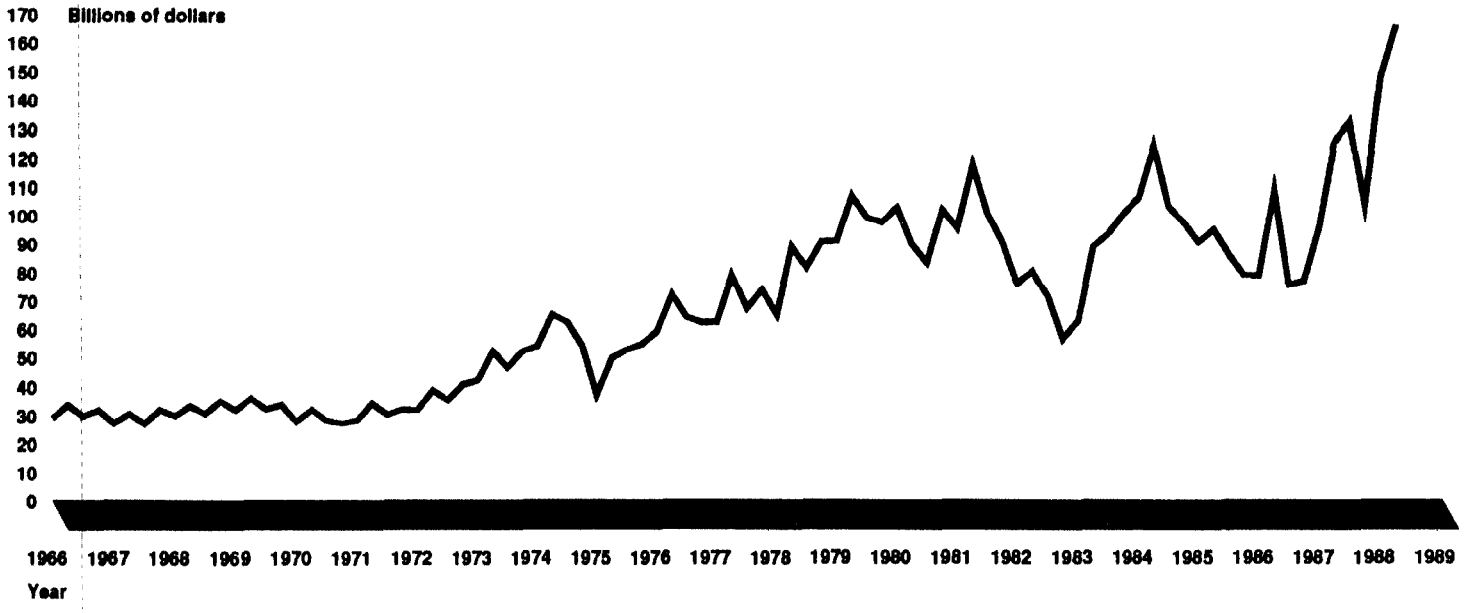
Steel Industry Definition: SIC 331-332.[a]

[a]In these appendices, abbreviations are used for data sources and industry classifications. Details on the sources, classifications, and abbreviations are provided in appendices VI and VII.

[1]Financial data for U.S. corporations, such as that used here, may be somewhat affected by changes in and problems related to the accounting for pensions in corporate financial statements.

Figure I.1B indicates that troubles in the period from 1981.Q3 to 1986.Q4 were not unique to the steel industry. Manufacturing as a whole suffered in a similar though less severe fashion. Like the profits of the steel industry, the profits from all manufacturing reached a peak in 1981.Q2, declined dramatically to a trough in 1982.Q4, recovered dramatically but briefly to a peak in 1984.Q2, dropped again substantially to a trough in 1986.Q3, and recovered in the years since except for a brief drop in 1987.Q4. Data on sales shows a similar parallel between the steel industry and manufacturing as a whole, with the steel industry again suffering more severely. These similarities suggest that the primary cause of the steel industry's problems in the early 1980s was the general economic recession that plagued the entire economy.

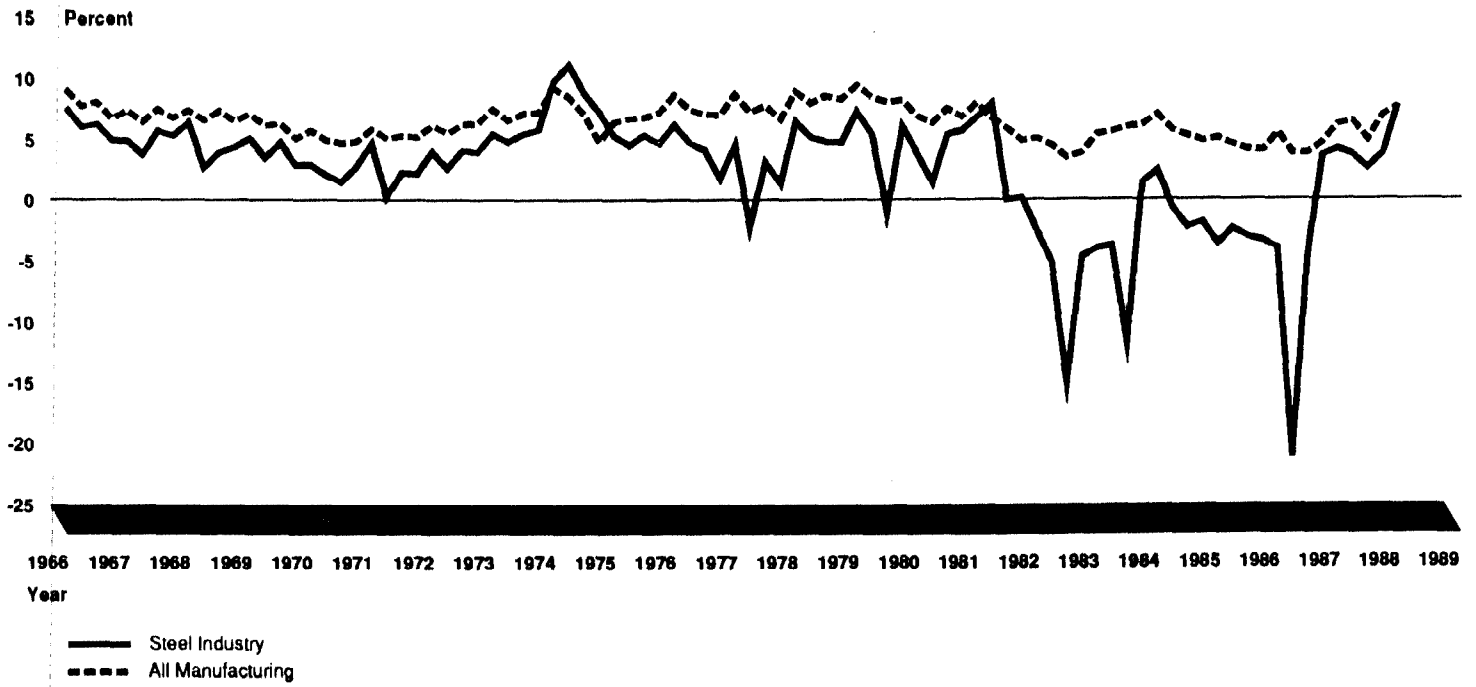
Figure I.1B: Annualized Net Income After Taxes: All Manufacturing



Source: QFR.
Steel Industry Definition: SIC 331-332.

In addition to its severe short-term problems in recent years, the steel industry has for many years experienced other problems that are substantially less severe but chronic. Figure I.2 indicates that the industry has consistently earned a lower rate of return on total assets than has manufacturing as a whole over the last 22 1/2 years.[2] In only six quarters did the industry's rate of return equal or exceed that for all manufacturing.

Figure I.2: Annualized Rate of Return on Total Assets

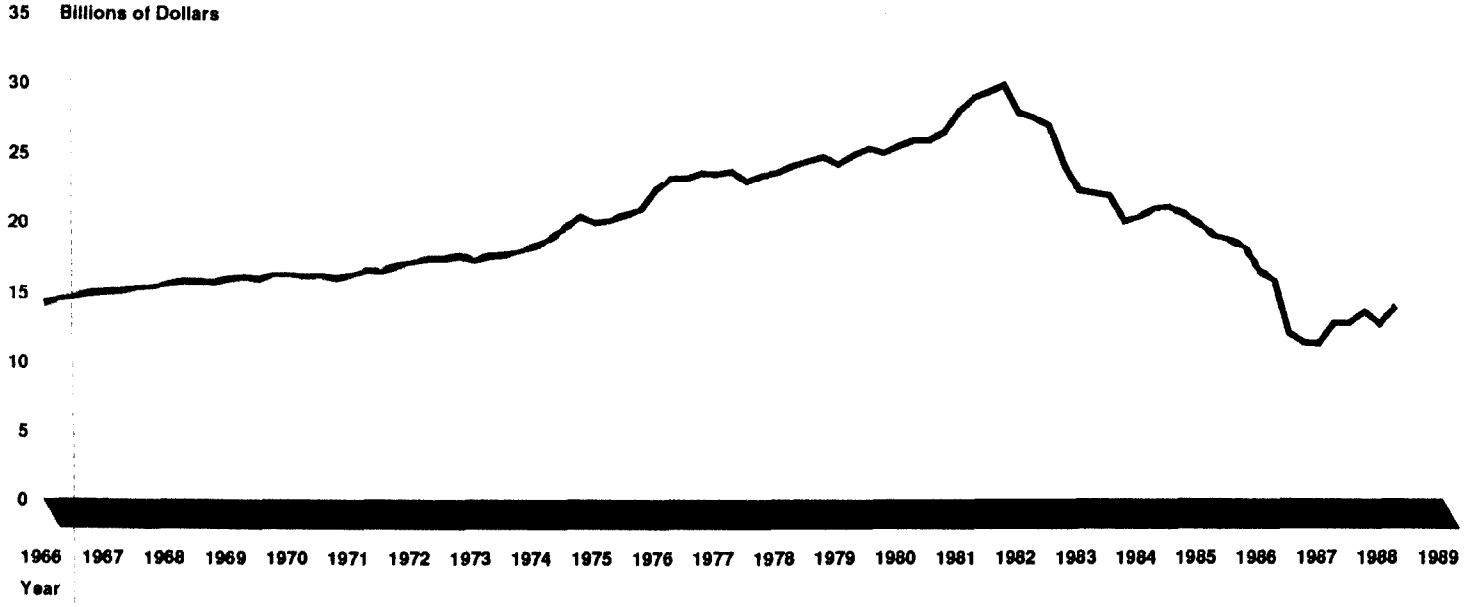


Source: QFR.
Steel Industry Definition: SIC 331-332.

[2]For rate of return on total assets we used after-tax net profits expressed as a percentage of total assets. This same procedure is used in the Quarterly Financial Report ... from which we obtained the data. Some studies use after-tax net profits plus interest expense (adjusted for the tax deduction for interest expense) expressed as a percentage of total assets. The latter option was not available to us because of lack of data. The choice should not affect our conclusions.

The industry's losses in the 1980s took a substantial toll on stockholders' equity, but that too has begun to recover. Figure I.3 shows that equity dropped by over 60 percent from its peak in 1981.Q4 to its trough in 1987.Q1. The recovery since then, though small in comparison to the decline, has been significant in comparison to the newly diminished equity values. By 1988.Q2, equity was over 20 percent higher than its 1987 trough value.

Figure I.3: Stockholders' Equity in the Steel Industry



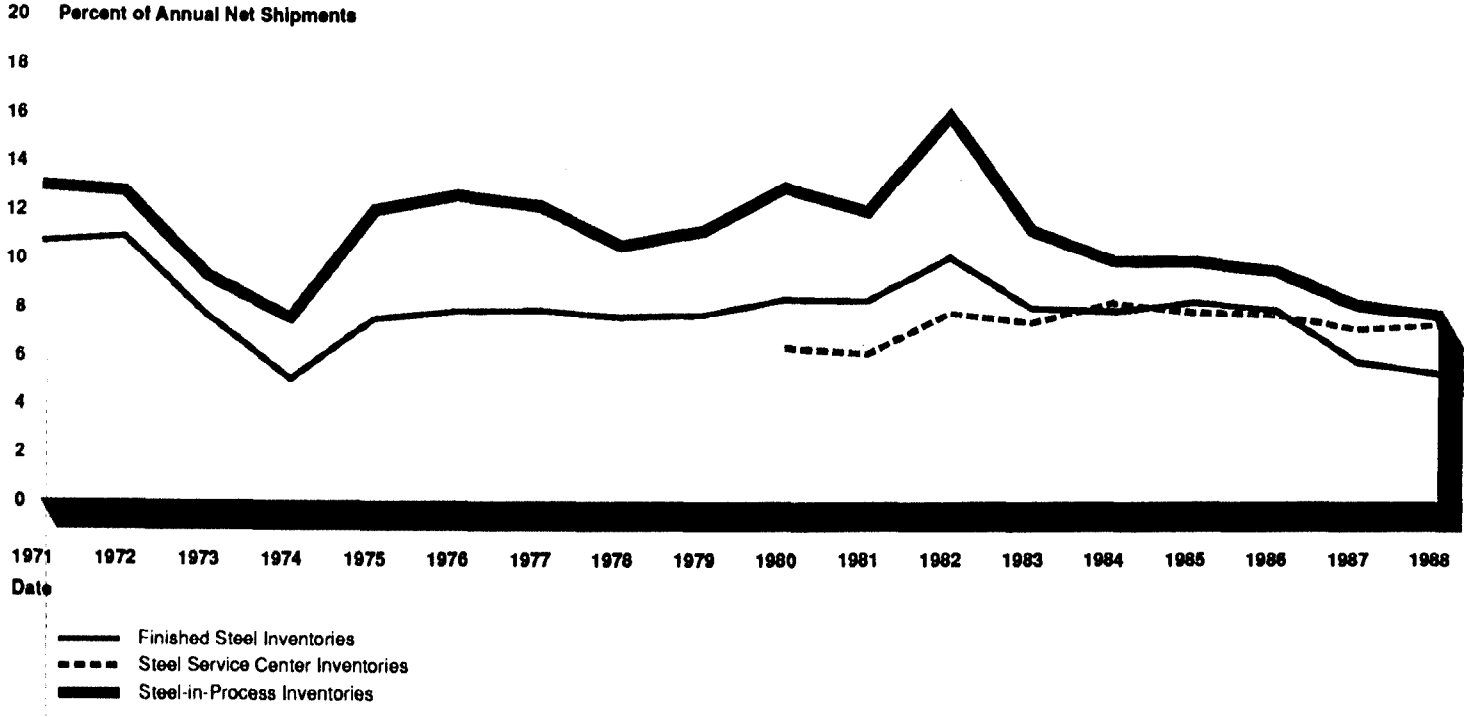
Source: QFR.

Steel Industry Definition: SIC 331-332.

In 1985.Q1, QFR made a substantial revision in the firms included in the steel industry. This revision resulted in a substantial artificial drop in the stockholders' equity series. We have adjusted the data for 1985 and later years to remove this drop and thereby provide for better comparability with the rest of the data.

In addition to the industry's current well-being, it is important to examine its vulnerability to a downturn in demand. The ratio of debt to equity, which was only slightly above that for all manufacturing in 1982, rose substantially up through 1986 and has since declined slightly. A high ratio could make it more difficult for a firm to obtain financing for investment. It also makes a firm's income more sensitive to sales fluctuations. The ratio of current assets to current liabilities, which had declined from above that for all manufacturing in the early 1980s to below it in the mid-1980s, rose back above it in late 1987 and 1988. This rise suggests that the risk of bankruptcy in the industry has declined since the mid-1980s. Figure I.4 indicates that the industry does not have excessive inventories that would cause problems in the event of an economic downturn. The ratios of finished-steel and steel-in-process inventories to net shipments were at or below their 1988 levels in only 1 of the previous 17 years. Consistent data on steel-service-center (warehouse) inventories extends back only to 1980, but it indicates that the ratio of these inventories to (manufacturers') net shipments has declined over the past 4 years.

Figure I.4: Ratios of Inventories to Manufacturers' Net Shipments



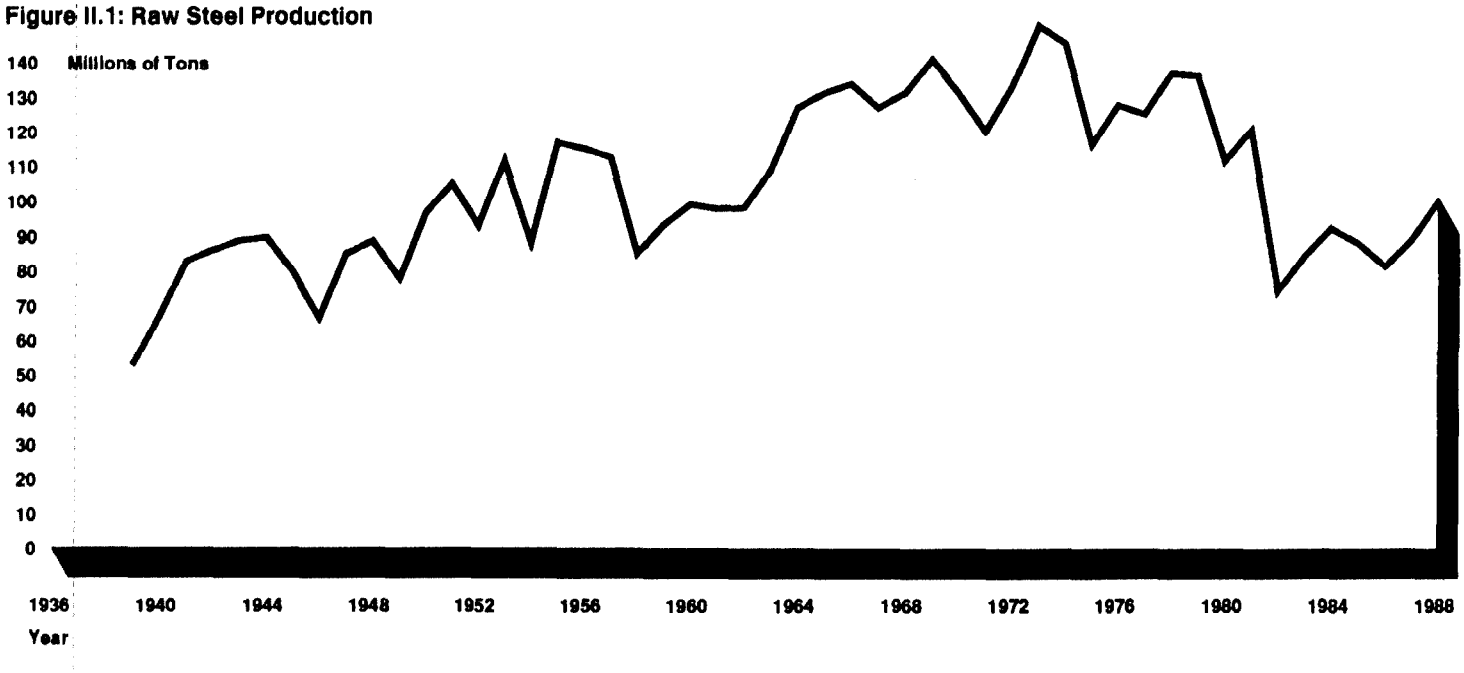
Source: GAO calculations based on data from CIR2 and CIR3.
Steel Industry Definition: SIC 33122, 33123, 33124, 33125, 33126, 33127, 33128, 3312C, 33155, 33167, 33168, 33176.

Steel Industry Operations

Corresponding to the steel industry's large decline in profits in the 1980s, there were large declines in production and employment. With the recovery in profits has come a significant but less than complete recovery in production and almost no recovery in employment. Because of the industry's elimination of excess capacity, there is little likelihood of substantial further recovery in production and employment. Though still suffering some adverse effects, the major steel-producing states have largely adjusted to the reductions in production and employment in the industry. Analysis of the steel industry over the long term shows that the importance of the industry to the U.S. economy in terms of employment and value added has fairly steadily eroded for several decades and that the cumulative erosion is substantial.

Raw steel production declined by over 45 percent from its peak in 1978 to its trough in 1982, with almost three fourths of that decline occurring between 1981 and 1982 (see fig. II.1). Production in 1982 was at its lowest level since 1946. By 1988, a little over one half of the 1981-82 decline had been erased—significant, but far from a complete recovery.

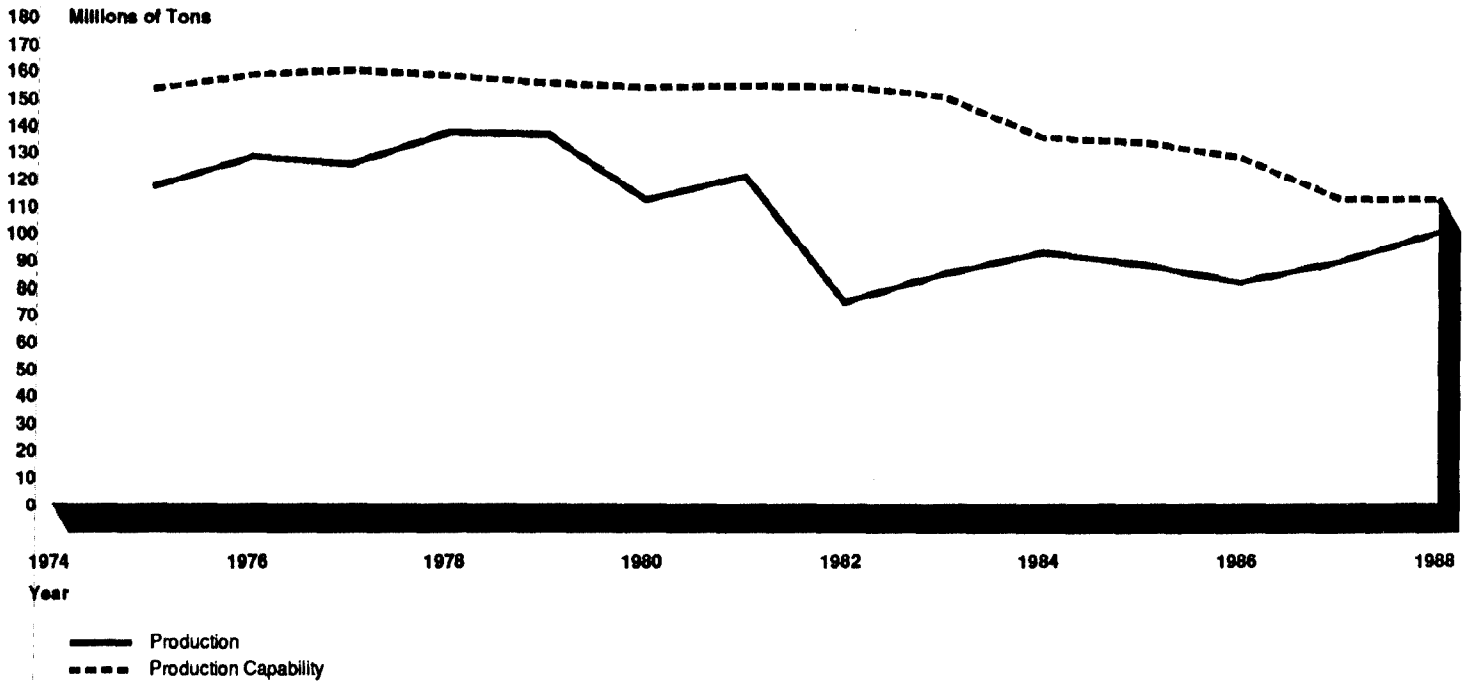
Figure II.1: Raw Steel Production



Source: AISI directly and AISI as reported in BS and CBS.

The industry has effectively foreclosed a return to previous higher levels of production by eliminating excess capacity. Figure II.2A indicates that from 1982 to 1988 the industry retired 42 million tons, or over 25 percent, of its raw steel production capability.[1] As a result, even though there has been only a partial recovery in production, the capability utilization rate in 1988 stood at 89.2 percent, its highest level in the 14-year period for which data is available (see fig. II.2B).

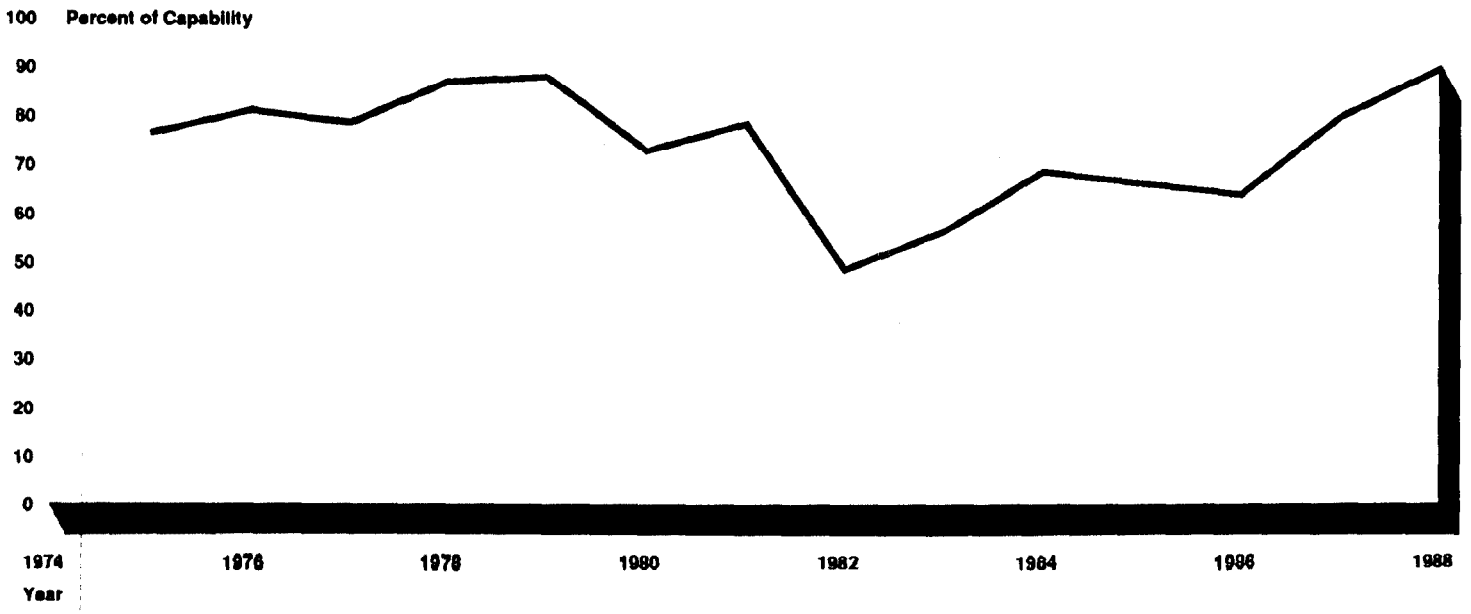
Figure II.2A: Steel Production and Production Capability



Source: AISI directly and AISI as reported in BS and CBS.

[1]Production capability is a concept used in the steel industry. It is defined as the tonnage capability to produce raw steel for a full order book based on the current availability of raw materials, fuels, and supplies, and on the industry's coke, iron, steel making, rolling, and finishing facilities. The capability utilization rate is production expressed as a percentage of production capability.

Figure II.2B: Steel Capability Utilization



Source: AISI directly and AISI as reported in BS and CBS.

It is possible for figures such as shipments, production, and sales to be misleading indicators of the amount of economic activity in an industry. The reason is that most industries purchase intermediate goods and raw materials that have already been processed to one degree or another and then further process them into output. If an industry maintains the same levels of shipments, production, and sales but starts purchasing raw materials at a more advanced stage of processing, then less processing is needed to produce output. Hence, economic activity within the industry declines even though sales, shipments, and production do not. This situation may be particularly relevant for the steel industry because recent years have seen an increase in the fraction of steel produced by minimills, which produce all of their steel from recycled steel scrap.[2]

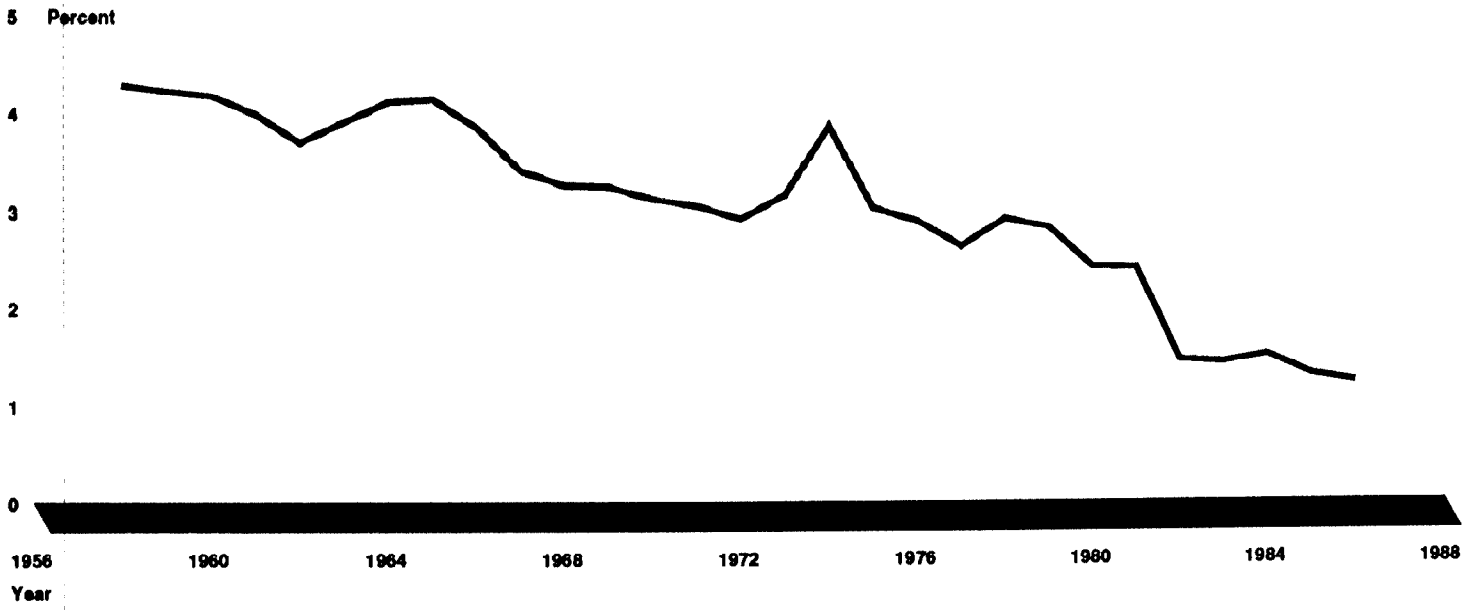
In recognition of this measurement problem, the Bureau of the Census publishes data on value added. Value added is determined by subtracting the value of intermediate goods and raw materials from the

[2]Minimills are discussed in more detail in appendix IV.

value of shipments. This data clearly shows the severe problems that beset the industry in 1982. Unfortunately, the most recent year for which the data is available is 1986, which predates the recovery indicated by the other data we analyzed.

The importance of the steel industry to the U.S. economy as measured by value added has declined fairly steadily and substantially over the past three decades. In 1986 the steel industry accounted for only 1.2 percent of total manufacturing value added, whereas in 1958 it had accounted for 4.3 percent—3 1/2 times its 1986 share (see fig. II.3).

Figure II.3: Value Added by the Steel Industry as a Percentage of Value Added by All Manufacturing



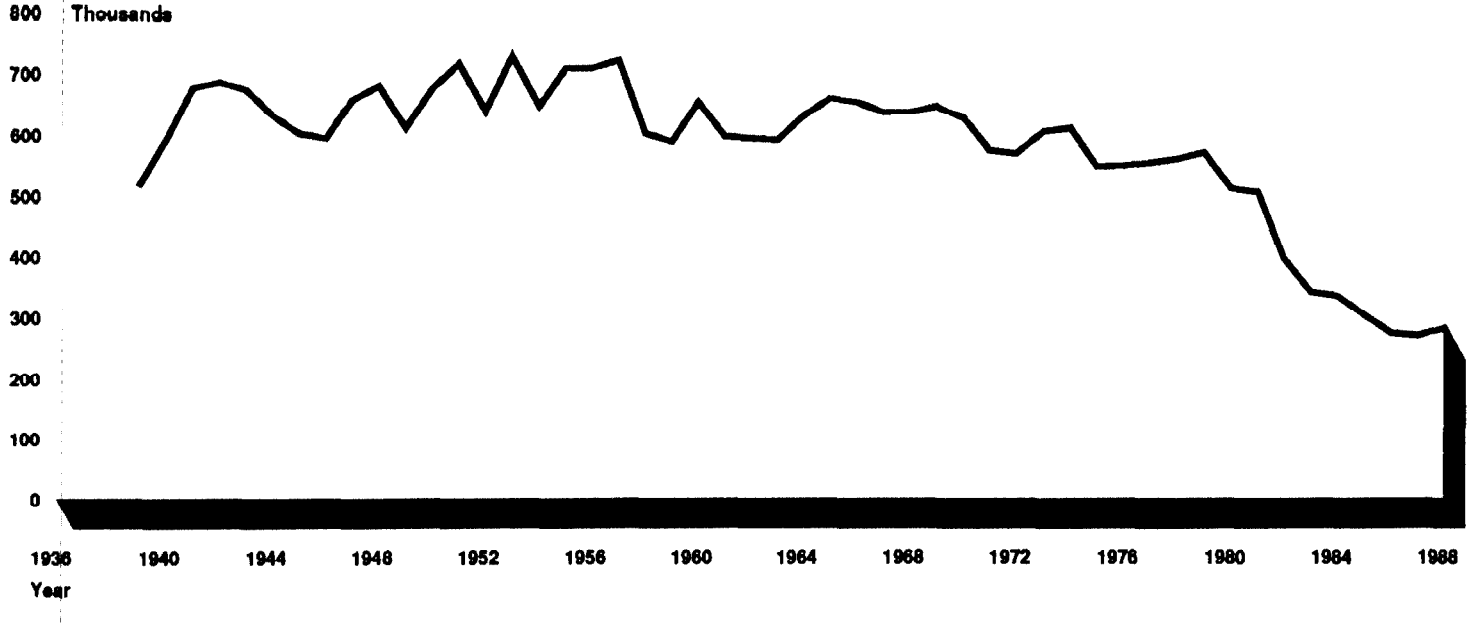
Source: GAO calculations based on data from ASM and CM.
Steel Industry Definition: SIC 3312.

Figure II.4 shows a rather sudden and precipitous drop in employment in the steel industry throughout the first half of the 1980s. From 1979 to 1987, employment fell from 570,500 to 269,400 —a 52.8 percent decline. In 1988, employment rose again for the first time since 1979, indicating at least a temporary stabilization; however, the rise was very

small in comparison to the drop over the previous 8 years. A return to previous levels of employment is highly unlikely since, as previously discussed, the industry is already operating at a historically high capability-utilization rate. The substantial recovery in production without much recovery in employment results at least in part from improvements in labor productivity.

In addition to the precipitous drop since 1979, figure II.4 also indicates that even prior to 1979 industry employment had been fluctuating about a declining trend since 1957. This observation is consistent with the observation from the financial data in appendix I that, in addition to the temporary problems of the 1980s, the industry has been experiencing less severe but chronic low profitability for at least 22 1/2 years. This employment data suggests that the industry's problems may extend back over 30 years.

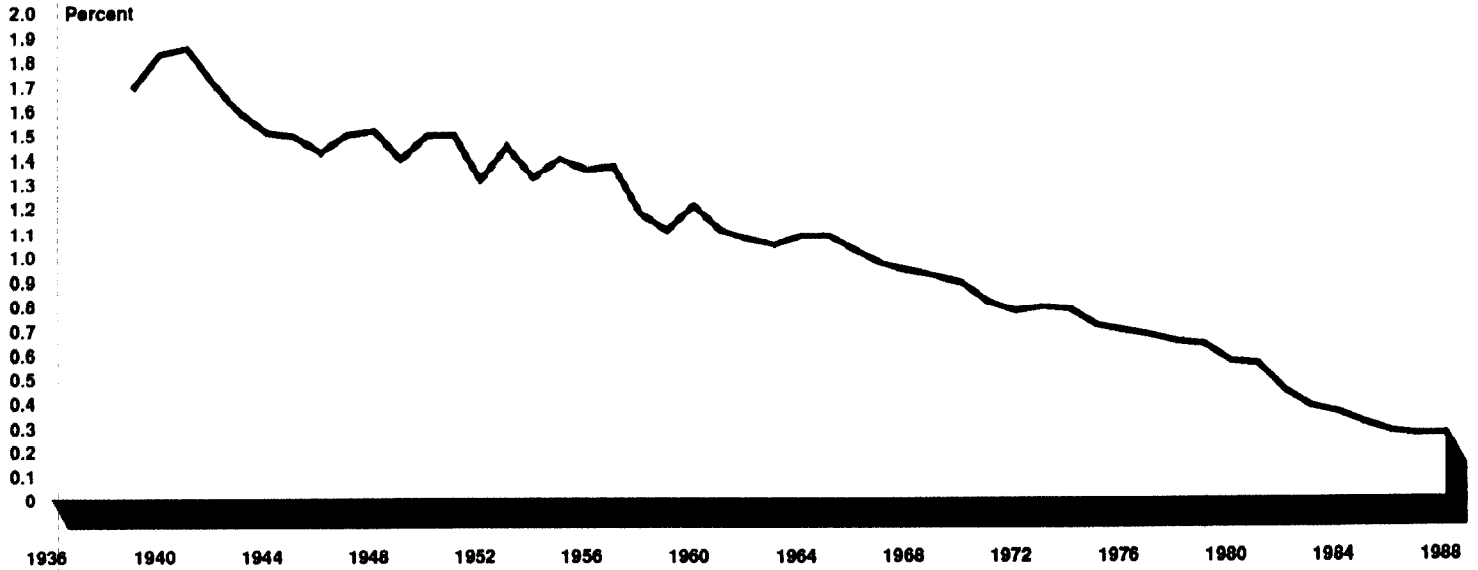
Figure II.4: Employment in the Steel Industry



Source: EHE and MLR.
Steel Industry Definition: SIC 331.

Figure II.5 reinforces the conclusion from the value-added data about the declining importance of the steel industry and extends the decline back another 17 years. It indicates that even before industry employment began declining absolutely after 1957, it had been declining fairly steadily as a share of total nonagricultural employment at least since 1941. Furthermore, the rate of this decline appears not to have increased significantly in 1957; and the decline after 1979, though a bit faster, looks more like a continuation of the long-term trend than like the previously noted sudden and precipitous decline in absolute numbers of employees.

Figure II.5: Steel Employment as a Percentage of Total Nonagricultural Employment



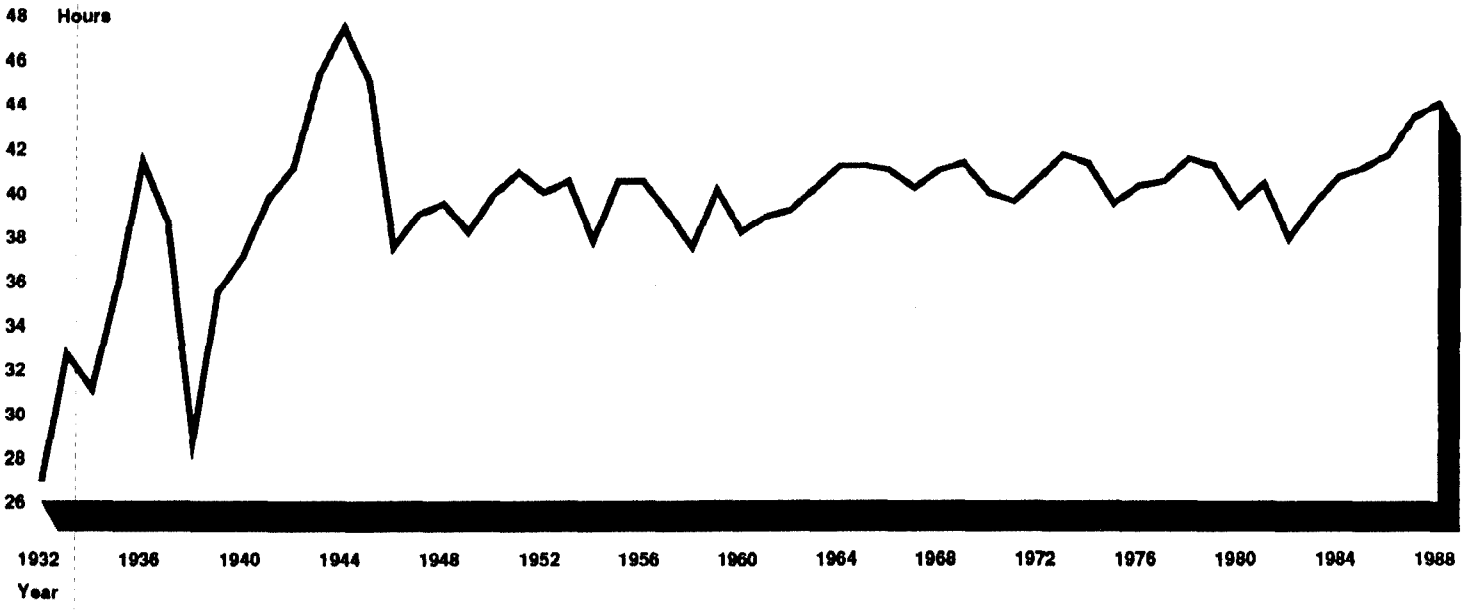
Source: GAO calculations based on data from EHE and MLR.
Steel Industry Definition: SIC 331.

The cumulative result of this declining trend over 47 years is very substantial. Whereas 1 in every 54 nonagricultural employees worked for the steel industry in 1941, only 1 in every 377 did in 1988. Thus, the industry's share of nonagricultural employment dropped by a factor of almost 7. This decline is not merely a reflection of the increasing importance of the service sector relative to manufacturing industries such as

steel. The steel industry's share of manufacturing employment also declined fairly steadily and substantially—from a peak of 5.4 percent in 1940 to 1.4 percent in 1988.

One bright spot in the employment picture is that the workweek is at historically high levels. The average number of hours worked per week by production workers in the steel industry in 1988 was 43.9—its highest level since World War II (see fig. II.6). The next highest level was in 1987. This data suggests that the industry may be trying to hold down employment, presumably out of fear that the current recovery is only temporary. If so, as the recovery continues the industry may become more confident and reduce overtime and increase employment.

Figure II.6: Average Workweek of Steel Production Workers



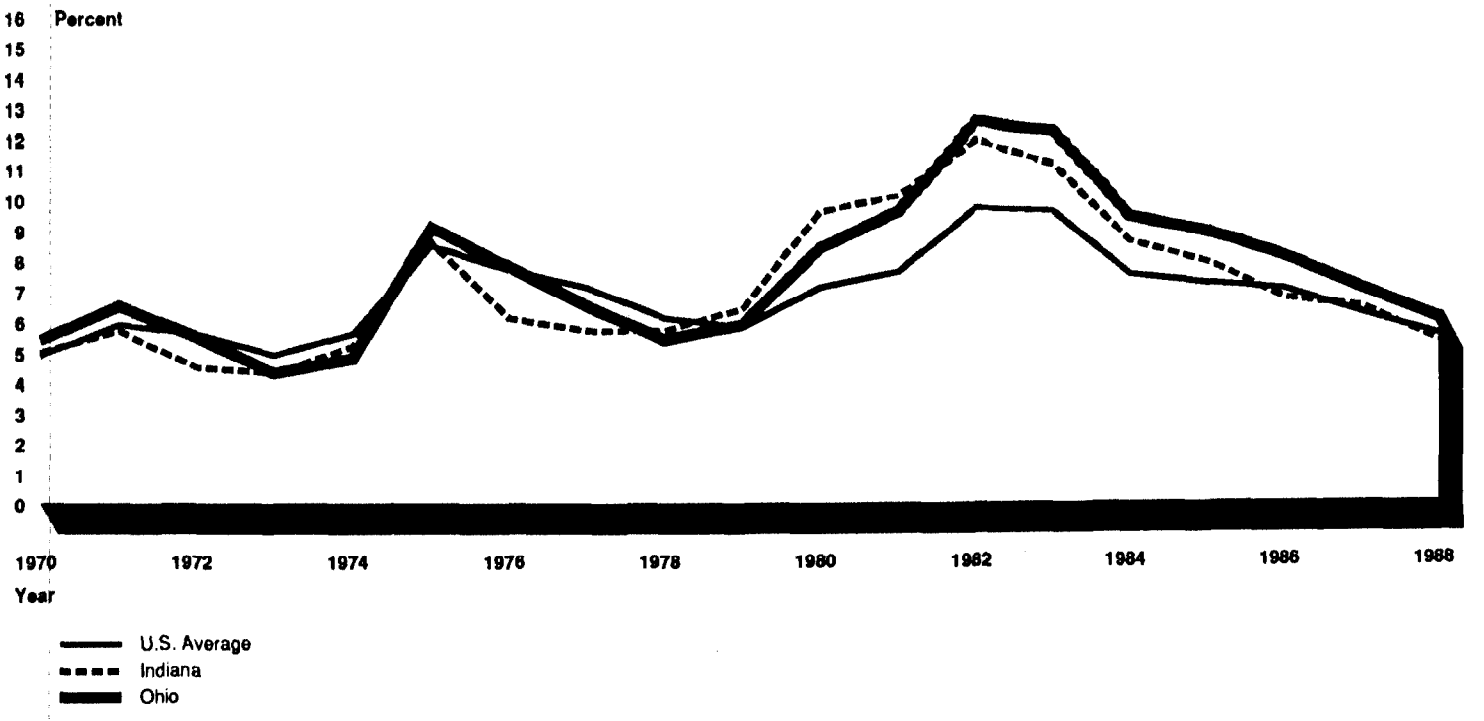
Source: EHE and MLR.
Steel Industry Definition: SIC 331.

Such large declines in production and employment as were experienced by the steel industry in the 1980s can have substantial negative effects on the economies of states in which the industry is concentrated. The

five states that produced the most raw steel in 1987, in order from most to least production, were Indiana, Ohio, Pennsylvania, Michigan, and Illinois. Together these states accounted for over two thirds of all raw steel produced in the United States that year.

The civilian unemployment rates for these states have declined substantially from the peak levels reached during the decline of the industry. Figures II.7A and II.7B show that all five states had unemployment rates above the national average from 1980 through 1985. In Michigan, where the problems in the steel industry came on the heels of problems in the automobile industry, the rate reached 15.5 percent in 1982—5.8

Figure II.7A: Civilian Unemployment Rates



Source: BLS.

percentage points above the national average. However, by 1988 Indiana and Pennsylvania had rates below the national average, and Ohio's rate was only half a point above. Only Illinois and Michigan still had rates more than one point above the average, and even their rates had dropped substantially. Michigan's unemployment rate in 1988 was less than half what it was in 1982. These numbers do not include unemployed workers who have become discouraged and quit looking for jobs. The number of such workers generally increases during bad economic times and decreases in more prosperous times.

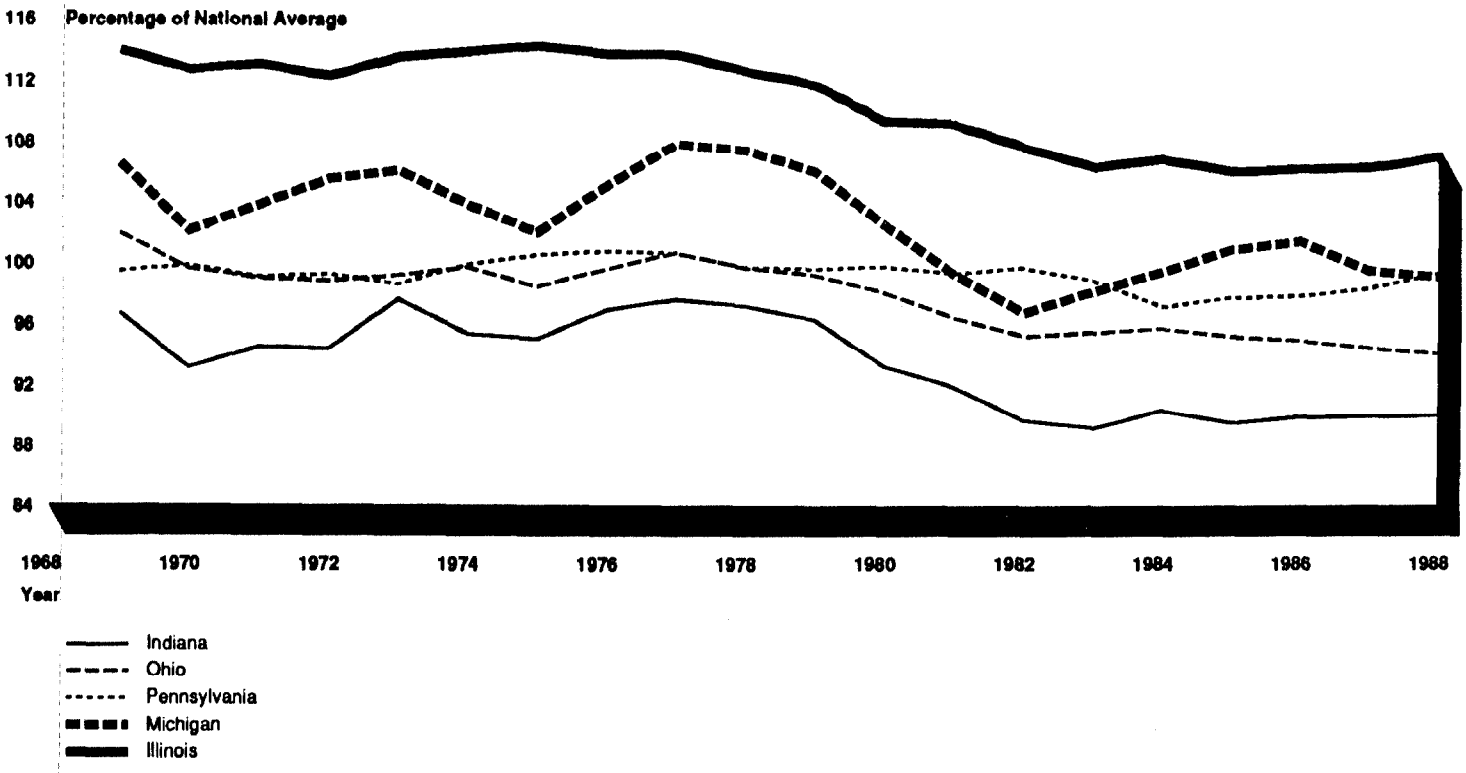
Figure II.7B: Civilian Unemployment Rates

Source: BLS.

The peak unemployment rates in these states and the worst years for the steel industry occurred in the same years as the peak unemployment rates for the country as a whole, 1982 and 1983. This fact reinforces the conclusion that a major part of the industry's problem during the early 1980s was the general recession in the economy.

Another indicator of economic well-being is per capita personal income. Figure II.8 shows that per capita personal income in all of the steel states except Pennsylvania declined relative to the national average from 1977 through 1982, but then roughly stabilized. Pennsylvania's deviated little over the entire 20 years shown. In considering these numbers, it should be noted that the decline in the steel industry is not the only thing affecting the relative incomes in these states. Farming, another industry with recent troubles, is important in several of these states; and as mentioned earlier, the problems of the automobile industry affect the numbers for Michigan. It should also be noted that the declines that are plotted are all relative to the national average, which itself was increasing; the figure does not measure absolute declines.

Figure II.8: State Per Capita Personal Incomes as Percentages of the National Average



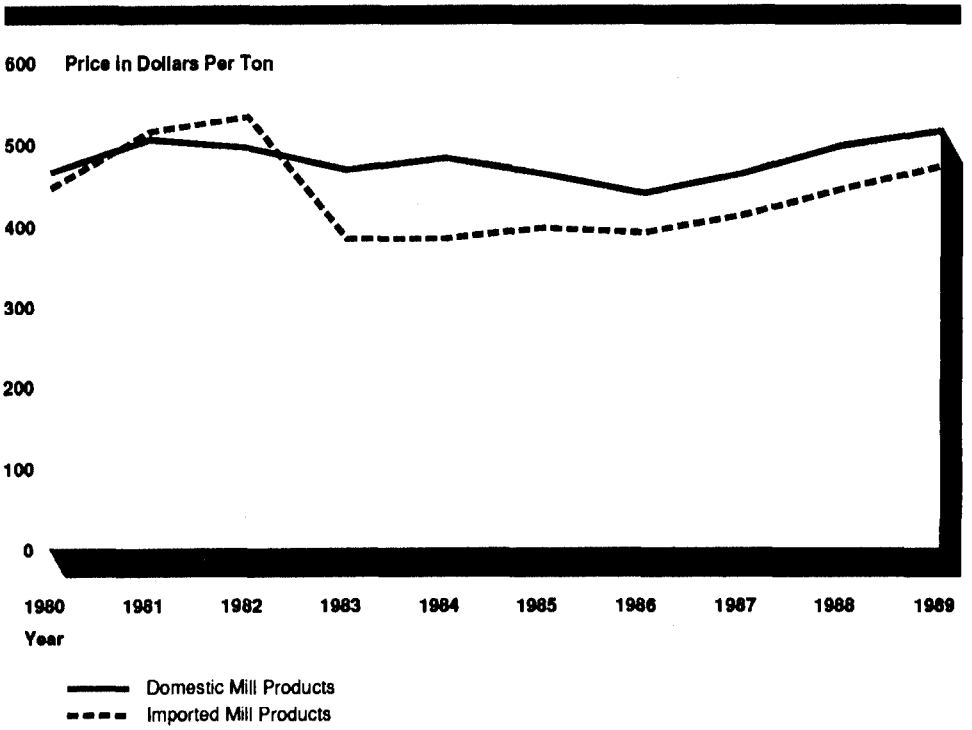
Source: GAO calculations based on data from the August 1987, April 1988, and October 1988 issues of SCB.
The numbers for 1988 are GAO projections based on 1st and 2nd quarter data.

Conditions in the U.S. Steel Market

The primary cause of the steel industry's problems both in the 1980s and over the long term has been declining domestic demand for steel. In the 1980s, demand declined as a result of the severe domestic recession. The economy has since recovered, and with it so have steel prices and demand for steel. Over the long term, the importance of steel products to the U.S. economy, as measured by domestic consumption of steel per dollar of real gross national product (GNP), has been declining for over 35 years. Though less important than declining domestic demand, increasing imports have also been a problem for the steel industry. Steel imports peaked as a share of the market in 1984 and have declined every year since then, marking the longest consecutive string of declines in post-WWII history.

As shown by figure III.1A, both domestic and imported steel prices in the United States have been rising since 1986. In 1988.Q2 the WEFA Group, which produces economic forecasts, predicted this rise to continue in 1989. Imported products experienced their lowest prices in 1983 and 1984.

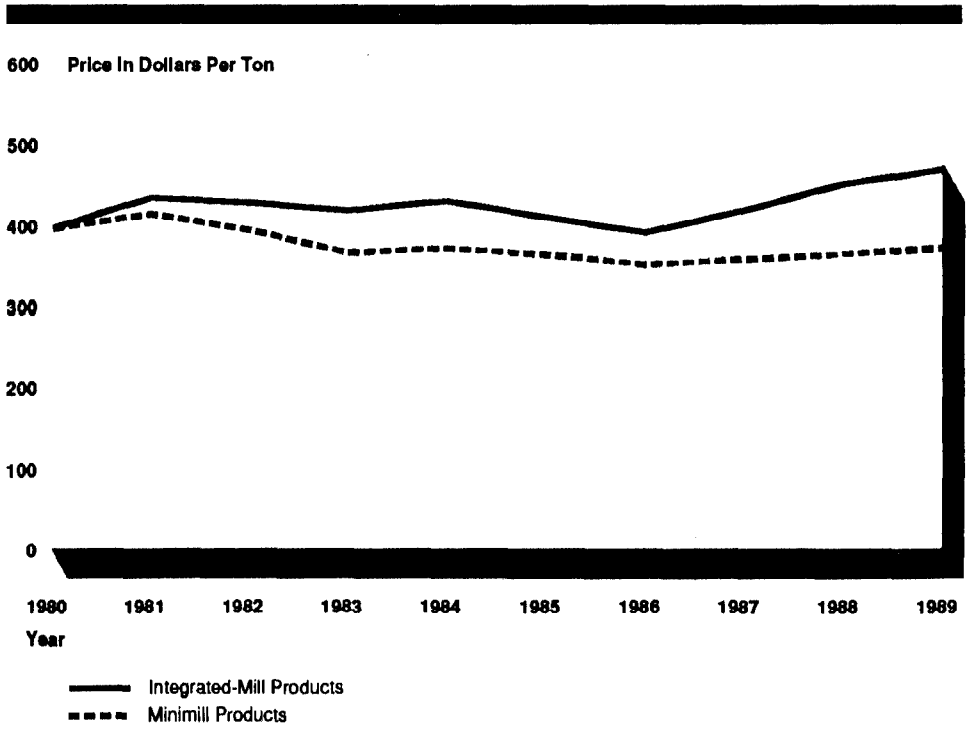
Figure III.1A: Composite Steel Prices



Source: WEFA.
Prices for 1988 and 1989 are projections made by WEFA in 1988.Q2.

The breakdown of domestic mill product prices by type of mill suggests that there is more to the problems of domestic steel producers than merely import competition. Imports exert pressure on the domestic industry by reducing prices and taking away market share. Figure III.1B indicates that since 1980 steel price movements have generally been more favorable to producers of integrated-mill products than to producers of minimill products; yet, minimills have generally outperformed integrated mills (see appendix IV). Thus, simple arguments based on product prices alone cannot explain the problems in the industry.

Figure III.1B: Domestically Produced Steel Prices

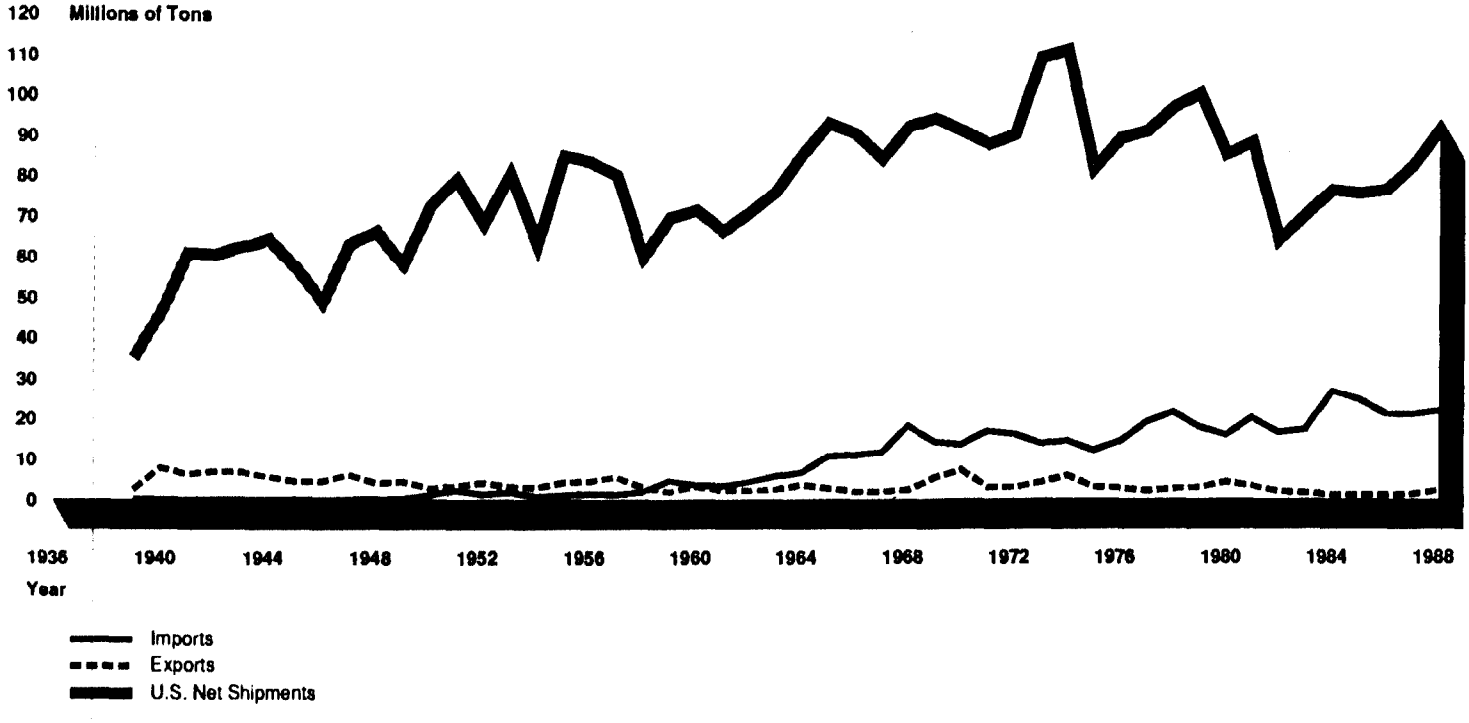


Source: WEFA.
Integrated-Mill Products: flat rolled, plate, heavy structurals, cold-finished bar, welded tubing, tin mill.
Minimill Products: carbon hot-rolled bar, light shapes, rebar, cold-finished bar.
Prices for 1988 and 1989 are projections made by WEFA in 1988.Q2.

Breakdown of domestic mill product prices by type of steel indicates that the price rise since 1986 has occurred for each of the three basic kinds of steel: carbon, alloy, and stainless. More detailed breakdowns by product indicate that the prices of almost all steel products have risen in the last 2 years.

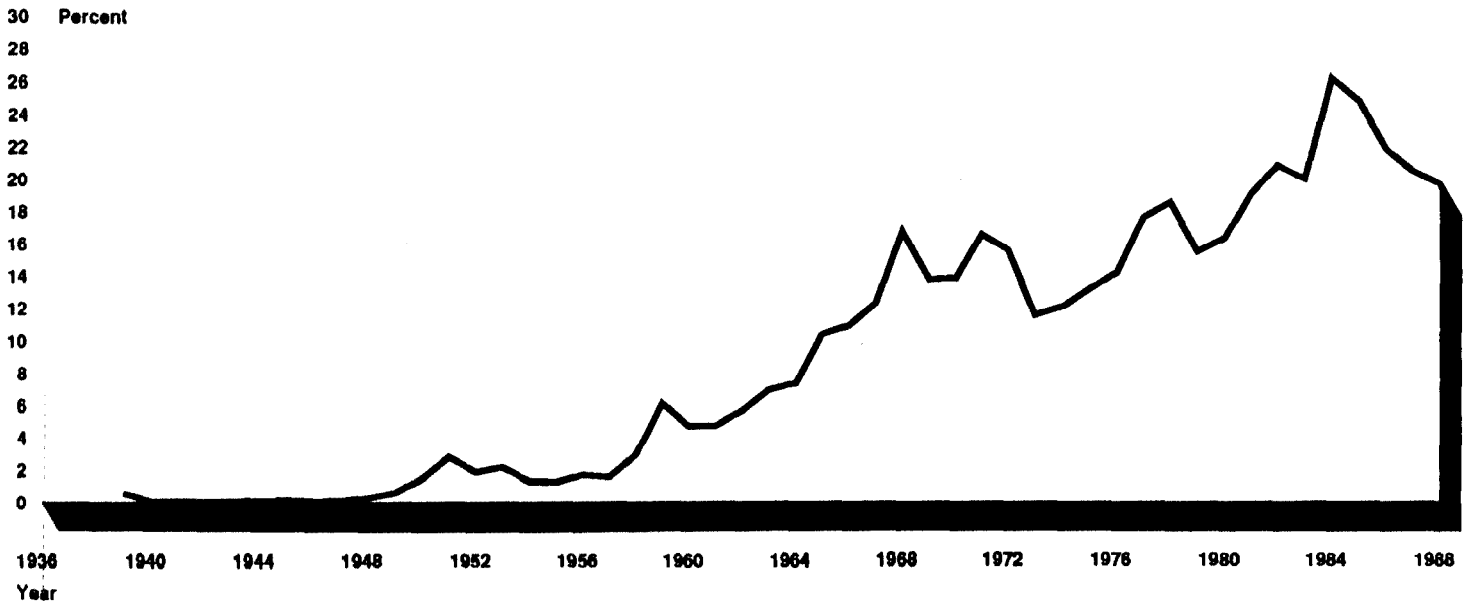
Figures III.2 and III.3 provide further strong evidence that international trade in steel, whether fair or unfair, has not been the primary cause of the U.S. industry's problems. Exports in particular are insignificant and have been for a long time. They have constituted less than 4 percent of U.S. net shipments in most of the last 30 years, and less than 5 percent in most of the last 40 years. Thus, changes in exports over time could not have had much effect on the industry.

Figure III.2: The U.S. Steel Market



For 1988:
Source: GAO estimates based on 1987 and 1988 data from ITCM and 1987 data from CIR3.
Steel Industry Definition: Same as for 1971-1987.
For 1971-1987:
Source: CIR3.
Steel Industry Definition: SIC 33122, 33123, 33124, 33125, 33126, 33127, 33128, 3312C, 33155, 33167, 33168, 33176.
For 1939-1970:
Source: AISI as reported in BS.
Steel Industry Definition: Primarily 3312.

Figure III.3: Share of Imports in the U.S. Steel Market (Imports as a Percentage of Apparent Consumption)



For 1988:
Source: GAO estimate based on 1987 and 1988 data from ITCM and 1987 data from CIR3.
Steel Industry Definition: Same as for 1971-1987.
For 1971-1987:
Source: GAO calculations based on data from CIR3.
Steel Industry Definition: SIC 33122, 33123, 33124, 33125, 33126, 33127, 33128, 3312C, 33155, 33167, 33168, 33176.
For 1939-1970:
Source: GAO calculations based on data from AISI as reported in BS.
Steel Industry Definition: Primarily 3312.

Figure III.2 clearly indicates that short-term (on the order of 5 years) fluctuations in imports over time have not been the principal cause of the observed short-run fluctuations in net shipments of U.S. producers. The fluctuations in imports have been substantially smaller than the fluctuations in net shipments. Further, temporary surges in imports generally have not occurred at the same time as troughs in net shipments; rather they have occurred 1 or 2 years later as net shipments were recovering. This last observation is true in particular for the industry's most recent troubles. The trough in net shipments occurred in 1982, which was the same year as a small trough in imports. Imports did not

surge to a peak until 2 years later, when net shipments were making a significant comeback. Then in 1985 and 1986, both net shipments and imports languished. In 1987, net shipments resumed their climb, followed by imports in 1988. Thus, in the short run, imports and domestic shipments appear to fluctuate more together in response to some other cause than in opposite directions in response to each other.

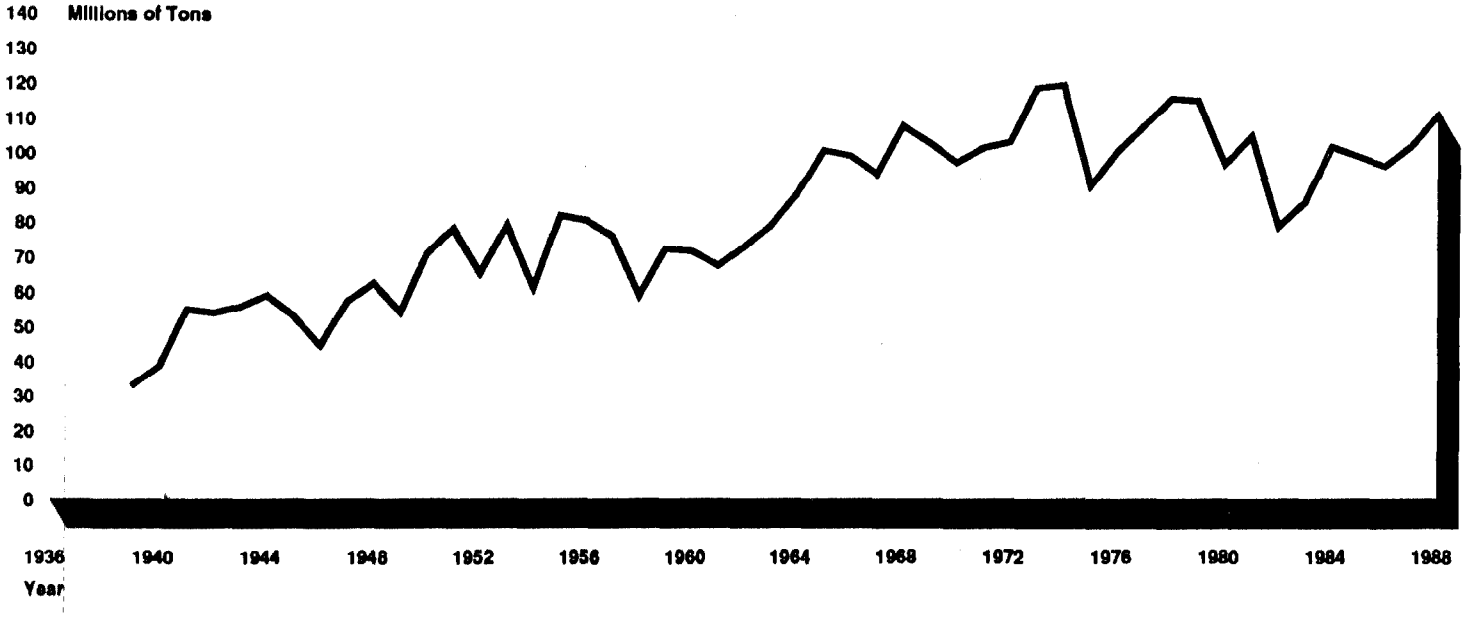
Longer-run movements in trade cannot explain the observed longer-run movements in net shipments either. Figure III.2 shows that exports have been fluctuating about a declining trend since 1939, and imports have been fluctuating about an increasing trend since the late 1950s. Thus, net imports (i.e. imports minus exports) have been following an increasing trend for almost 50 years, and they did not suddenly start increasing faster after 1974. Yet, net shipments followed an upward trend from 1938 to 1974 and have declined since then.

Figure III.3 indicates that the share of imports in the U.S. steel market has declined every year since 1984, marking the longest series of consecutive annual declines in post-WWII history and resulting in the attainment of the market share goals set by the President and Congress when the quota program was set up. In 1984, imports had 26.1 percent of the market. By 1988 their share had declined to only 19.6 percent, which is below the level when the import surge began and within the range of 17.0 to 20.2 percent set as a goal in Title VIII of the Trade and Tariff Act of 1984. The 1987 share of 20.5 percent was very close to this goal. The share of imports exclusive of semifinished steel in 1988 was 18.0 percent, which meets the 18.5 percent goal set by the President for this quantity in his directive to the U.S. Trade Representative to set up the program.

Figure III.4 confirms that domestic demand, rather than imports, is the primary cause of the changing fortunes of the steel industry. The figure shows the size of the U.S. market over time as measured by apparent consumption.[1] The shape of the path in this figure is almost identical to that of net U.S. shipments in figure III.2. The peaks and valleys occur in identical years in the two figures and correspond well in magnitude. Furthermore, as was the case with net U.S. shipments, the market size increased from 1938 to 1974, and then began to decline.

[1]Apparent consumption is defined as net U.S. shipments plus imports minus exports and thus equals total shipments to U.S. customers from both domestic and foreign suppliers.

Figure III.4: Size of the U.S. Steel Market (Apparent Consumption)



For 1988:
Source: GAO estimate based on 1987 and 1988 data from ITCM and 1987 data from CIR3.
Steel Industry Definition: Same as for 1971-1987.
For 1971-1987:
Source: GAO calculations based on data from CIR3.
Steel Industry Definition: SIC 33122, 33123, 33124, 33125, 33126, 33127, 33128, 3312C, 33155, 33167, 33168, 33176.
For 1939-1970:
Source: GAO calculations based on data from AISI as reported in BS.
Steel Industry Definition: Primarily 3312.

The conclusion that changes in domestic demand are the primary cause of the industry's problems leads to questions about the causes of these changes in demand. One substantial cause is economy-wide recessions. A plot of the growth rate of GNP over time indicates a deep recession in the 1980s with remarkably similar characteristics to the demand for steel shown in figure III.4. Both GNP growth and steel demand show a trough in 1980, a small recovery in 1981, a deeper trough in 1982, a recovery to

another peak in 1984, a slight decline to another trough in 1986, and a recovery in 1987 and 1988. Recession troughs in 1970 and 1975 also correspond well with steel demand troughs in those same years.

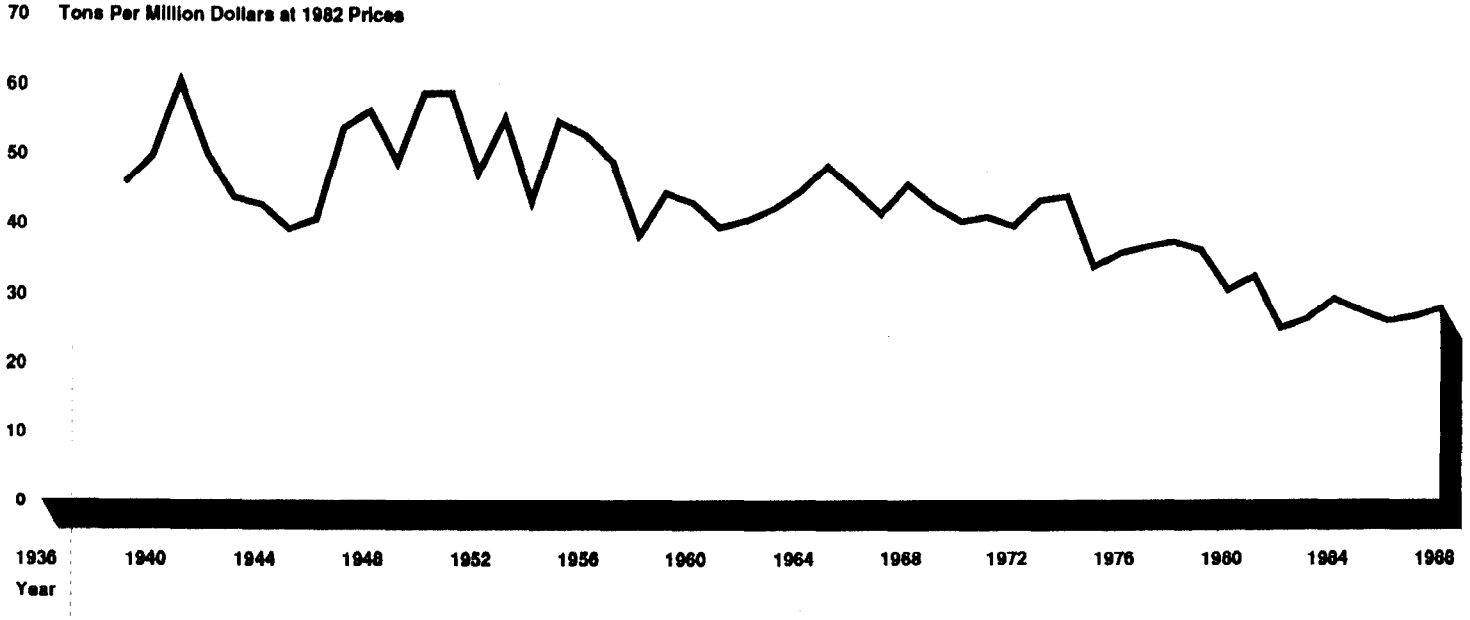
Figure III.5 indicates that the demand for steel has been declining relative to the size of the economy for over 35 years and that the cumulative decline is substantial. In 1988 less than half as many tons of steel per $1000 of real GNP (i.e. prices adjusted to remove inflation) were shipped to U.S. users by domestic and foreign suppliers as were shipped in 1951. Thus, the steel industry has become less significant to the economy not only in terms of employment and value added as discussed earlier but also in terms of the economy's need for steel products. Reasons for this declining dependence include competition from other materials (e.g. aluminum cans replacing steel cans, plastic replacing steel for many automobile parts, new construction materials), completion of the interstate highway system (highways contain steel), reductions in the sizes of automobiles, and the increased share of imported automobiles (which contain steel purchased in the exporting country rather than in the United States) in the U.S. market.

This last reason points to a phenomenon known as "indirect steel trade," which is the trading of steel in the form of downstream products, such as automobiles, that are constructed from it. This trade is not included in ordinary import and export statistics for steel such as those presented in figures III.2 and III.3. According to one source,[2] U.S. net indirect steel imports (i.e. indirect imports minus indirect exports) were negligible in 1981, rose steadily to approximately 9 million tons by 1986 (approximately 45 percent of net direct imports), and then declined slightly in 1987.

Net indirect steel imports are not reduced by the steel import quotas; in fact, the quotas increase such imports. By making steel more expensive and difficult to obtain in the United States, trade restrictions put domestic steel-consuming industries at a competitive disadvantage relative to their foreign counterparts. The result is reduced exports of steel-containing products and increased imports. The International Trade Commission has estimated that the steel quotas reduced exports of the products of steel-consuming U.S. industries by $258 million in 1985,

[2]The Salem Group, as quoted on page 24 of America's Steel Industry: A Time to Act, Action Research Report No. 4, by the Cuomo Commission on Trade and Competitiveness, 1988.

Figure III.5: Ratio of Steel-Market Size to Real GNP (Apparent Consumption/Real GNP)



For 1988:
Source: GAO estimate based on 1987 and 1988 data from ITCM, 1987 data from CIR3, and 1988 data from BEA as reported in ERP.
Steel Industry Definition: Same as for 1971-1987.
For 1971-1987:
Source: GAO calculations based on data from CIR3 and from BEA as reported in ERP.
Steel Industry Definition: SIC 33122, 33123, 33124, 33125, 33126, 33127, 33128, 3312C, 33155, 33167, 33168, 33176.
For 1939-1970:
Source: GAO calculations based on data from AISI as reported in BS and from BEA as reported in ERP.
Steel Industry Definition: Primarily 3312.

$673 million in 1986, $699 million in 1987, and $95 million in 1988. It has estimated further that the quotas increased U.S. imports of the products of steel consuming industries by $332 million in 1985, $992 million in 1986, $964 million in 1987, and $117 million in 1988.[3]

[3]The Effects of the Steel Voluntary Restraint Agreements on U.S. Steel-Consuming Industries, USITC Publication 2182, May 1989. The ITC states that there is an upward bias in the methodology used to obtain these estimates and that the estimates should therefore be viewed as upper bounds for the correct numbers.

Minimills vs. Integrated Mills

Not all of the steel industry has suffered seriously. The industry consists of two rather distinct segments: minimills and integrated producers. The problems of the industry are concentrated in the integrated sector; the minimills have generally performed quite well.

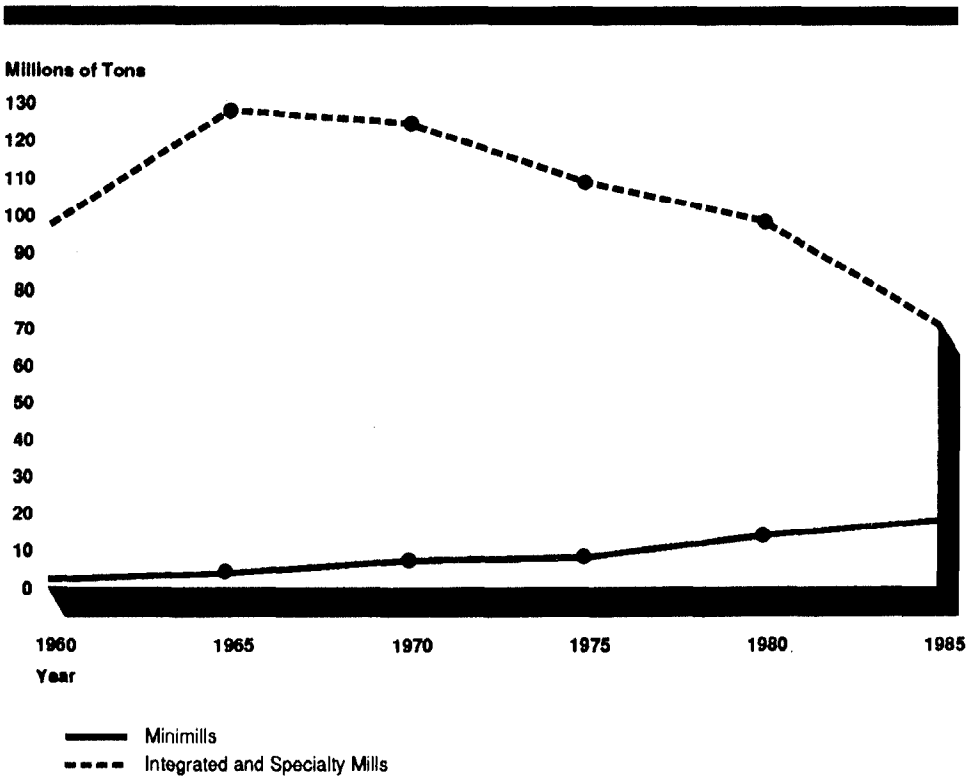
As the name suggests, minimills have relatively small-scale operations. They do not produce new steel from iron ore; they confine themselves to the use of electric furnaces to melt down steel scrap and process it into finished products. For various reasons, minimills can produce only a limited array of products in comparison to that produced by integrated firms. With improvements in technology over time, this array is becoming less limited and minimills are taking more markets away from the integrated producers. Minimills can be located wherever there is a supply of steel scrap and a demand for steel products; hence, they are dispersed nationwide. However, they are most concentrated in southern states.

Integrated producers include the traditional big steel firms. Their scales of operations are much larger than those of the minimills; and though they have some electric furnaces and process steel scrap like the minimills, they also produce substantial amounts of steel from iron ore and are able to produce a full line of steel products. Integrated producers are located near major industrial customers and supplies of iron ore and coal; hence, they are concentrated in midwestern states.

Minimills have performed quite well in comparison to the integrated producers. Figure IV.1 shows that while raw steel production by integrated and specialty steel producers declined by 45.5 percent (57.1 million tons) from 1965 to 1985, production by minimills increased by 376 percent (13.9 million tons). More significantly, production by integrated producers declined by 28.1 percent (27.6 million tons) from 1980 to 1985 as the industry encountered its recent severe problems, but over the same period minimill production increased by 30.4 percent (4.1 million tons). Figure IV.2 shows that minimills were profitable throughout the 4 years from July 1, 1984 to June 30, 1988, whereas the steel industry as a whole lost money in 3 of those years and had a lower return on sales[1] than did the minimills in the remaining year.

[1]Data for return on assets was not available.

Figure IV.1: Raw Steel Production by Minimills and by Integrated and Specialty Mills

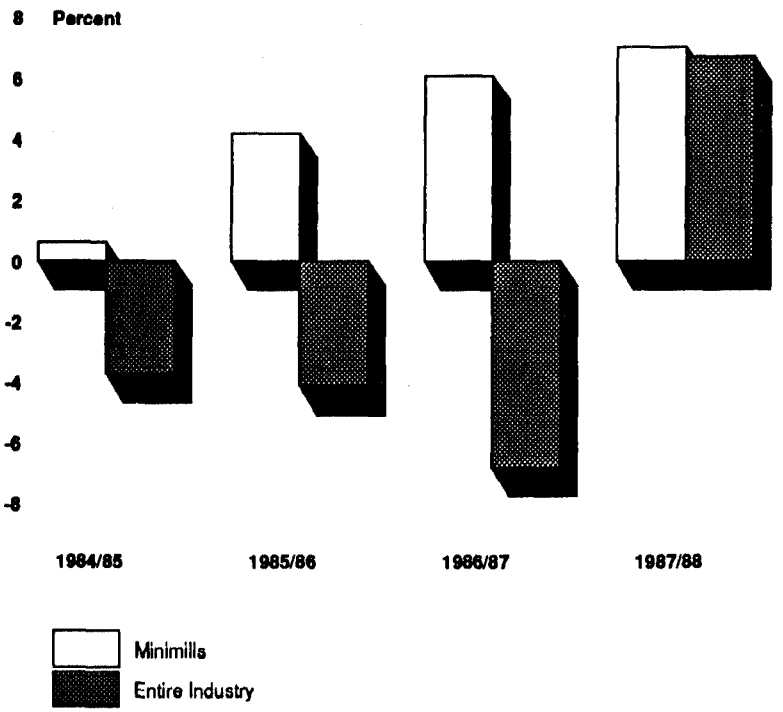


Source: Page 12 of B&C.
Data points are at 5-year intervals as indicated by the dots on the graph.

Competition from domestic minimills is almost as big a problem for the integrated producers as is competition from imports. According to Barnett and Crandall[2] (see table IV.1), shipments by integrated and specialty steel producers declined by 44 million tons between 1974 and 1985; and of this decline, Barnett and Crandall attribute 24 million tons (54.5 percent) to reduced U.S. consumption of steel, 8 million tons (18.2 percent) to increased imports, 7 million tons (15.9 percent) to increased shipments by minimills, and 5 million tons (11.4 percent) to decreased exports.

[2]Barnett, Donald F. and Robert W. Crandall, Up From the Ashes: The Rise of the Steel Minimill in the United States, the Brookings Institution, Washington, D.C., 1986, pages 13-14.

Figure IV.2: Return on Sales for Minimills and for the Entire Industry



Source: ITCA.
Years run from July 1 to June 30.

Table IV.1: Changes in Steel Flows From 1974 to 1985

	Millions of Tons	Percent of Total
Decline in U.S. consumption	24	54.5
Increase in imports	8	18.2
Increase in shipments by minimills	7	15.9
Decrease in exports	5	11.4
Total = Decline in shipments by integrated and specialty steel producers	**44**	**100.0**

Source: Pages 13 and 14 of B&C.

Integrated producers and minimills have both faced imports and declining domestic demand, but only the integrated producers have had serious trouble. Minimills have performed better than the integrated producers for many reasons. Some of these are:

1. An abundant supply of cheap steel scrap and increasing prices for iron ore in the United States. Recently, however, scrap prices have risen, erasing much of this advantage for the minimills.

2. Greater use of continuous casting. Continuous casting is a relatively recent technological advance that increases efficiency and otherwise reduces the cost of producing steel. Over 95 percent of minimill output is continuously cast in comparison to less than 65 percent for integrated mills.

3. Lower labor costs and good labor relations. There is less unionization among minimill labor forces (roughly 50 percent of minimills are nonunion and many have unions independent of the United Steelworkers of America), and the wages of minimill workers are generally less than those of other steelworkers. However, according to the ITC, profit-sharing and incentive plans are more widespread among minimills and enable many minimill employees to earn almost as much as integrated-mill employees.

4. Greater freedom of location. Since minimills can be located anywhere there are an available supply of scrap and electricity at reasonable cost, they can generally be located near customers, thereby reducing transportation expense.

5. Fewer environmental problems. The worst pollution problems in the steel industry occur in the production of raw steel from iron ore and coal, which the minimills do not do. Hence, the minimills have lower pollution-control costs.

6. Advances in production technology. These advances have resulted in improved labor productivity and expanded product lines for the minimills.

Because separate data for minimills and integrated mills is sparse, other parts of this report are forced to treat the steel industry as a unified whole. However, the reader should bear in mind that many of the conclusions drawn, while accurate for most of the industry, may not be accurate for the minimill sector.

Factors Affecting Imports

In the early 1980s, the value of the dollar increased substantially, making U.S. steel more expensive relative to imports and thereby resulting in the surge of imports that peaked in 1984. The quotas that went into effect at the end of that year helped to contain the surge in 1985. Then, the dollar declined in value and the import surge subsided. As a result, the effect of the quotas on imports has declined substantially. The vast majority of the quotas are now going unfilled. Long-term factors contributing to the increasing share of imports in the U.S. market include high U.S. labor costs and slow labor productivity growth in the U.S. industry brought on in part by little effort at R&D and slowness to implement new technologies. Though reduced some by labor concessions in recent years, labor costs in the U.S. steel industry remain very high in comparison to those in other U.S. manufacturing industries and in comparison to those in the steel industries of other countries.

Exchange Rates

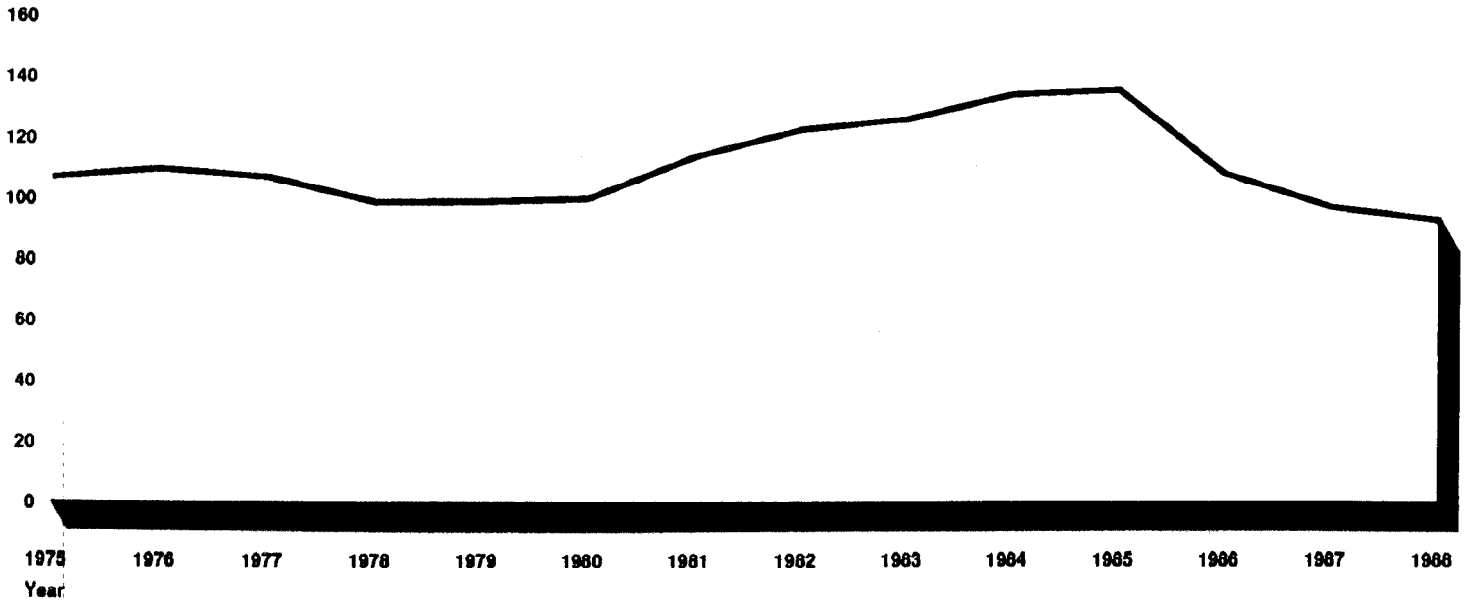
Probably the most important cause of the surge and subsequent decline of the share of imports in the U.S. steel market in the 1980s was the large rise and subsequent decline of the dollar against other currencies in foreign-exchange markets. Figure V.1 plots a real effective exchange-rate index for the dollar.[1] From 1980 to 1985, the dollar rose in value by over 35 percent. The rise made U.S. steel products that much more expensive relative to imported steel products. At first, foreign products could not make much headway because the recession resulted in low demand for all steel, domestic and foreign. Then as the recovery began, imports surged to a record 26.1 percent share of the market. Since 1985 the dollar has declined, falling back below its 1980 value in 1987 and 1988. Accordingly, the import surge has subsided. The rise and fall of the dollar were widespread, encompassing the currencies of most major U.S. trading partners.

The Quota Program

The quota program helped contain the import surge at its peak, contributing to the decline in import market share in 1985 and thereby helping to protect the U.S. steel industry from the effects of the high dollar. With the decline of the dollar, the surge has passed and the quotas are no longer having much effect. Figure V.2 shows that in 1985 aggregate total steel exports to the United States from countries bound by quota agreements were equal to 102.9 percent of the aggregate total of quotas,

[1]Real effective exchange-rate indices measure the value of the dollar against the currencies of all U.S. trading partners on a trade-weighted basis and are corrected to remove the effects of inflation in the United States and all other countries. The absolute values of these indices do not have any meaning. What is meaningful is how the values change over time.

Figure V.1: Real Effective Exchange-Rate Index (1980=100)



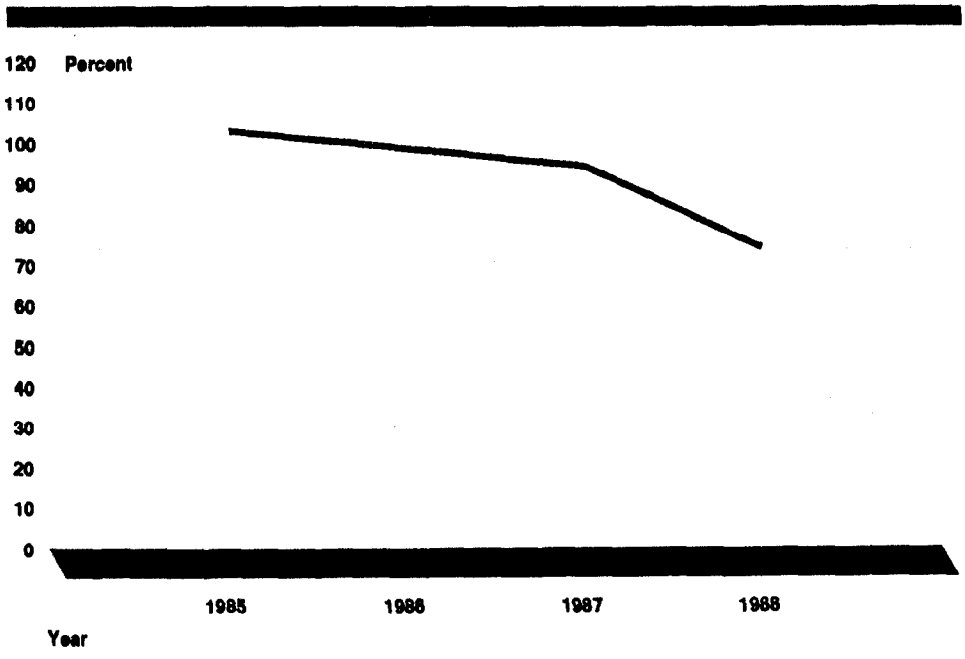
Source: IFS.
Wholesale prices were used to remove the effects of inflation.

which means that countries were bumping up against their quota limits for 1985 and using part of their quotas for 1986.[2] In 1986, 1987, and 1988, the respective percentages were 98.6, 94.0, and 74.0. The decline each year suggests that there was progressively less bumping into quota limits, indicating that the quotas were becoming less binding each year and especially less binding in 1988.

Further evidence is provided by data for the individual quotas for each country. Each quota agreement specifies individual quotas on a number of different steel products or classes of steel products for the country or countries in question. If each of these individual quotas is considered to be completely filled and binding when it is 100-percent or more filled, then individual quotas comprising 79.2 percent of the aggregate total quota tonnage were completely filled and binding in 1985. In 1986, the

[2]The quota agreements contain provisions for limited transfer of quotas to and from the following year.

Figure V.2: Aggregate Steel Exports to the United States as a Percentage of the Sum Total of All Quotas



Source: OAC.
The value for 1988 is a GAO projection based on data for January through September of 1988 released in March of 1989.

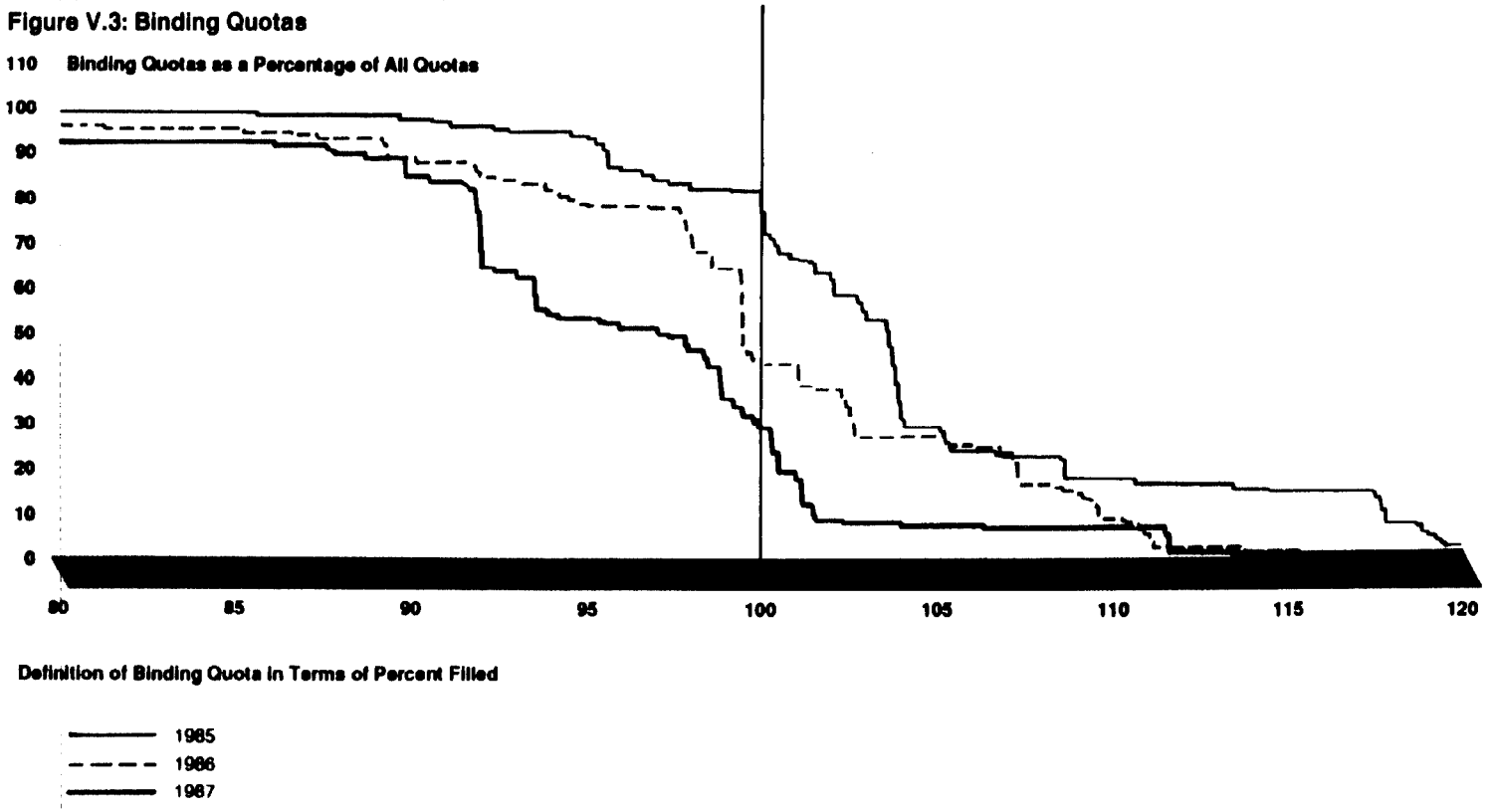
percentage was only 42.6; and in 1987, it was only 28.4.[3] Complete data for 1988 is not yet available; but given the numbers in the previous paragraph, the percentage for 1988 is most likely substantially lower than the 28.4-percent figure in 1987. Thus, with each passing year fewer of the quotas have been filled and served to restrain imports, and by 1988 the quotas were having little effect in aggregate.

Theoretically, ordinary quotas are completely binding when they are 100-percent filled, and are not binding at all when less than 100-percent filled. They cannot be more than 100 percent filled. Because the current quota agreements have provisions for limited transfer of quotas from one year to another, quotas can be more than 100 percent filled and may not become a restraining influence until they are, say, 102- or 104-percent filled. Alternatively, because of certain frictions in the administration and execution of the agreements, the quotas may become binding when they are only 98- or 96-percent filled. Figure V.3 shows that for

[3]Technically, one could observe declining percentages like these even with increasingly binding quotas if it were the case that each year new unbinding quotas were negotiated to go along with the quotas already in effect. Other data not presented here rejects this possibility.

virtually all reasonable definitions of a binding quota (horizontal axis) ranging from 80-percent filled to over 110-percent filled, the fraction of all quota tonnage that was binding declined each year from 1985 to 1987. Thus, no matter how one defines a binding quota, the quotas have become less binding each year with the passing of the surge.

Figure V.3: Binding Quotas



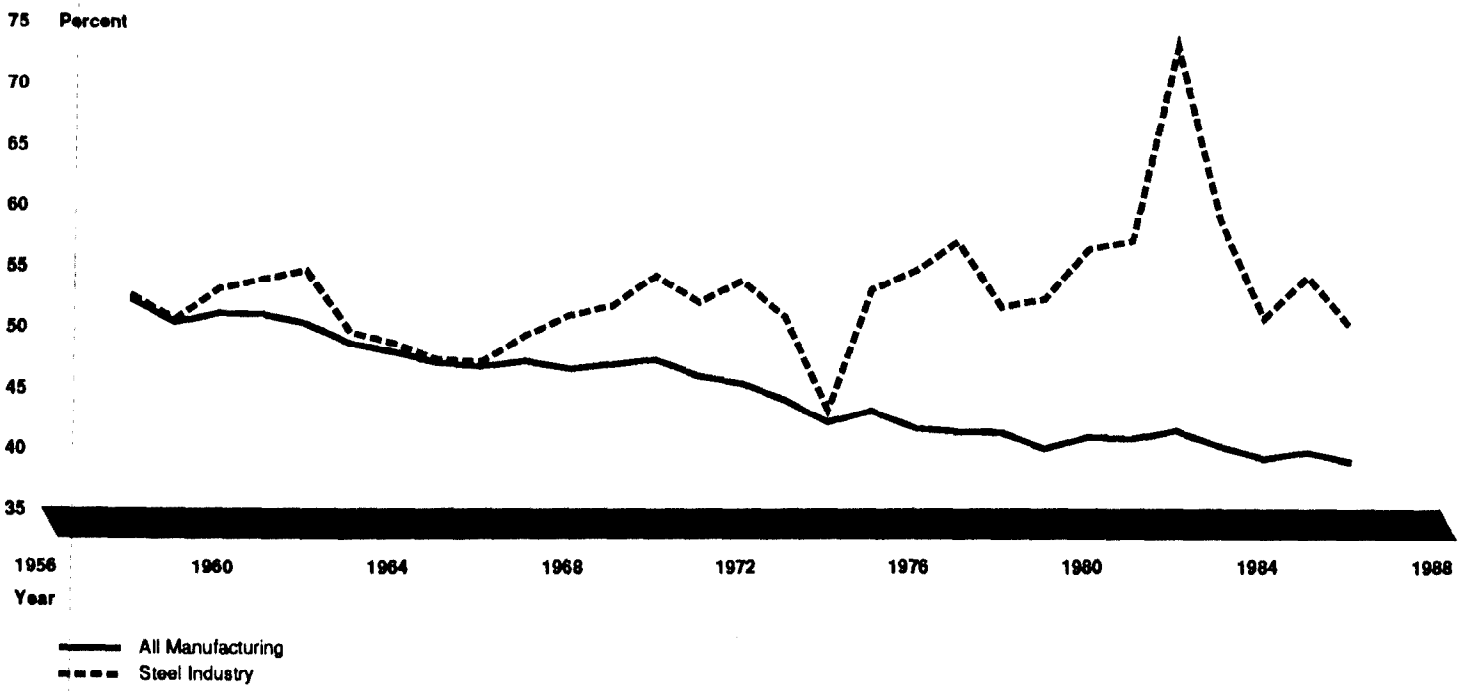
Source: GAO calculations based on data from OAC.

Though the quotas are having little effect on the market in aggregate, some particular steel products may still be affected. For example, the total tonnage of short-supply requests for semifinished steel products increased substantially in 1988, which suggests that the quotas on these particular products may have become more binding.

The Cost of Labor

Steel production requires relatively large amounts of labor in comparison to the rest of manufacturing in the United States. Figure V.4 shows expenditure on payroll as a percentage of value added for the steel industry and for manufacturing as a whole. It indicates that the steel industry was in rough parity with all manufacturing and the percentage for both was declining until 1966. At that point the decline for the steel industry ceased while that for manufacturing continued. Since then the steel industry has spent relatively more on labor than has the rest of manufacturing. Payroll does not include expenditure on pensions and other benefits; however, data on total labor compensation, which does include such expenditure, supports these conclusions for 1970 through 1986 (the range of years for which we found such data).

Figure V.4: Payroll as a Percentage of Value Added



Source: ASM and CM.
Steel Industry Definition: SIC 3312.

Data on value added per production-worker hour also supports the conclusion. Both total labor cost data and payroll data will exaggerate the

labor requirements of an industry if the wages in that industry are higher than they ought to be, but value added per production-worker hour does not have this problem. Wage data from many countries, some of which is presented in figures V.7A and V.7B later in this report, suggests that one hour of labor in the steel industry is equivalent to roughly 1.1 to 1.3 or even more hours of labor in all manufacturing. Assuming this equivalence, the steel industry requires relatively more labor than does manufacturing as a whole if the value added per production-worker hour in the industry drops below 110 to 130 percent of that for all manufacturing. Figure V.5 indicates that this percentage has been declining for the past three decades, that it fell below 130 percent in 1960, and that it fell below 110 percent in 1968.

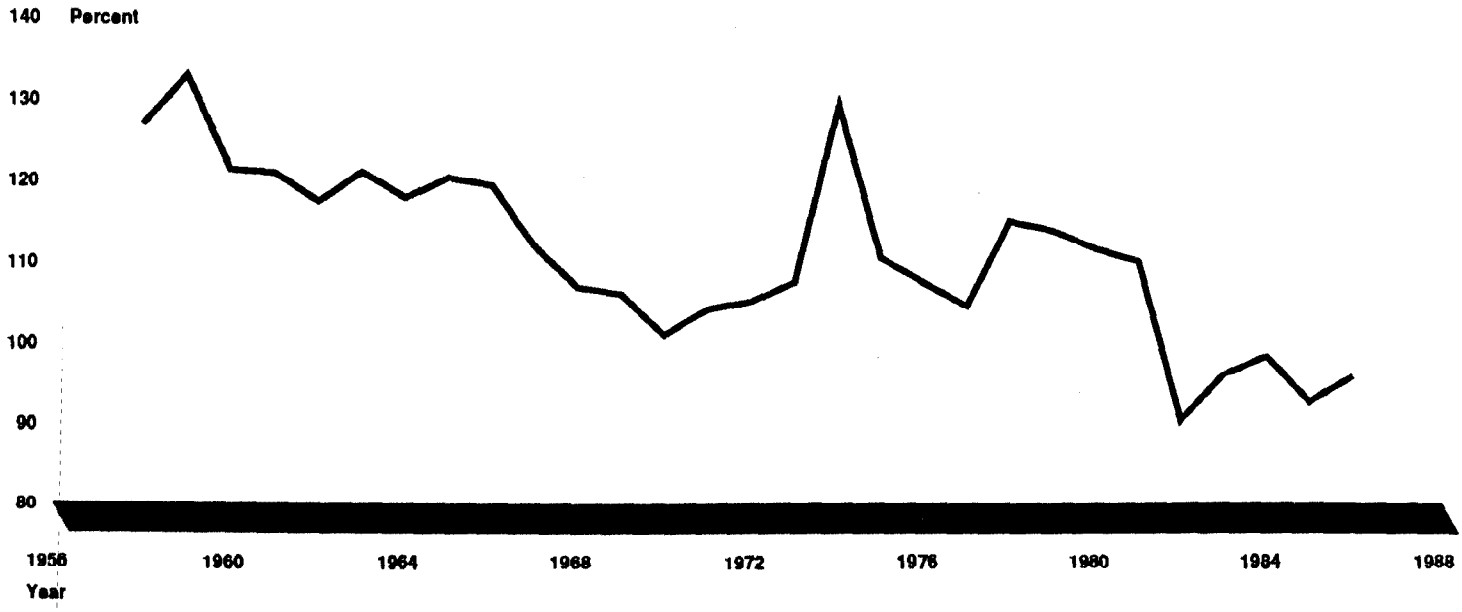
The large amounts of labor required for steel production make the profitability of the industry sensitive to labor costs; hence, low-wage developing countries with new state-of-the-art steel plants have an advantage over the higher-wage industrialized countries. Thus, one should expect that the steel industries of the United States, Japan, and the European Community (EC) should be declining and those of developing countries should be expanding. Figure V.6 shows that such is indeed the case. The production capacity of the U.S. industry has been declining since the late 1970s, that of the EC since 1980, and that of Japan since 1985. It has been reported that Japan has plans to further reduce capacity by 25 to 30 percent over the next several years.[4] Meanwhile, the capacity of developing countries has been increasing since at least as far back as 1975. This process may be retarded by the inefficiency of some developing-country steel industries, but is accentuated by the growing markets for steel in the developing countries and by the subsidies and protection that many developing countries (like many other countries) provide to their steel industries. Steel firms in both the United States and Japan, possibly seeing the handwriting on the wall, have begun diversifying into other lines of business. For example, USX Corporation bought Marathon Oil in 1982, and Japanese steel firms are reported to have begun diversifying into financial services and other service-oriented sectors.[4]

Other factors increase the likelihood that developing countries will export steel. Crandall[5] has estimated that the minimum efficient scale of a new integrated steel mill is in the vicinity of 6 to 7 million tons of raw

[4]America's Steel Industry: A Time to Act, Action Research Report No. 4, by the Cuomo Commission on Trade and Competitiveness, 1988.

[5]Crandall, Robert W. The U.S. Steel Industry in Recurrent Crisis: Policy Options in a Competitive World, Brookings Institution, 1981, pages 10-11.

Figure V.5: Value Added Per Production-Worker Hour: Steel Industry as a Percentage of All Manufacturing



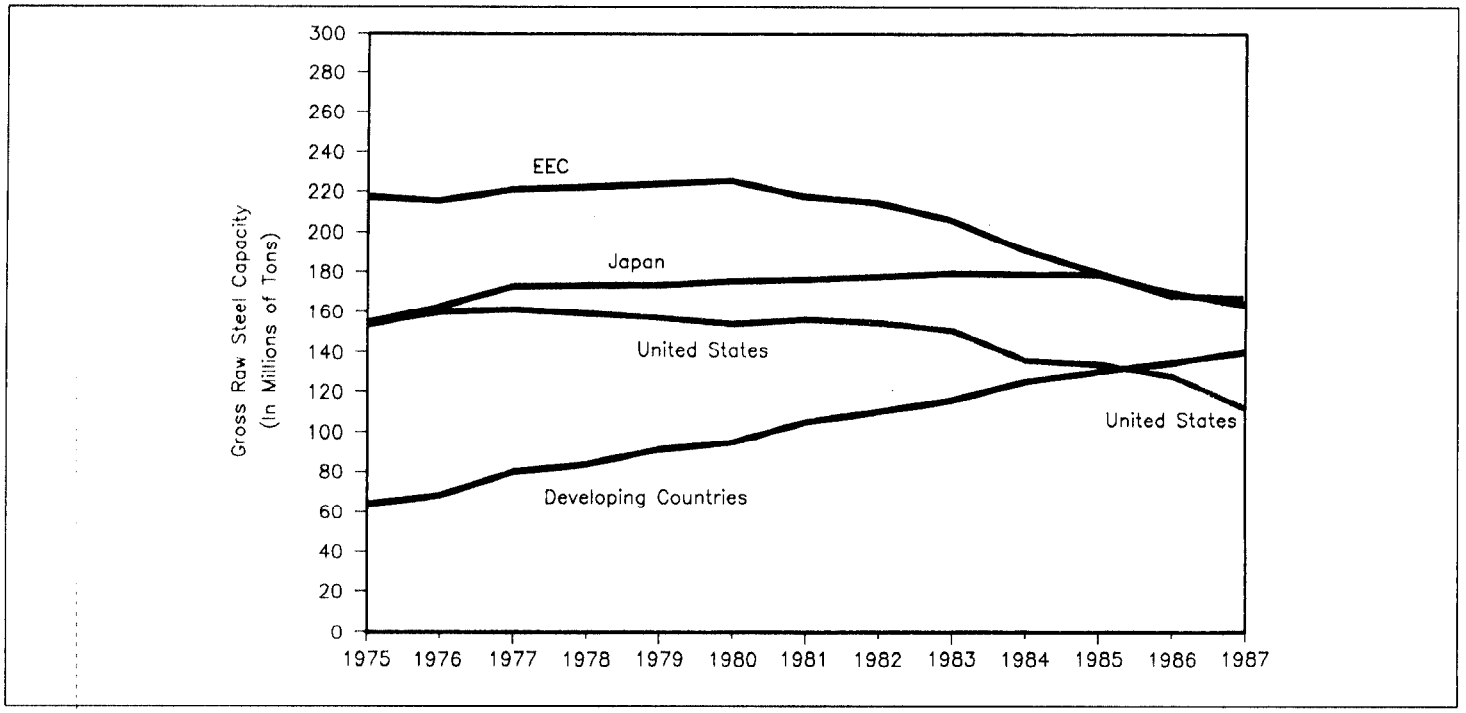
Source: ASM and CM.
Steel Industry Definition: SIC 3312.

steel per year. Hence, a single new plant is likely to be so large that a small developing economy cannot absorb all of the steel it produces. The excess is then likely to be exported. Further, some developing countries are driven to export by the need to earn dollars to repay large debts which they owe to the United States and other developed countries.

In making comparisons of labor costs among different countries, one must cope with the problem that compensation in each country is denominated in a different currency. One way of getting around this problem is to use exchange rates to convert all of the foreign-currency compensations into dollars. Some studies do this using the current market exchange rate.[6] The problem with this procedure is that it confounds movements in relative compensation with movements in exchange rates. The dollar has declined drastically against other currencies since 1985;

[6]Examples include the ITC's Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Adjust and Modernize, September 1988; the American Iron and Steel Institute's Current Issues in Steel - 2, "Improved U.S. International Competitiveness as Result of the VRAs," July 1, 1988; and America's Steel Industry: A Time to Act, Action Research Report No. 4, by the Cuomo Commission on Trade and Competitiveness.

Figure V.6: Production Capacities of Various Countries and Groups of Countries



Graph reproduced from PHB.
PHB's source: AISI Annuals, World Steel Dynamics.

thus, use of current market exchange rates to convert compensation into dollars would make foreign compensation appear to rise relative to that in the United States even if all compensation remained fixed.[7]

A better procedure is to use purchasing-power-parity exchange rates[8] rather than current market rates to convert foreign labor costs to dollars. Such a procedure gives the best possible comparison of the standards of living that workers in different countries can purchase with their compensation. Using this procedure we found that the United States has the highest steel-industry hourly compensation costs of the

[7]Such a rise is equally helpful to the U.S. industry regardless of whether it occurs because of lower relative U.S. wages or because of a decline in the exchange rate. However, there is a big difference with regard to who pays the cost. A lower relative wage means that workers are adjusting and paying the cost in the form of reduced relative income. A lower exchange rate means that U.S. consumers and U.S. purchasers of foreign assets are paying the cost.

[8]The purchasing-power-parity (PPP) exchange rate is the rate that equates purchasing power across currencies. Thus, if one were to take $1000 and use them to purchase yen at the PPP exchange rate, the quantity of yen thereby obtained could purchase the same quantity of some general market-basket of goods in Japan that the $1000 could purchase in the United States.

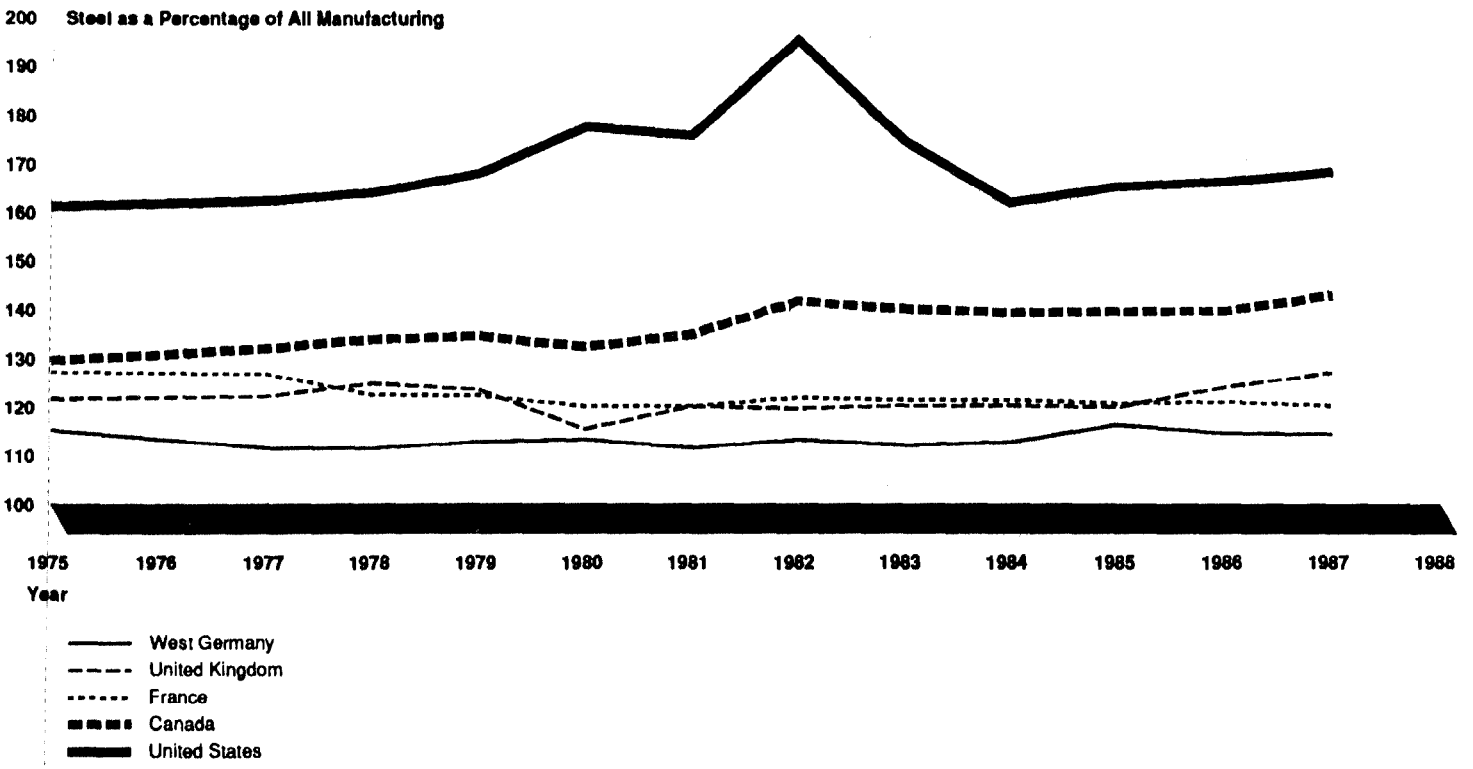
10 major steel-producing countries for which we had data[9] and that this has been true for at least the past 13 years.

Some may feel it is unfair to ask steelworkers to pass up the generally high prevailing wages in U.S. manufacturing in order to keep their jobs; however, compensation costs in the U.S. steel industry are high even after factoring out the high standard of living prevailing in U.S. manufacturing. Figures V.7A and V.7B show the ratio of steel-industry hourly compensation costs to average manufacturing hourly compensation costs for a number of major steel-producing countries. They indicate that this ratio was substantially higher for the United States for the entire 13-year period for which we found data than for all of the other countries except Japan and Korea. We also obtained data for Austria, Belgium, Italy, Luxembourg, the Netherlands, and Venezuela. The ratios for all of these countries were lower than that for the United States throughout the 13-year period.

[9]These countries are the United States, Canada, Japan, South Korea, Belgium, France, West Germany, Italy, the Netherlands, and the United Kingdom.

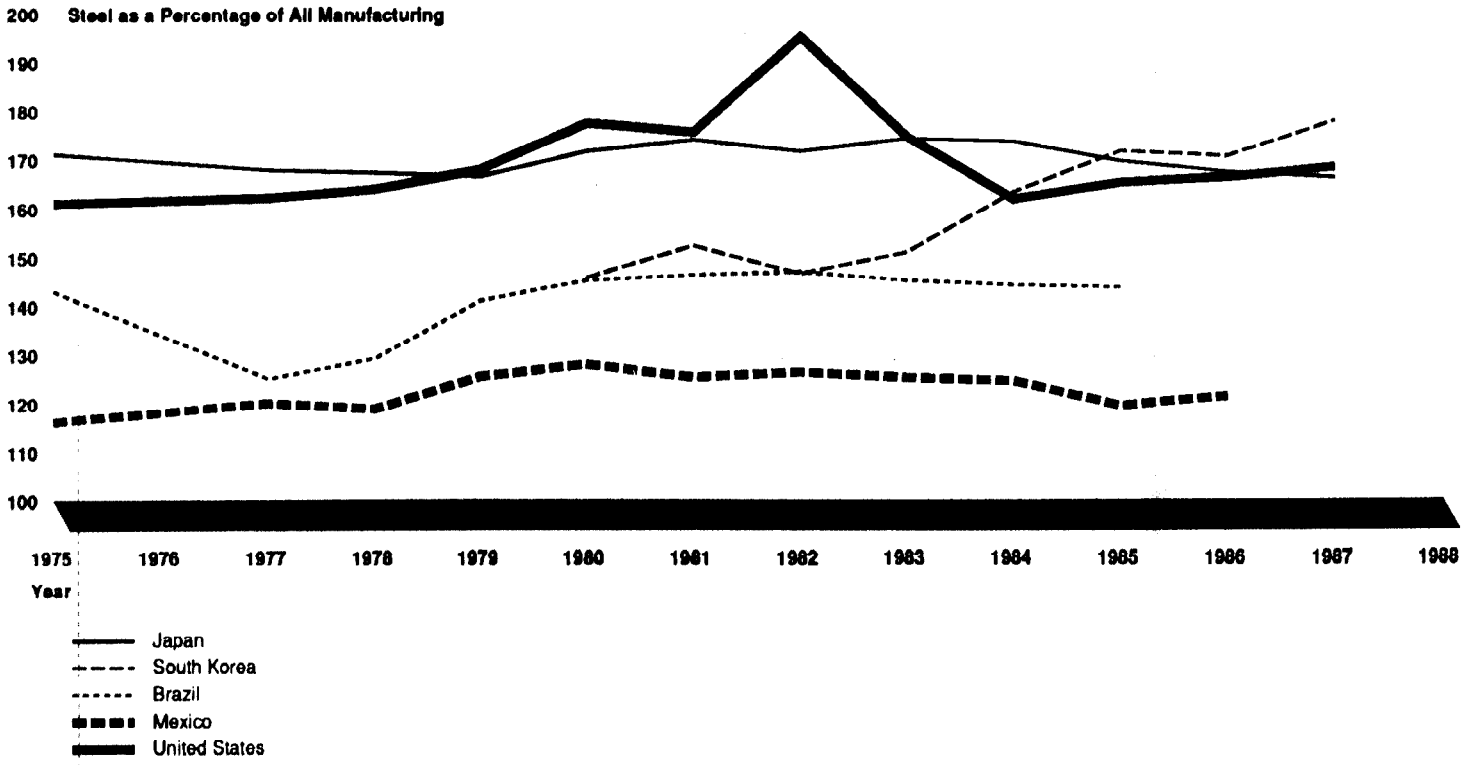
Figures V.7A and V.7B further indicate that relative compensation costs for U.S. steel workers reached a peak in 1982, the same year that the industry was having its worst troubles. In that year, average compensation costs in the steel industry were 95 percent higher than the average for all manufacturing. The costs in the steel industry then declined for 2 years, but they remain very high. In 1987, they were still 68 percent higher than the average for all manufacturing.

Figure V.7A: Hourly Compensation Costs for Production Workers



Source: GAO calculations based on data from BLS.
Steel Industry Definition: SIC 331.
Data for 1976 is missing.

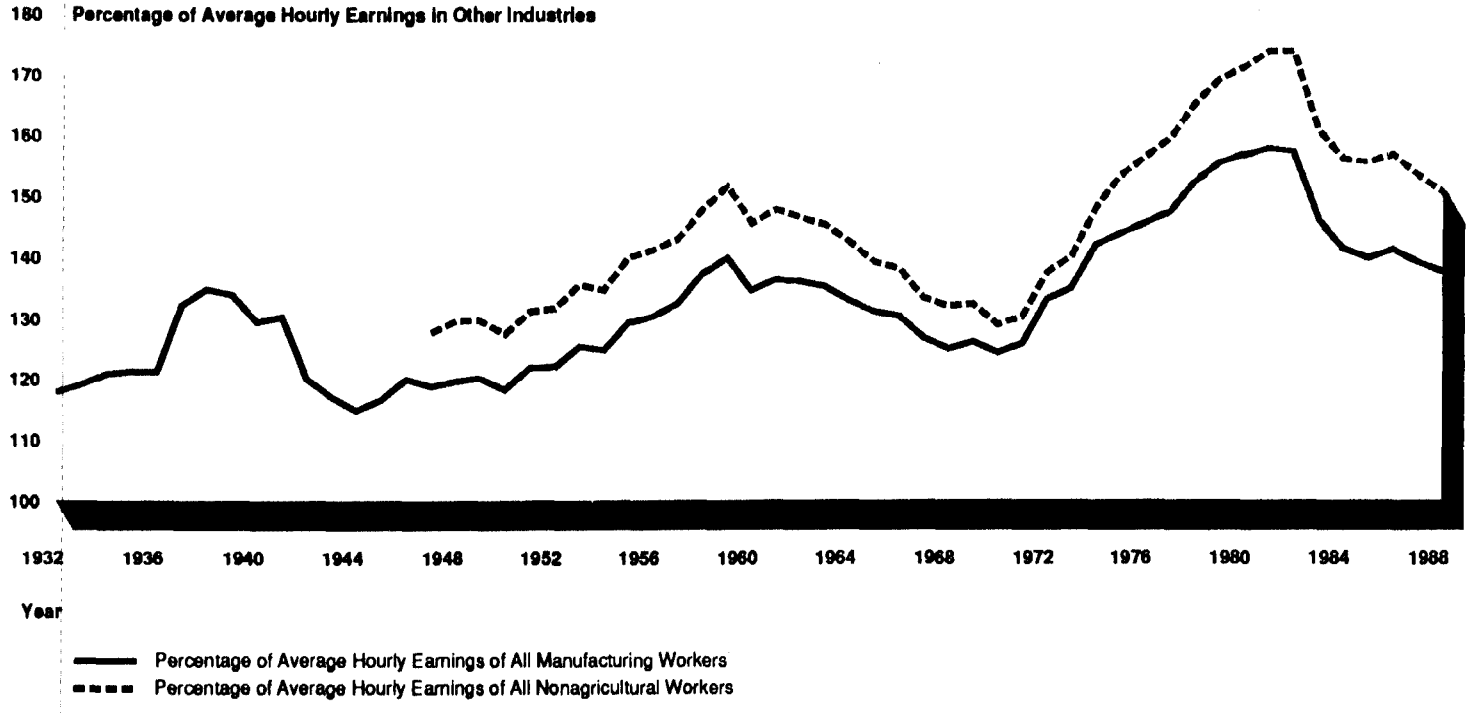
Figure V.7B: Hourly Compensation Costs for Production Workers



Source: GAO calculations based on data from BLS.
Steel Industry Definition: SIC 331.
Data for 1976 is missing.

Problems related to the accounting for pensions and other post-employment benefits may affect the numbers used in these figures. However, the general conclusion from them is supported by other data that does not suffer from these problems. Figure V.8 shows the ratios of average hourly earnings in the U.S. steel industry to the averages for all U.S. manufacturing and all nonagricultural workers. This data does not include pension costs. The figures indicate that the two ratios peaked in 1981 and 1982 at their highest levels of the past five decades. They have since declined substantially, but by 1988 they still were 38 percent higher than the average for all manufacturing, a higher margin than in any post-WWII year prior to 1974 except for 1959.

Figure V.8: Average Hourly Earnings in the U.S. Steel Industry as a Percentage of Those in Other U.S. Industries

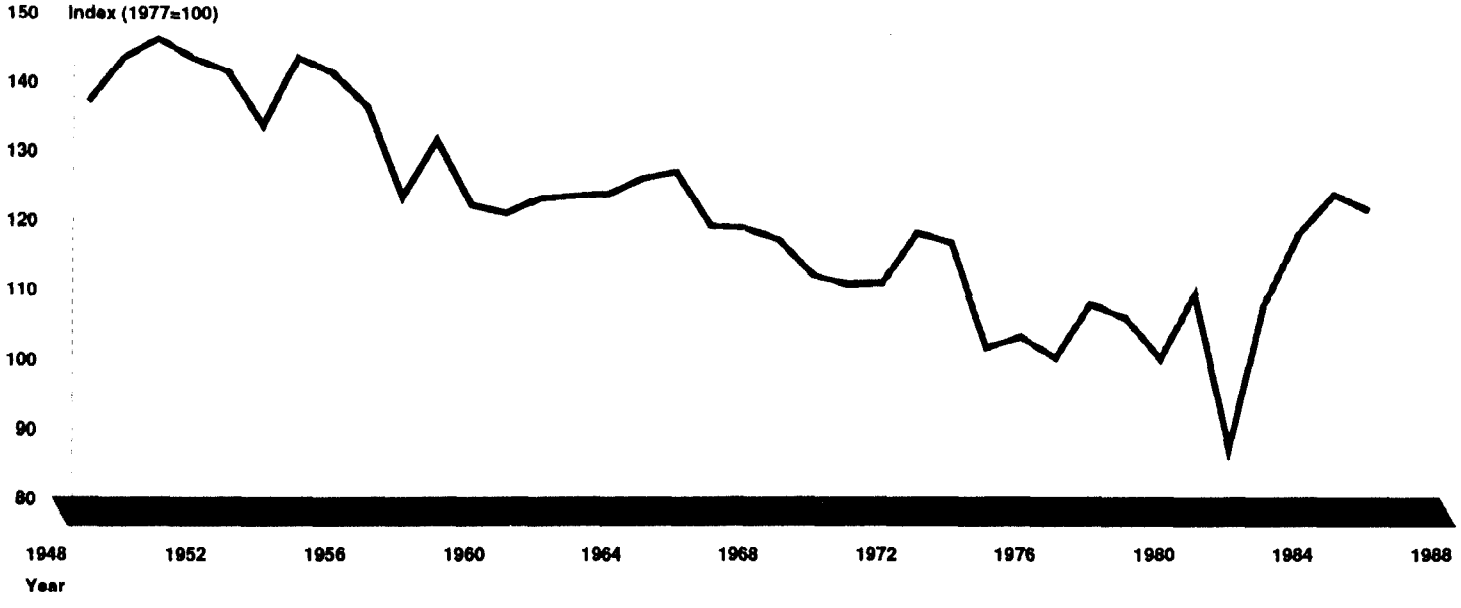


Source: GAO calculations based on data from EHE.
Steel Industry Definition: SIC 331.

Lagging Productivity

The U.S. steel industry might have been able to sustain such high wages without ceding market share to imports had it maintained labor-productivity growth rates comparable to those of other industries; however, it did not do so. Figure V.9 indicates that the labor productivity of the U.S. steel industry declined fairly steadily relative to that of the rest of U.S. manufacturing for most of the post-WWII period. Only since 1982 has the industry begun to recover this lost ground.

Figure V.9: Ratio of U.S. Steel Industry Labor Productivity to Average Labor Productivity for All U.S. Manufacturing Industries



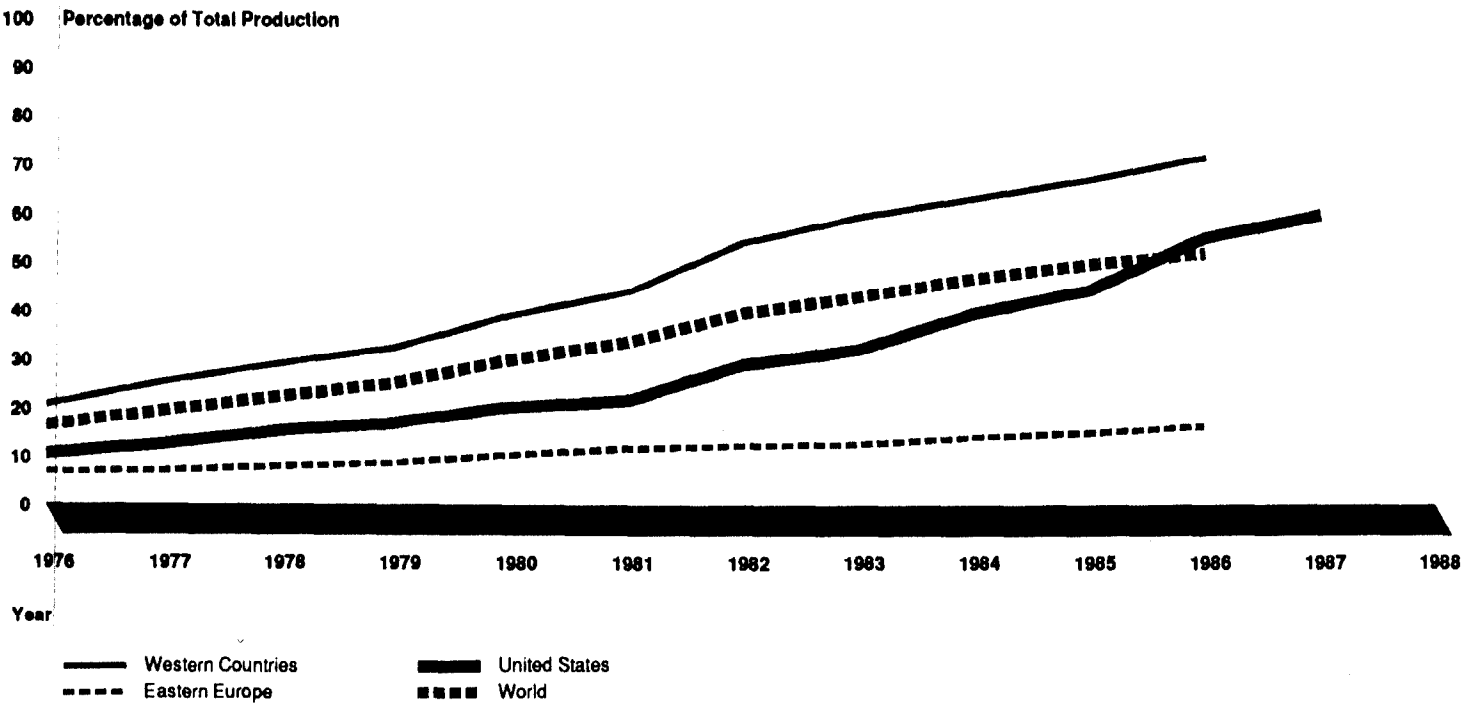
Source: GAO calculations based on data from BLS.
Steel Industry Definition: SIC 331.

A similar plot of capital productivity indicates that the capital productivity of the steel industry has risen over the post-war period relative to that of the rest of manufacturing. While this rise might seem to be a good thing, it is not. In conjunction with the declining relative labor productivity shown in figure V.9 it is an indication that the industry has not increased its capital-labor ratio as fast as other manufacturing industries have. The resulting relatively high amounts of labor used with capital make the capital very productive; however, the relatively

low amounts of capital used with labor make the labor not very productive. In a developed country such as the United States, labor is relatively scarce and expensive and capital is relatively abundant and cheap. Hence, it is better to use more capital and less labor.

That the U.S. industry has lagged in the installation of labor-saving and productivity-improving technology is also supported by more direct evidence. Figure V.10 shows that the industry was slow to incorporate continuous casting, a production process that increases product yield and eliminates several production steps, thereby conserving on labor, energy, and raw materials. As late as 1985, a lower percentage of U.S. steel was produced by continuous casting than was the case for the world as a whole; and in 1987 the U.S. percentage remained below that for industrialized countries as a whole, western countries as a whole, and many of the U.S. industry's biggest competitors, including Japan, South Korea, and the EC. Earlier, the U.S. industry was also slow to replace its outmoded open-hearth furnaces with new, more productive, basic oxygen furnaces.

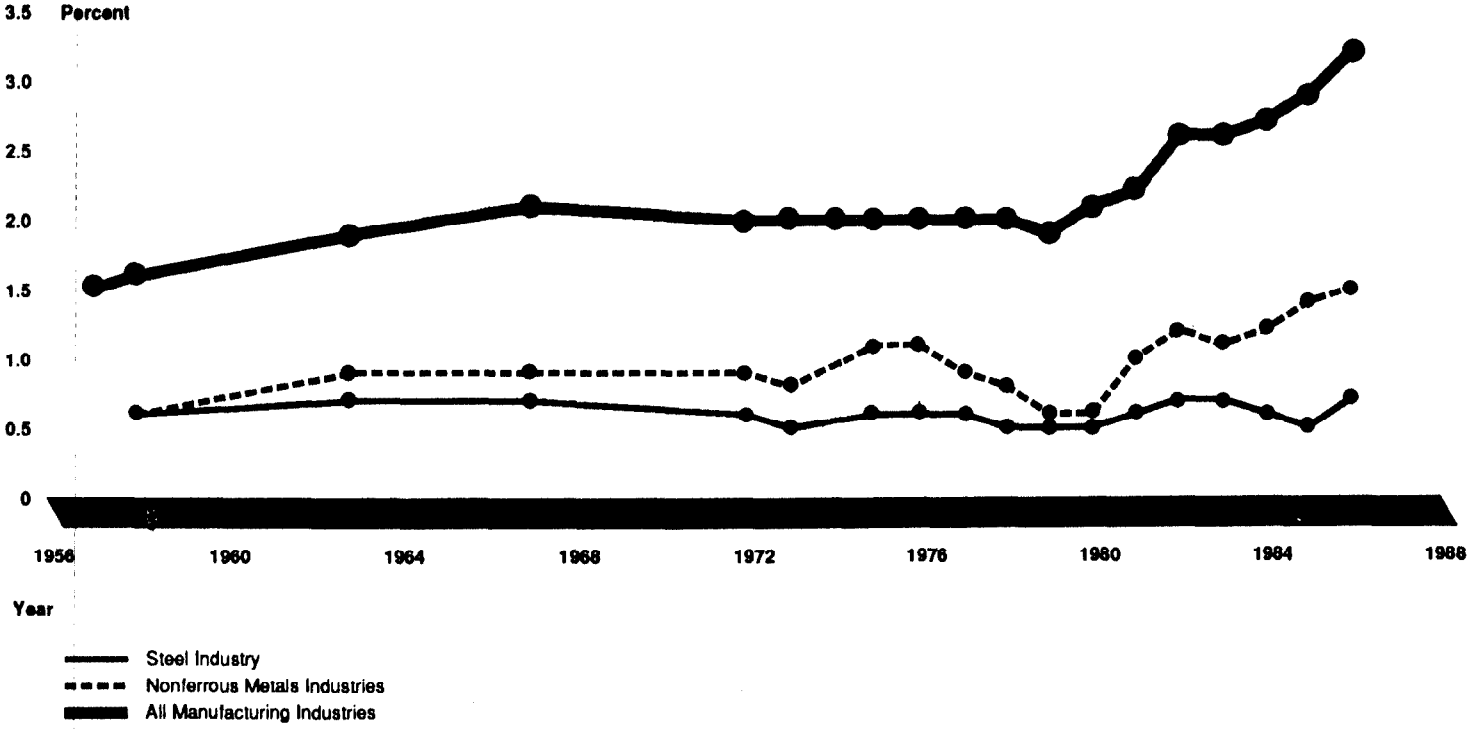
Figure V.10: Production by Continuous Casting



Source: AISI and IISI.

Not only has the U.S. industry lagged in the installation of new technologies, it has also put very little effort into the R&D required to invent and develop them. Figure V.11 shows that for the past three decades the percentage of sales revenue spent on R&D by the steel industry has been roughly one third (or even less) of the comparable percentage for manufacturing as a whole and also less than the comparable percentage for the related nonferrous metals industry. The percentage for the steel industry has continually been less than the percentages for almost all of the other manufacturing industries on which the National Science Foundation (NSF) collects data.[10]

Figure V.11: Company R&D as a Percentage of Net Sales



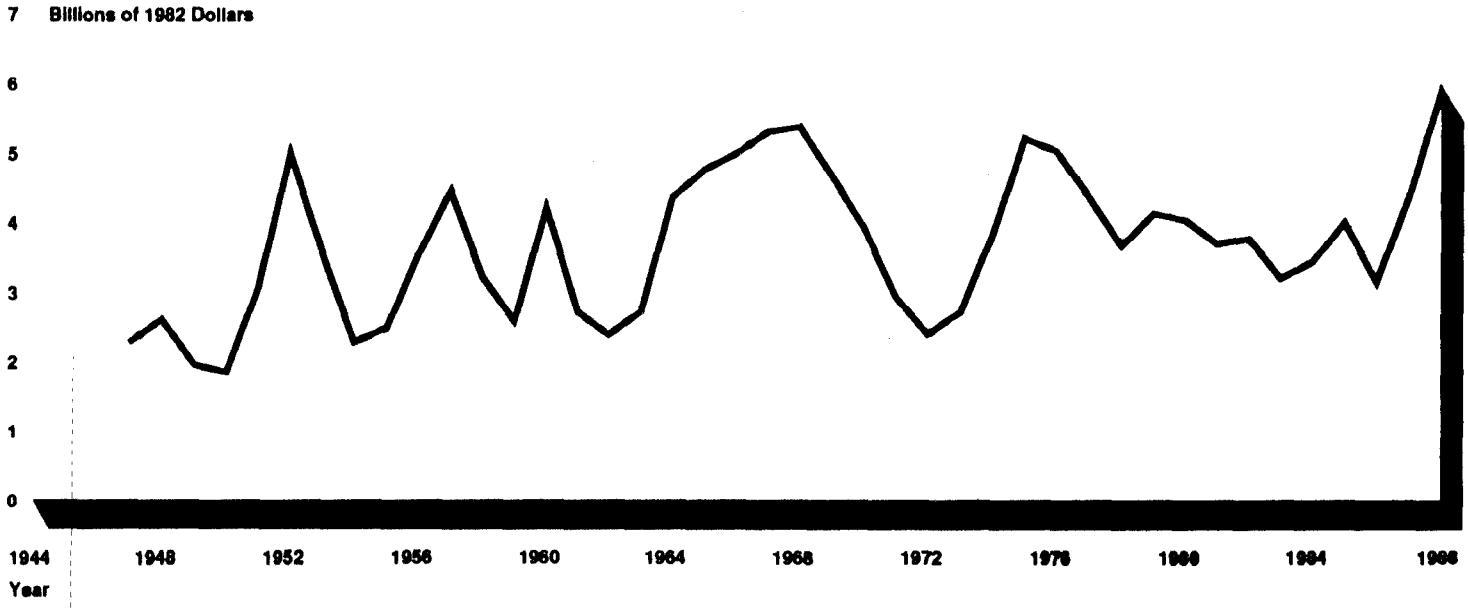
Source: NSF.
Steel Industry Definition: SIC 331-332.
Some data points are missing. Dots indicate available data points.

[10]These industries include essentially all of manufacturing.

Similar statements are true with regard to the fraction of the work force composed of scientists and engineers working on R&D. This fraction for the steel industry was substantially less than one fourth that for manufacturing as a whole and also less than that for the nonferrous metals industry for most of the past 30 years. The fraction for the steel industry was also continually less than the corresponding fractions for almost all of the other individual manufacturing industries on which the NSF collects data.

It is difficult to determine whether or not the R&D and investment requirements in the legislation authorizing the quotas have had much effect on total R&D and investment. The most recent numbers in the NSF data on R&D are for 1986—only the second year after the legislation became effective. Figure V.12 indicates that after enactment of the legislation, expenditures on new plant and equipment in the steel industry first increased in 1985, then declined in 1986, and then increased sharply in 1987 and 1988. The number for 1988 must be viewed with some caution because it is an extrapolation based on preliminary data for only the first two quarters of that year. Nevertheless, it does indicate strength in the first two quarters.

Figure V.12: New Plant and Equipment Expenditures



Source: SCB.
Steel Industry Definition: SIC 331.

Notes on Data Sources

The sources and abbreviations for the data used for the table and graphs in appendices I through V are as follows:

AISI - American Iron and Steel Institute. Unless stated otherwise in the reference, AISI data in this report is obtained from the 1987 Annual Statistical Report. AISI financial data is discussed under the "QFR" listing in this appendix.

ASM - Annual Survey of Manufactures (various years), published by the Bureau of the Census.

B&C - Barnett, Donald F. and Robert W. Crandall, Up From the Ashes: The Rise of the Steel Minimill in the United States, Brookings Institution, 1986.

BEA - Bureau of Economic Analysis.

BLS - Bureau of Labor Statistics.

BS - Business Statistics (various years): A Supplement to the Survey of Current Business, published by the Bureau of Economic Analysis.

CBS -"Current Business Statistics," the monthly blue-page section of the Survey of Current Business, published by the Bureau of Economic Analysis.

CIR1 - Current Industrial Reports: Manufacturers' Shipments, Inventories, and Orders, published by the Bureau of the Census.

CIR2 - Current Industrial Reports: Inventories of Steel Producing Mills, published by the Bureau of the Census. Prior to 1987, the subtitle of this report was Inventories of Steel Mill Shapes.

CIR3 - Current Industrial Reports: Steel Mill Products, published by the Bureau of the Census.

CM - Census of Manufactures (1982, 1977, 1972), published by the Bureau of the Census.

EHE - Employment, Hours, and Earnings, United States, 1909-84, published by the Bureau of Labor Statistics in March 1985; and Supplement to Employment and Earnings, also published by Bureau of Labor Statistics in August 1988.

ERP - Economic Report of the President, January 1989.

IFS - International Financial Statistics, 1988 yearbook and various monthly issues, published by the International Monetary Fund.

IISI - International Iron and Steel Institute, Committee on Statistics, Brussels, Belgium. All IISI data in this report is taken from Steel Statistical Yearbook 1987.

ITCA - International Trade Commission, Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Modernize, USITC Publication 2115, September 1988.

ITCM - International Trade Commission, Monthly Report on the Status of the Steel Industry, USITC Publication 2141, December 1988.

MLR -"Current Labor Statistics" section of the Monthly Labor Review, published by the Bureau of Labor Statistics.

NSF - National Science Foundation, Research and Development in Industry, 1984. Also, data collected for a newer edition of this publication that is not yet published.

OAC - Office of Agreements Compliance. This is the office at the Department of Commerce that is charged with enforcing the current steel quota agreements.

PHB - Putnam, Hayes, and Bartlett, Inc., VRAs and the Domestic Steel Industry, prepared for the American Iron and Steel Institute, published in August 1988.

QFR - Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations, published over the years by the Securities and Exchange Commission, the Federal Trade Commission, and (currently) the Bureau of the Census.

QFR is one of two sources of financial data for the steel industry, both of which have flaws. QFR's definition of the steel industry includes all of SIC 331 and 332 and thus is broader than the definitions used by most other data sources. The data is collected on a company basis rather than an establishment basis. "Company basis" means that if one company has several establishments with different product lines (e.g. some

that produce steel and others that produce petroleum products), a primary product line for the company is determined, and the entire company is then treated as if it were in the industry that produces that product line. This fact becomes important in a case such as that for the USX Corporation, which purchased Marathon Oil Company in 1982. If USX were still classified as a steel company after the purchase, then all of Marathon Oil's sales, profits, etc. would be attributed to the steel industry and not to the oil industry. If the corporation were reclassified as an oil company, then all steel sales, profits, etc. would be attributed to the oil industry and not to the steel industry.

The other source for financial data on the steel industry is AISI. The AISI definition of the steel industry is approximately the same as SIC 3312 (the Standard Industrial Classification system is not used), which is more in line with the definitions used by most other sources. Further, in cases in which a firm has other product lines in addition to steel, the AISI data refers only to the steel segment of the firm's business. However, the data covers only reporting companies, and in 1986 and 1987 these companies accounted for only 77 percent of the reported raw steel production in 1987. Furthermore, the universe of reporting companies changes from year to year. Finally, unlike QFR, AISI collects financial data only on the steel industry, thereby making it impossible to make comparisons between the financial performances of the steel industry and all of manufacturing using comparable data.

SCB - Survey of Current Business, published by the Bureau of Economic Analysis.

WEFA - The WEFA Group: Wharton Econometric Forecasting Associates, Steel Market Intelligence Report: U.S. and World Steel Short-Term Forecast through 1990, Second Quarter 1988.

The Standard Industrial Classification System

Not all data-collection organizations use the same definition of the steel industry. Consequently, care must be taken when using steel-industry data from more than one source. Differences in industry definition should not affect the analysis and conclusions presented in this report. Nevertheless, to help readers avoid drawing erroneous conclusions from the data presented, we have indicated the steel-industry definition used in each figure. Most of these definitions are given in terms of Standard Industrial Classification (SIC) codes, with which the reader may not be familiar. Hence, we present here a description of the relevant SIC codes abstracted and compiled from the Standard Industrial Classification Manual, 1972 published by the Office of Management and Budget and from the 1982 Census of Manufactures, Industry Series: Blast Furnaces, Steel Works, and Rolling and Finishing Mills.

331 BLAST FURNACES, STEEL WORKS, AND ROLLING AND FINISHING MILLS

3312 Blast Furnaces (Including Coke Ovens), Steel Works, and Rolling Mills

Establishments primarily engaged in manufacturing hot metal, pig iron, silvery pig iron, and ferroalloys from iron ore and iron and steel scrap; converting pig iron, scrap iron and scrap steel into steel; and in hot rolling iron and steel into basic shapes such as plates, sheets, strips, rods, bars, and tubing. Merchant blast furnaces and byproduct or beehive coke ovens are also included in this industry.

33121 Coke-oven and blast-furnace products
33122 Steel ingot and semifinished shapes and forms
33123 Hot-rolled sheet and strip
33124 Hot-rolled bars and bar shapes
33125 Steel wire produced in steel mills
33126 Steel pipe and tubes produced in steel mills
33127 Cold-rolled steel sheet and strip produced in steel mills
33128 Cold-finished steel bars and bar shapes produced in steel mills
3312A Seamless rolled-ring ferrous forgings produced in steel mills
3312B Open-die or smith ferrous forgings, hammer or press, produced in steel mills
3312C Other steel mill products except wire products

3313 Electrometallurgical Products

Establishments primarily engaged in manufacturing ferro and nonferrous additive alloys by electrometallurgical or metallothermic processes, including high-percentage ferroalloys and high-percentage nonferrous additive alloys.

33131 Ferromanganese
33132 Ferrochromium
33133 Ferrosilicon
33134 Other ferroalloy products produced in electric furnaces

3315 Steel-Wire Drawing and Steel Nails and Spikes

Establishments primarily engaged in drawing wire from purchased iron or steel rods, bars, or wire and which may be engaged in the further manufacture of products made from wire; establishments primarily engaged in manufacturing steel nails and spikes from purchased materials are also included in this industry. Rolling mills engaged in the production of ferrous wire from wire rods or hot-rolled bars produced in the same establishment are classified in Industry 3312.

33151 Noninsulated ferrous wire rope, cable, and strand produced in wiredrawing plants
33152 Steel nails and spikes produced in wiredrawing plants
33155 Steel wire not produced in steel mills
33156 Fencing and fence gates produced in wiredrawing plants
33157 Ferrous wire cloth and other ferrous woven wire products produced in wiredrawing plants
33159 Other fabricated ferrous wire products, except springs, produced in wiredrawing plants

3316 Cold-Rolled Steel Sheet, Strip, and Bars

Establishments primarily engaged in (1) cold-rolling steel sheets and strip from purchased hot-rolled sheets; (2) cold-drawing steel bars and steel shapes from purchased hot-rolled steel bars; and (3) producing other cold-finished steel. Establishments primarily engaged in the production of steel, including hot-rolled steel sheets, and further cold-rolling such sheets are classified in Industry 3312.

33167 Cold-rolled steel sheet and strip not produced in steel mills
33168 Cold-finished steel bars and bar shapes not produced in steel mills

3317 Steel Pipe and Tubes

Establishments primarily engaged in the production of welded or seamless steel pipe and tubes and heavy riveted steel pipe from purchased materials. Establishments primarily engaged in the production of steel, including steel skelp or steel blanks, tube rounds, or pierced billets, are classified in Industry 3312.

332 IRON AND STEEL FOUNDRIES

This group includes establishments primarily engaged in manufacturing iron and steel castings. These establishments generally operate on a job or order basis, manufacturing castings for sale to others or for interplant transfer. Establishments which produce iron and steel castings and which are also engaged in fabricating operations, such as machining, assembling, etc., in manufacturing a specified product are classified in the industry of the specified product. Iron and steel castings are made to a considerable extent by establishments classified in other industries, that operate foundry departments for the production of castings for incorporation, in the same establishment, into such products as stoves, furnaces, plumbing fixtures, motor vehicles, etc. Establishments primarily engaged in the manufacture and rolling of steel and also making steel castings are classified in Industry 3312.

3321 Gray Iron Foundries

Establishments primarily engaged in manufacturing gray iron castings, including cast iron pressure and soil pipes and fittings.

3322 Malleable Iron Foundries

Establishments primarily engaged in manufacturing malleable iron castings.

3324 Steel Investment Foundries

Establishments primarily engaged in manufacturing steel investment castings.

3325 Steel Foundries Not Elsewhere Classified

Establishments primarily engaged in manufacturing steel castings not elsewhere classified.

In most of the figures in this report, the steel industry is defined by SIC 331, SIC 3312, or some combination of 5-digit SIC codes contained mostly under SIC 3312. Generally, there is not much practical difference among these definitions. SIC 3312 encompasses the vast majority of the economic activity under SIC 331 (e.g. 80.9 percent of employment and 79.9 percent of value added in 1982); and the combinations of 5-digit codes usually include most activity under SIC 3312 and only a little not under it.

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